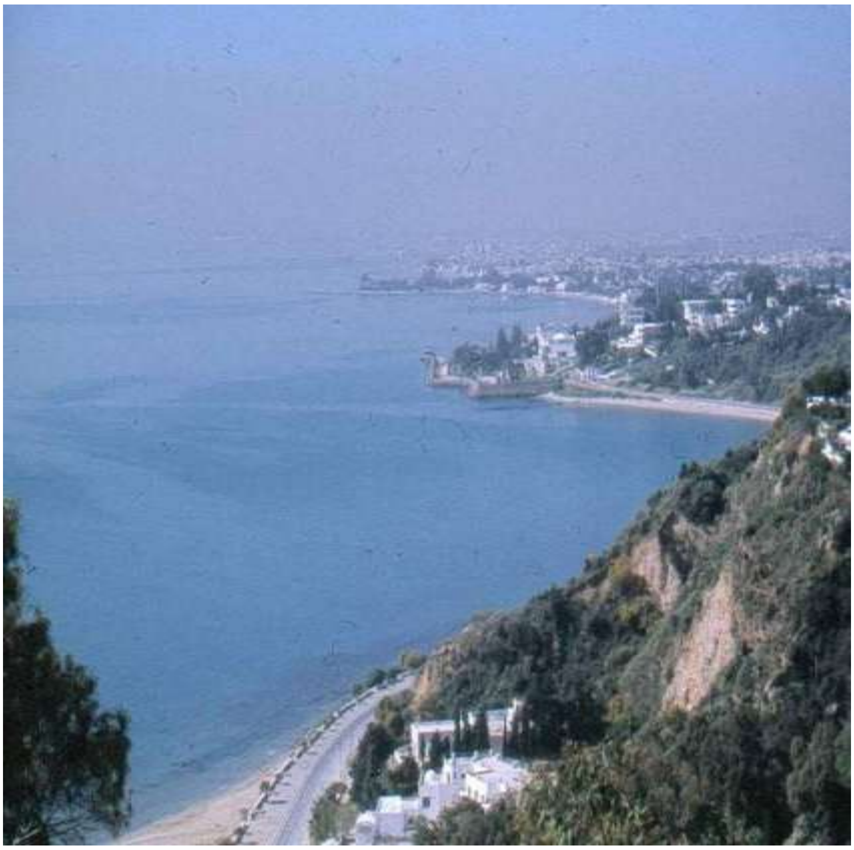
THE 2nd Maghreb Conference on Desalination and Water Treatment

CMTDE 2009

Abstracts



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Synthesis of ZnAPSO-34 membrane for se water desalination

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Abstract

The desalination of sea water became a strategic issue. It represents an alternate source of potable water. This technique brings answers to the requirements out of water to short and long-term. The desalination of water by reverse osmosis using membranes containing zeolites MFI or ZSM-5 was studied. In our work, we were interested in a new family of material who are the aluminophosphates, which are similar to zeolites. This work concerned the in-situ preparation of a film of ZnAPSO-34 on porous α-alumina tubes: this film of ZnAPSO-34 corresponding to the structure chabazite (CHA) has an effective intracrystal nanopore diameter of 0.38 nm. The hydrothermal synthesis was made in an autoclave under autogenous pressure. The membrane used was characterized by X-ray diffraction and scanning electron microscope after calcination.

Experimental study of sea water desalination :
Solar distiller with greenhouse effect

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Abstract

The main objective of this work is to study the effects of certain parameters of the distiller with greenhouse effect, particularly: the global radiation, the room temperature, the temperature of the water on the overall effectiveness. We use of the approach of the method of the total heat balance. We are particularly interested in the desalination of sea water. The follow-up of the deposit of the layer of salt enabled us to make the assessments, and to estimate the evolution of the production of our distiller. Our study was undertaken on a distiller designed and carried out by our laboratory (UDES).

Keywords *: Sea water desalibation , Solar distiller.*

Efficiency of filtration as a pretreatment for seawater desalination by reverse osmosis

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Abstract

The seawater is characterised by the variability of its turbidity over the time. Sometimes, they are very turbides. At the present time, the pre-treatment by coagulation-flocculation is an efficiency process for the removal of colloidal particles. However, this process can not remove the overall suspended and colloidal matters. To this end, we have interested on the sand filtration as a principal step to improve the efficiency of the seawater pretreatment of seawater in order to improve the water quality by reducing the turbidity which is related to the content of suspended matter.

The experimental device consists of a glass column containing a filter material (sand) of granulometry defined; we used a gravel as support of the column. A flow meter upstream makes it possible to regulate the feed water flow. A pump is placed at the entry of the column in order to feed the cycle of filtration top to the bottom and washing of bottom cycles it upwards. The filtered water temperature is fixed at a temperature of 25° C. The method is based on Principe of a rapid filtration.

The monolayer filtration is realised with a sea water of a turbidity varying from 2 NTU with 3.5 NTU and a suspended matter concentration SS varying from 4 mg/L to 5mg/L. The operating conditions of filtration were studied by varying the bed depth filter material, the feed water flow and the granulometry of material in order to improve the filter performance.

Study of chemical structure and active porous texture of a carbonaceous material from calorimetric measures

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Abstract

The porous texture and the chemical structure of carbonaceous material, a graphite, are determined from the BET method applied to adsorption isotherms of nitrogen at 77 K and from Boehm method respectively. Otherwise, the results deduced from the calorimetric measures from which the active surface area of this material are estimated, are in good agreement and relatively close to those determined from chemical adsorption (Walker's method).

Keywords: *Porous texture, Chemical structure, Adsorption.*

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Removel of phenol and 2-4 dichlorophenol from aqueous solutions using activated carbon prepared by chemical activation of jujuba seeds.

Kinetic, thermodynamic and equilibrium studies

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Abstract

Jujube seeds, has been used as a raw material for the preparation of activated carbon. Activated carbon was prepared from jujube seeds by KOH chemical activation, followed by pyrolysis at 800°C. Batch studies were conducted for kinetics, thermodynamic and equilibrium studies on the sorption of phenol and 2-4 dichlorophenol from aqueous solution. The operating variables studied were initial phenols concentration, contact time, temperature and solution pH. Results show that the pH value of 7 is favorable for the sorption of phenols. The sorption data have been analysed using Langmuir and Freundlich isotherms. The isothermal data for sorption followed Langmuir Model. The sorption processes conformed to the pseudo-second-order rate kinetics. Thermodynamic parameters such as *enthalpy*, *entropy*, and *Gibb's free energy changes* were also calculated and it was found that the sorption of phenols by jujube seeds activated carbon was a spontaneous process. The sorption mechanism of adsorbat was explained by FT-IR spectroscopy and confirmed the presence of–COOH and C=O groups in the activated carbon structure. The maximum adsorption efficiency of phenol and 2-4 dichlorophenol was 142.85 mg.g^{-1} and 250 mg.g^{-1}, respectively.

Keywords*: Sorption; Jujuba seeds; Phenol; Isotherms; Langmuir; activated carbon*

CMTDE_6

Adsorption of organic and inorganic pollutants on activated carbons from dates stones

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Abstract

The aim of this contribution is to study the adsorption of inorganic and organic polluants on five activated carbons.

Activated carbons from date stones have been prepared by chemical activation with KOH and $ZnCl_2$ and physical activation with CO_2 and also combination of both of them in order to show the effect of a nature of chemical reagent and the method of activation on surface area and porosity of the resulting activated carbons.

Results obtained indicate that the chemical activation with KOH produces an activated carbons having mesoporosity as well developed as in the $ZnCl_2$ activation. This last process led also to develop the microporosity more than KOH activation.

Partial gasification of the high surface area carbon obtained by zinc chloride activation in CO_2 shows some improvement in adsorption.

Adsorption at 298K of potassium dichromate and pyridine from aqueous solutions on activated carbons has been studied. The adsorption capacity of the activated carbons depended on the surface area and porosity of the carbon, and the nature of the compounds adsorbed.

The adsorption of organic compound (pyridine) on activated carbons is comparatively better than inorganic compound (potassium dichromate).

Effects of activation method on the pore structure of activated carbon from date pits application to the treatment of waters

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Abstract

Three series of activated carbons have been prepared by chemical activation of date pit with $ZnCl_2$ (DZ), KOH (DK), and H_3PO_4 (DP) in order to show the effect of variables such as a nature of chemical reagent and extent of impregnation on surface area and porosity of the resulting activated carbons.

The pore structure of the activated carbons was characterized by CO_2 adsorption at 273K and by N_2 adsorption at 77K. The macro and mesoporosity were determined by mercury porosimetry.

According to the nature of the adjuvant, the activated carbons present different porosities. Chemical activation of the date pits with KOH and H_3PO_4 produces an activated carbons having mesoporosity as well developed as in the $ZnCl_2$ activation. This last process led also to develop the microporosity more than KOH and H_3PO_4 activation.

Adsorption at 298K of potassium dichromate, triton X100 and phthalate from aqueous solutions on activated carbons has been studied. The adsorption capacity of the activated carbons depended on the surface area and porosity of the carbon, and the nature of the compounds adsorbed.

The adsorption of phthalate and triton X100 on activated carbons DK and DZ is comparatively better than potassium dichromate.

Inorganic Porous Membrane
Synthesis and Characterization

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Abstract

Inorganic membranes are emerging as an alternative polymeric membranes for applications due to their thermal ,mechanical and chemical characteristics.The membrane mineral which are prepared from ceramic materials are very resistant to a wide variety of solvents and are quite stable at hard operating conditions.These features have attracted a great deal of attention from the standpoint of membrane applications for separation processes ; micro and ultra-filtration have gained an important place in a large number of industries, there are ,in particular ,waste water treatment ,gas separation and the engineering industries. Among the methods of preparation developped, the sol-gel process is appropriate to elaborate thin and porous layers with controlable porosity. Solution chemistry in which weak interactions favor the self assembly of molecular precursors opens many possibilities for the synthesis of oxide materials .The state of the final products strongly depends on the sol-gel and drying conditions in which it is prepared. It is therefore of importance to determine how sol-gel parameters affect the physical properties of membrane.

The synthesis of gel is based on hydrolysis-condensation reactions indirectly to form a veritable lattice of oxide from molecular precursors.The hydrolysis reaction must be controlled to avoid precipitation of hydrous metal oxide. A true oxide network is formed by chemical bonds in the solution. Condensation reactions can then be controlled giving monodispersed oxide nanoparticles. The control of sol-gel transition and thermal decomposition has allowed us the synthesis of the mixed oxide Al_2O_3-ZrO_2.

The deposit thin layers has been realized with the sol prepared with the destabilization of colloidal solution process.This is possible by infiltrating a low viscosity sol or by direct coating on to an ultrafiltration layer. We have choosen to study the Al_2O_3-ZrO_2 system for their interesting properties and the interest which may bring in the domain of inorganic membranes chemical and, mechanical high resistance.

The stuctural characterization was studied by differential thermal analysis, infrared spectroscopy, X-ray diffraction.The textural characterization by nitrogen adsorption-desorption allowed us to observe the variation of the surface area, porous volume, and pore diameters according to temperature. The obtained results by adsorption-desorption of nitrogen showed that textural characteristics are linked at structural changes.Scanning electron-spectroscopy observation showed homogeneous layers without cracking. Good preparation conditions permitted us the obtention of homogeneous inorganic membranes. In this paper, some experimental results on the synthesis and characterization of inorganic porous membrane will be presented.

Keywords *: sol-gel , inorganic , membrane , porous*

CMTDE_9

Role of mass transfer mechanisms in kinetic adsorption of nitrates using ion exchange resin

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Abstract

Theoretical and experimental investigations were conducted on the adsorption of nitrates by Amberlite IRA 400 resin in a stirred tank reactor. A mass transfer model based on the squared-driving force principle was presented to describe the transfer of nitrates between the aqueous and the solid phases.
The effect of various parameters such as nitrate ion concentration, degree of stirring and diameter on the mass transfer coefficient (MTC) of the diffusion-controlled reaction between nitrate ions and the resin was studied. It was found that MTC decreased with increasing nitrate ions concentration and increased with increasing degree of stirring.

Theory and Results

The transfer of nitrates from the aqueous solution to the solid resin phase in a batch adsorption process could be governed by various mass transfer resistances between the two phases. Several models of various complexities have been proposed to describe the mass transfer processes [1, 2]. Mass transfer models always involved some parameters which need to be estimated with some degree of certainty. The squared-driving force mass transfer model proposed by Jiang et al. [2] has the advantages of relative simplicity and reasonable accuracy. The model is represented by:

$$\frac{1}{C_O \quad mC_S^*} Ln\left[\frac{C_S^* \, C_O \quad mC_S}{C_O \, C_S^* \quad C_S}\right] \quad Kt$$

Where K is the overall mass transfer coefficient and t is the time.
The overall mass transfer coefficient K corresponded to the slope of the left-hand expression versus time. The model matched experimental data, justifying the use of the pseudo steady state squared driving force mass transfer model. The overall mass transfer coefficients obtained from the linear plot were found to depend on the agitation, the nitrate concentration and the diameter.

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CMTDE_10

Kinitic and thermodinamic studie of removel of para chlorophenol from potablewater using activated carbon

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Abstract

The adsorption of 2-chlorophenol on date carbon was investigated to assess its possible use as an adsorbent for the processing of phenolic wastewater .The influences of various factors such as initial concentration ,agitation speed , amount of adsorbent ,the temperature and pH on the adsorption capacity has been studied. The percentage removel of 2-chlorophenol was observed to increase with increase an initial concentration of 2-chlorophenol .The adsorption of 2-CP decrease with an increase in temperature indicated the exothermic nature of the reaction .The Langmuir and Freundlich equation interpret adsorption isothermal data . Kinetics data was obtained by using a pseudo-first-order, pseudo-second-order equation to understand the reaction mechanism .Thermodynamic parameters such as ΔG,ΔH and ΔS for the adsorption process were calculated .

Keywords: *date cores**;** 2-chlorophénol; adsorption; isotherm; water pollution, thermodynamic parameters.*

CMTDE_11

Marine Bio-fouling of Different Alloys Exposed to Continuous Flowing Fresh Seawater by Electrochemical Impedance Spectroscopy (EIS)

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Abstract

The petroleum industry and desalination plants suffer from marine bio-fouling problems that have a major role in the stimulation of the corrosion process. Thus, the aim of this study was to investigate the effect of the micro and the macro-organisms, on the corrosion behavior of different alloys used in Kuwait's industries. The alloys used in this study were; sanicro 28, stainless steel 316, Cu-Ni 70-30, and titanium. The Electrochemical Impedance Spectroscopy (EIS) was used in this study in order to determine the corrosion susceptibility of different alloys exposed to continuous fresh Seawater This was achieved by calculating the charge transfer resistance of the metal surface and the resistance of the solution .The total exposure time of the tests was about 180 days. The visual inspection of the tested samples, showed a bio-film formation on the surface of these samples. Also, it was observed that the stainless steel 316, sanicro 28, Cu-Ni 70-30, and Titanium alloys exhibited good corrosion resistance.

Keywords: *Marine Bio-fouling, Electrochemical Impedance Spectroscopy (EIS), Seawater, Corrosion resistance.*

Chemical treatment of dairy processing wastewater in Kuwait

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Abstract

Importance of wastewater in water management projects in Kuwait is steadily increasing because freshwater is limited and scarce. This research work is focused on the chemical treatment of wastewater generated by dairy industries in Kuwait. The main aim of this study is to improve effluent quality and explore the potential of reusing this effluent in irrigation and cleaning processes of tanks and facilities of dairy plants. Dairy processing wastewater stream of the main dairy company in Kuwait was first characterized through an extensive campaign of sampling and analysis. Results of the analysis have shown that tested dairy wastewater is highly concentrated (high values of COD, BOD, TSS, nitrogen content and turbidity). Then, coagulation-flocculation processes were used at laboratory bench scale to improve the effluent quality by removing or decreasing the organic matter contents and other suspended solids. Experimental results using ferric chlorosulfate as a coagulant have shown significant improvement in the effluent quality. Elimination efficiencies of 80% for chemical oxygen demands (COD) and over 90% of total suspended solid (TSS) were achieved. With such quality the treated wastewater can easily be used in irrigation or cleaning of the factory facilities leading to significant reduction in freshwater consumption.

***Key words**: Dairy, industrial wastewater, chemical treatment, wastewater reuse.*

Enhancing Performance of Reverse Osmosis by reusing wastewater

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Abstract

Developing sustainable water desalination technologies is the most urgent issue for incoming years that are full of concerns about water shortage. This can be achieved partially by

1. Approaching to zero waste discharge by wastewater reuse.
2. Developing new generation of membrane that are more friendly to fouling
3. Integrating multi stage RO units and intellectually combination of waste water and raw water
4. Increasing the efficiency of RO units by improving operational conditions Reverse Osmosis and ion exchange (IX) resins are the workhorse of the industrial water purification system. The Mixed bed cartridge usually serves as a final polish of the water before it sees the final application. Currently the best technology for producing industrial pure water is the combination of RO and IX systems. They are a set of discreet technologies which must be properly integrated to optimize pure water production and minimize operation costs. In fact, in a properly designed water treatment plant, the most vulnerable and expensive components are placed nearest the final point of use and are protected by upstream water treatment units which are less vulnerable and expensive. For example, the mixed bed ion exchange unit is the last component in the chain of industrial water treatment and is one of the most vulnerable and expensive. It is protected by the preceding RO plant which in turn is protected by suitable pretreatment units such as carbon filter which is preceded by softening process and clarifier. It must be accepted that mistakes made during the design or operation of water purification systems are a significant source for wasting water and it should not be ignored at all. These mistakes can lead to ongoing problems and waste a high fraction of receiving water in many industries. Therefore, it is easily possible to save water by improving the methods of operations and reuse of effluents.

We had already published a paper about enhancing permeate flux in a RO plant by controlling membrane fouling [1]. It was illustrated that alternative method for softening process in a petrochemical industry resulted in a significant saving of water in addition to decrease the operating cost of water treatment processes by controlling RO membrane fouling. This experience shows clearly that membrane fouling and scaling can be minimized by improving design and operating conditions.

In this contribution, we focus on the first item of sustainable technology, that is, approaching to zero waste discharge by wastewater reuse. We have developed a highly appreciated method that has been applied successfully for industrial wastewater reuse at the Razi petrochemical Company (RPC). Let me introduce shortly the RPC. It was established in 1968 to utilize Iran's abundant gas resources for producing ammonia, urea, diammonium phosphate (DAP), sulphur and phosphoric and sulphuric acids**.**

RPC's establishment formed the basis of Mahshahr Industrial Area, on the Persian Gulf, where today is the heart of Iranian petrochemical industry. In RPC, a combination of RO

and IX is used to produce 1400 m^3/h industrial water with various levels of purity.

As a case study, we illustrated that with logical integration, about 100 m^3 /h of waste water can be economically treated and reused without any more purification facilities. Because in most reuse applications the feed water is often secondary effluent, many operators are reluctant to consider reuse issue. They often only concern about irreversible membrane damage due to membrane fouling. It is correct that for RO, Membrane Fouling is the #1 Problem in most reuse applications. Their feeling may be correct as implications of membrane fouling are a decrease in flux and salt rejection, an increase in energy consumption due to need for a higher feed pressure and finally RO failure. As a matter of fact, appropriate pretreatments of inflow are the key points for having a long term stable performance not only for RO membranes but also for water treatment plant. In addition, in some cases, the polluted effluent flow not only is safe for membrane but it may improve the performance of RO plant. This was really happened in Razi petrochemical complex. During the process of producing urea in RPC by reacting Carbon Dioxide under high pressure with Ammonia, a considerable amount of waste water is produced. In fact, this waste water is steam condensate that its main impurity is Ammonia. In original design it must be discharged to environment. Recently the company decided to reuse this effluent by pretreatment it in a stripping tower. This technique has been done and resulted in reusing up to 100 m^3 /h water.

I suggested a more interesting technique for reusing this effluent. There was no need to use stripping the effluent. I found that this effluent can be recycled to feed water without any further treatment. The main concern of this effluent was Ammonia that it might damage the RO units. But this condensate polluted with Ammonia has no fouling for membrane, it also improve the performance of RO units.

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CMTDE_14

Adsorption of copper (II) onto molecular sieves NaY

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Abstract

The ecological problems bound to the heavy metals constitute the source of deterioration of the environment the most important and most dangerous. These effluents cannot be rejected in the nature because of their harmfulness without previous treatment making them lower to the admissible norms.

The adsorption on the zeolites has been recognized like being efficient and of a reasonable cost in the treatment of the industrial dismissals. In this context, a NaY zeolite synthesized by our care is tested in the recuperation of the copper ions (II). The parameters capable to influence on the adsorption of this ion on this material as copper concentration, pH, temperature and solide/liquide ratio have been studied. Appreciable adsorption yields were obtained in our experiences and kinetic study showed that copper adsorption follows pseudo second order. Thermodynamic parameters, i.e. enthalpy of adsorption $\Delta H°_{ads}$, entropy change $\Delta S°_{ads}$ and Gibbs free energy $\Delta G°_{ads}$ for the sorption of copper ions on NaY zeolite were examined. It was found that temperature is a parameter disfavouring the yield of the copper adsorption.

Key-words: *environment, zeolite, copper ion (II), adsorption, heavy metals.*

CMTDE_15

Surfactant-Modified Native Soils in the Treatment of Oilfield (Nimr) Produced Water in Oman

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Abstract

In Omani oilfields, every barrel (~ 159 liters) of oil brought to the surface is accompanied by around eight barrels of water; this is known as water cut in the petroleum industry and it is a common problem in maturing oilfields. Omani oil company (Petroleum Development Oman) is currently producing about 4.5 millions bpd. This water contains tiny droplets of crude oil suspended in it (100-300 ppm) and inorganic solutes (~ 8.2 g/L) as well as some toxic and corrosive chemicals (polycyclic aromatic hydrocarbons, toxic metals, H_2S, etc..). Treatment of this considerable amount of water in hot and dry countries like Oman may be a solution to the continuous water demand in Oman which is expected to rise sharply in the near future.

Our objective is therefore to investigate the possibility to use surfactant-modified soils for the removal of crude oil and inorganic salts form Omani oilfield produced water. Omani native soil was used in this study. Preliminary results from laboratory-scale packed columns with unmodified native soil showed an excellent rejection (~ 98%) for aromatic hydrocarbons, total petroleum hydrocarbons as well as substantial removal of inorganic solute, as reflected by the decrease of EC from 11.8 $mScm^{-1}$ to around 5.33 $mScm^{-1}$ for the first 100 ml permeate collected. However, the oil rejection decreased drastically from 90.18 % for the first 100 ml individual permeate collected to 33.28% for the fourth individual 100 ml collected. When surfactant is added to the feed (Nimr water), all individual permeates collected (four separate 100 mL samples) were free of oil (100% rejection). Current investigations are in progress in order to optimize the system in removing both oil and salt. This optimization is based on the effects of *i*) surfactant type, concentration, and composition; *ii*) column packing (amount and type of soil used, particle size, flow rate,..); and *iii*) surfactant-free permeate. Our ultimate objective is to demonstrate the feasibility of this process in a pilot-scale application.

Production of drinking water by micro, ultra And nanofiltration from water of the barrage Ain-Zada, Setif, Algeria

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Abstract

The classical drinking water industry faces a growing number of difficulties in the treatment of surface water for drinking water production. Pressure driven membrane processes (microfiltration, ultrafiltration, nanofiltration, etc…) are possible alternatives to conventional treatment processes, such as in the case of Setif, Algeria. This industry is a classical case of a conventional treatment process which comprises three steps. The first step consists in the pretreatment of raw water by addition of disinfectant (NaClO). The second step is clarification using coagulation, flocculation, decantation, rapid sand filtration. The last step is disinfection by natrium hypochlorite (NaClO), which gives a bad taste to treated water due to formation of disinfection by products (DBP's) due to interaction between organic matters and chlorine. The used of a well-chosen membrane process and also a well-chosen membrane configuration is a key element to avoid membrane fouling, maintain acceptable retention, and a high stable flux. In this paper, four nanofiltration membranes (NF PES10, N30F, NF270, NF polyamide), two ultrafiltration membranes (UF-PES 004H, UC 010) and two microfiltration membranes (0.22 µm and 0.45 µm) are used to product drinking water from raw water of Setif's barrage. This raw water was very limpid (turbidity less than 10 NTU) and organic matter usually less than5 mg/l. All the membranes expect those of microfiltration (0.22 µm and 0.45 µm) show a constant flux as a function of time and acceptable retention. It was shown that application of pressure driven membrane processes is feasible in the context of drinking water production in Algeria

Keywords **:** *drinking water, ultraphylic membrane, microfiltration, ultrafiltration, nanofiltration, contact angle, fouling, interaction matter organics-cholrine.*

Study and identification of retention process of phenol by adsorption on agricultural byproducts

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Abstract

The phenol makes party of the family of made up aromatic. It is used for the manufacture of pharmaceutical products, the synthetic dyes, resins, the pesticides, the tanning matters, the perfumes, the lubricants, essential oils and solvents.

The phenols are heavier than water and tend to settle. They dissolve slowly and, even diluted, continue to form toxic solutions. Because of their strong toxicity in water, the phenols appear in the category of risk of pollution water.

In this work we propose a study on the adsorption of phenol contained in industrial waste water or of the aqueous solutions by the carbon not activated obtained from a local cereal by-product.

The adsorbents were washed before used in order to eliminate all the impurities, then calcined at a temperature of 600°C in exclusion of the air. The application of these derived agricultural produce to the retention or fixing of phenol led to determine the kinetics where equilibrium is obtained at the end of 120 minutes, the isotherm of adsorption was also examined. At low concentrations, it is of type IV according to the classification of Brunauer, Emmet and Teller and at high concentrations it gives a pace of an isotherm to multi-layer. This study is undertaken relative to the effect of parameters such as size of the particles, the pH, the initial concentration out of phenol, the solide/liquide ratio.

The results show high retention of the phenol; exceeding 70% for an initial concentration of 20 mg/l, at 20°C, a mean size diameter of 0.1 mm, a mixing velocity of 600 rpm, an adsorbent concentration of 10 g /l, a pH=3 and contact time of two hours

Keywords *: by-products, phenol, adsorption, removal, water, waste water.*

CMTDE_18

Methyl orange removal from aqueous solution by natural and treated skin almonds

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Abstract

Colour is the most obvious indicator of water pollution. The discharge of coloured wastes into receiving streams not only affects the aesthetic nature but causes adverse effects such as allergic dermatitis, cancer and mutation [1]. Various methods of dye removal from wastewater have been applied including chemical precipitation, membrane processses, ion exchange and adsorption. One of the most effective methods for the removal of dyes has been based on adsorption using low cost materials. Many efforts, however, have been made to investigate the use of various low cost adsorbents like clay [2], bagasse fly ash [3], peat [4], fungal biomass [5] and sawdust [6]. The aim of this study is to explore the feasibility of using skin almonds (SA), a new agriculture sorbent, for removal of hazardous dye methyl orange. The first objective of this work was to study the influence of differents chemical treatment on adsorption capacity of SA to remove methyl orange.the treatment of the SA with alkaline solution as well as with salt solution decreased the sorption ability for MO, whereas the acidic treatment increased markedly the sorption ability for the anionic dye (MO). The next objective is to evaluate the proprieties of adsorbent, the effect of contact time, temperature, dye concentration and particle size. Adsorption of the dye over both the adsorbents (natural and treated) has been monitored through Langmiur, Freundlish and the Redlich-Peterson adsorption isotherms models. Thre kinetic models, pseudo first order, pseudo second order and Elovich equation were employed to analyse the kinetics data. It was found that the pseude second order is the better choice to describe the adsorption behavior. In addition, an activation energy has also been determined based on the pseude second order rate constants.

Key words *: dye, methyl orange, skin almonds, adsorption and kinetic*

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CMTDE_19

Fouling effect on membrane deterioration in reverse osmosis process

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Abstract

The paper deals with the ageing and degradation of a polyamide thin-film composite RO membrane operating at full scale during groundwater treatment. A RO unit membrane operating with partial recirculation of concentrate is followed up during four years of operation at beverage industry. Conductivity, permeate flux and membrane resistance were assessed during 9 cycles of operation. A destructive analysis by means of scanning electron microscopy of a membrane surface is carried out after four years of operation in order to determine the state of the membranes active layer. Performances studies of the thin-film composite RO membranes show a good permeate quality in terms of rejection rate (greater than 95 %) and microorganisms removal efficiency rating of 76%. However, fouling development on membrane surfaces leads to a decrease in permeate flux. Chemical cleaning is then needed in order to establish the initial permeate flux. Chemical cleaning as well as disinfection procedures frequencies causes a membranes deterioration and shortens membrane life. The ageing is highlighted by a significant increase in permeate salinity and a progressive decline of membrane resistance. The SEM analysis of the worn membrane has shown an apparent degradation of the membrane active layer. Pores diameters of 10 µm were detected on the membrane surfaces.

Keywords: *reverse osmosis, membrane, thin film composite, fouling, degradation*

CMTDE_20

Preparation a kaolin porous tubular support for the treatment of dye and heavy metals solutions

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Abstract.

Membrane technologies offer one possibility to further improve the quality of the wastewater. In this study, a new type of ceramic support was used to ultrafilter a wastewater.

The characterization of the porous properties and structure of the support synthesis was carried out by Scanning Electron Microscopy (SEM), absorption rate, shrinkage rate and Hg-porosimetry methods. The pore size distribution showed a unimodal pore size distribution with an average pore size of about 0.9 μm. The reliability of support was measured by filtration tests and removal of heavy metals.

Filtration studies using porous tubular supports were performed for solutions containing Congo Red, Methylene blue and Malachite green solutions. The study of the liquid filtration and flow through these supports showed that the rejection rate were 100% for Methylene blue, Malachite green and during almost 120 minutes under a pressure of 5 bar. We beforehand tested the flow rate for each support with distilled water and the results show that the support of active kaolin gave a flux for distilled water of 622.0 L/m^2.hr at the pressure of 5 bar.

Effective removal of toxic metals, in connection with a comprehensive wastewater treatment strategy is one of the largest topics of present research. The increased awareness on the toxicity of metals prompted the implementation of strict regulations for its disposal. This paper presents the heavy metals (cadmium, Zinc and Plumb) separation capability of ultrafiltration membrane supports from aqueous solutions. The influence of applied pressure, feed solute concentration, feed pH the rejection of cadmium, Zinc and Plumb ions was studied. The maximum observed solute retention of cadmium; Zinc and Plumb ions are 100%, for an initial feed concentration of 10^{-4} mol/L.

Key words: *synthesis, support kaolin, dyes, heavy metals, flux*

Hydrodynamic regimes analysis in an electroflotation column in the treatment of industrial effluent

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Abstract

We present in this study the hydrodynamic regimes analysis in an electroflotation column in batch mode.

The study shows the effects of physicochemical liquid phase properties and current density on Reynolds number. The method of video recording and image processing was used to determine the diameter, the rise velocity of bubble and the gas retention within three model solutions.

Modelling Reynolds number by nonlinear regression method has been used in order to predict optimal treatment regime of an industrial effluent. The control parameter is the suspended solids purification rate. This rate exceeded 95 % in optimal regime of effluent treatment.

Keywords: *Hydrodynamic regimes – Electroflotation – Treatment – Effluent – suspended solids*

CMTDE_22

Effects of surfactants on oxygen transfer rate in the electroflotation process

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Abstract

This work concerns the treatment of liquid effluents rich in cationic and anionic surfactant by the electroflotation process in batch mode.

The oxygen transfer was studied considering its importance for the abatement of the dissolved organic matter in the industrial effluents. The volumetric mass transfer coefficient (K_La) witch is the key parameter in the characterisation of transfer process was evaluated for different values of current density and various surfactant concentrations.

The volumetric mass transfer coefficient was also dissociated to evaluate the liquid side mass transfer coefficient (K_L) and specific interfacial area (a).

Models of (K_L) have been established to describe the effects of the operational parameters as well as the physicochemical characteristics of the liquid phase on the oxygen transfer.

Mots clés : *Electroflotation**,** mass transfer coefficient**,** current density, surfactant.*

Effect of the ammonium sulfate concentration on the optimal composition of the miméral medium.

Phenol biodegradation by mixed culture in batch REACTOR

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Abstract

Phenol biodegradation in a batch reactor using a mixed bacterium was studied. The purpose of the experiments was to determine the biodegradation kinetics by measuring biomass rates and phenol concentration as a function of time and different concentration of mineral medium in a batch reactor.

The mineral medium concentration were composed of $(NH_4)_2SO_4$ (1 – 4 g/L), KH_2PO_4 (1 – 4 g/L), NaH_2PO_4 (1 – 4 mg/L), $MgSO_4$ (0.05 – 0.2 mg/L). The temperature (30°C), initial pH (7.0), stirring velocity (200 r /min) and phenol concentration (100 mg/L) were kept constant. The optimal conditions of the mineral medium concentration ($(NH_4)_2SO_4$ (2 g/L), KH_2PO_4 (2 g/L), NaH_2PO_4 (3 g/L), $MgSO_4$ (0.1 g/L)) was observed with best specific growth rate (0.358 h^{-1}) and maximum percentage degradation of phenol (99.99%).

Key words *Biodegradation, phenol, mixed bacteria, kinetic.*

CMTDE_24

Study of environmental impact of a mix discharge of construction and demolition debris, urban garbage and industrial wastes :The Tidjelabine landfill.

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Abstract

The goal of this article is to assess soil and underground water pollution by heavy metals and hydrocarbons caused by the creation of a mix discharge for construction and demolition debris, urban garbage and industrial wastes, on the site of "TIDJELABINE ", which was originally a grain-bearing land.

The presence of targeted heavy metals (copper, cadmium, lead, zinc) and total hydrocarbons have been confirmed within the surface water of this site through a characterization and analysis program of the debris, wastes and lixiviats that initiated in April 2006 and completed in June 2007.

The present work concerns the elaboration of as precise as possible diagnosis of this site and the evaluation of horizontal and in-depth spreading of these pollutants within the soil and underground waters.

Soil and water samples have been taken in this site along 1500 meters around the discharge centre.

Analyses in laboratory have been realized with the active cooperation of the staff of the “Centre de Recherche et Dévéloppement” (Sonatrach Boumerdes).

Obtained results confirm those of May 2007 on surface water and lixiviats, and show relatively poor spreading of the pollution by targeted heavy metals in the soil and underground water. These results also denote a high degree of pollution by hydrocarbons in samples from potable water wells (average 8 meters depth) and traces in deeper drillings (average 60 meters depth). Same hydrocarbons are also present in practically all soil samples down to 2 meters depth.

A first sketch of the spreading panache of the pollution by hydrocarbons in the area has been deduced.

Keys words : *Water& soil pollution, spreading, heavy metals, hydrocarbons.*

Study of propagation of brine of desalination plants in marine middle

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Abstract

The work realised in this study consists to determine propagation of brine, rejection of desalination plants of sea water in marine middle. A pilot experience was planned and realised. Different tests were realised with different rejections points of brine. Propagation of mixture of brine and chemical products were equally determined. The experimental results obtained show that the brine propagates very various manner.

CMTDE_26

Purification of water polluted by phenol, parametric study

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Abstract

The aim of this work is the parametric study of the purification polluted water with phenol by using a mixture of activated carbon of vegetable origin prepared starting from the cores of date, apricot and fishing.

Several chemical agents of activation were tested for the preparation of the activated carbon. The best results are obtained with sulphuric acid at 20% (73.12% of the elimination) for the date cores, with the zinc chloride salt at 20% elimination is 63.12% and 79.37% for the cores of fishing and the apricot cores respectively.

The kinetic study showed that the maximum of adsorption is reached after 60 minutes of contact with the adsorbents prepared containing cores of date and fishing and 90 mn for the apricot cores.

The tests of adsorption with a mixture of these three activated carbon showed that 68.75 % of elimination is reached; the equilibrium time of adsorption is reached at 60 mn with a stirring velocity of 300 rpm at the ambient temperature.

The pH is practically without any influence in the elimination of phenol, on the other hand the stirring velocity and the initial concentration of the pollutant can influence the elimination of phenol.

Key words : *Phenol, pollution waters, industrial effluent, core date, apricot core, core of fishing, adsorption, models of Langmuir.*

CMTDE_27

On brackish water desalination economics and alternative renewable energies in Mena countries

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Abstract

Nowadays, water management in MENA, no longer exclusive to a sectoral issue pertaining to engineering and technical expertise such as irrigation, water supply and water storage, becomes a shared developmental challenge. In order to face an increasingly growing water crisis, attention on balancing the supply and demand for water given the current constraints, needs analysis of conventional and non conventional water resources from a range of perspectives, including considerations about technological dynamics and alternative renewable energies, which are highly recommended.

Thanks to engaged technical progress enabling sensitive desalination cost reduction, water crisis could be of lower impacts. For this region being the world leader in desalination technology investments, we are obliged to rexamine the characteristics of alternative renewable energies. To prevent water shortage from being a constraint to economic development and social stability in MENA, we argue brackish water desalination as one of the most promising and viable options, notably in long term for future generations.

This paper contains four sections. brackish water characteristics are clarified in section 1. Then in section 2, we focus on factors affecting both desalination costs and desalination implementation costs. A particular attention is spent in section 3 to electro-dialysis reverse (EDR), subsequent capital and O&M costs approximations. Besides, since there is a pressing need for brackish water desalination, which is energy intensive, alternative renewable energies related to desalination technologies are hightlighted in section 4.

Key words: *alternative, brackish water, desalination, electro-dialysis reverse, implementation, O&M, renewable energy.*

Effect of applied voltage and initial concentration to desalting NaCl solution using electrodialysis

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Abstract

The desalination process of electrodialysis is one of membrane separation that competes with reverse osmosis for desalination of brackish water and seawater. In this work water desalination using a laboratory electrodialysis was performed and evaluated to desalting aqueous solutions containing 5000, 10000 and 20000 mg/L NaCl at different applied potential (10, 15 and 20 V) and at a constant flow rate of 3 L/min. Nine electrodialysis runs were performed. The results showed that the increasing of applied potential and decreasing of NaCl concentration have an important effect to enhance the electrodialysis performance. The efficiencies of each experiment were evaluated as function of specific power consumption with the electrical energy consumed in electrodialysis stack. It was obtained that the specific power consumption increased when the salt concentration and applied voltage increased. A laboratory electrodialysis stack containing fifteen cation exchange membranes and fifteen anion exchange membranes of 0,716 m^2 total effective area was used.

Keywords: *Desalting, NaCl solution, Electrodialysis, Specific power consumption*

Competitive adsorption of Phenol and heavy metal ions on titanium dioxide (DEGUSSA P25)

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Abstract

In this work, we study the adsorption of phenol, chosen as an organic pollutant model and four heavy metal (Cu(II), Zn(II), Cd(II) and Fe(II)) in aqueous suspension of titanium dioxide anatase (Degussa P25) nanoparticles. The measure of adsorbed quantity of phenol was made by HPLC, on the other hand, the measure of amount of adsorbed heavy metal was made by atomic absorption spectrophotometrie (AAS). As suggested by several authors the adsorption of phenol was a chemisorption occurs on different sites at the TiO_2 surface via binding ligand complex and the adsorption of heavy metal ions proceeds via cations exchange or by formation of inner-sphere surface complexes with hydroxyl groups the active site of the surface of TiO_2 particles. The adsorption equilibrium data were well fitted by Freundlich isotherm model than both Langmiur and Temkin isotherm models. Simultaneous adsorption of phenol and each of heavy metals was also studied. The presence of heavy metal decrease the adsorption of phenol on TiO_2 relative to the adsorption of phenol in the absence of this heavy metals. In the other side the presence of phenol reduce the amount of heavy metal adsorbed on TiO_2 relative to the adsorption of this metal in the absence of phenol. it can be explained by competitive adsorption between the added cations and phenol although, heavy metals and phenol adsorption occur via different mechanisms and at differents sites. In the others side, both the phenol and heavy metal require surface adsorption sites.

Keys words *: Competitive adsorption; TiO_2; phenol; HPLC; heavy metals.*

The Chemical Investigating Methods of Concentration Polarization µin Electrodialysis (Plateau Length and Overlimiting Current Iov)

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Abstract

This research work investigates the i-v curve, particularly the physical meaning of the plateau length, of the limiting current I_{lim} and the nature of the over-limiting current Iov
.

In recent papers Wessling & al.(1) presented Iov as a puzzle and a non elucidated problem. They concluded that electro-convection, theory proposed by I. Rubinstein, explains I_{ov} .

Our research team has developed original experimental methods to investigate the i-v curve and
related problems :

The buffer solutions method [2]$HPO4^{=}/H2PO4^{-}$ used as co-ions or counter-ions [3] confirm that H^{+} and OH^{-}, then water dissociation, cannot contribute to Iov transport;

The weak electrolytes method [3];The addition of phenol, boric acid,,, (Fig.1) conserves I_{lim} and shortens the plateau length. At a critical concentration of phenol the plateau and at the same time, the polarization, are completely eliminated (Fig.1).

Today we confirm this approach by new experiments which combine both properties: the buffer is NH_4^+ /NH_3 and the weak electrolyte is NH_3 (Fig.2-3). Our experiments have been obtained automatically (Autolab30) and manually with CMV and CMX membranes and a free convection four electrodes cell.

We explain these results by the change of the dielectric properties of the membrane inside. Under the effect of very high local electric field (space charges), the pKa of weak electrolytes is lowered (Wien effect and Booth equation) which improves the membrane conductivity. These phenomena explain Iov. Our discussion will be based on the effects of weak electrolyte pKa values and concentrations. The research works of P.Pintauro & al (ICOM2005) and A.Tanioka constitute a strong literature confirmation of our new chemical experimental approach .

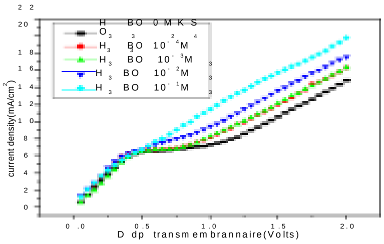

Figure 1: I-V urve.(MEC).

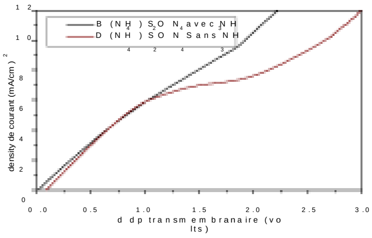

Figure2: I-V curve (MEC).

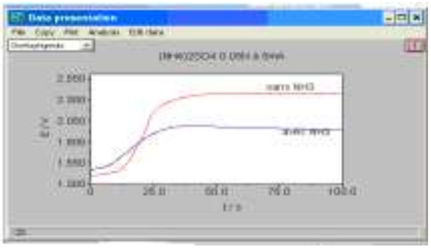

Figure 3:V-t curve (MEC)

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CMTDE_31

The electrodialysis membrane fouling , scaling and poisonning
A review and a general approach

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INTRODUCTION

The objective of this research work is to present a literature review and a general approach of the electrodialysis membrane fouling (EDMF) phenomenon .The electrodialysis membrane fouling (by humic and fulvic acids in natural waters), poisoning (by Fe^{+++}, …) , scaling (by $CaCO_3$, $CaSO_4$, hydroxides deposits), constitute serious problems to the progress of the ED process . Practical solutions exist to avoid the membrane fouling : the electrodialysis reversal (EDR), the pretreatment by adsorption , acidification … However there is not a general theory which anticipates and explains the basic mechanisms of the EDMF .The electrodialysis is very well adapted to brakisch waters which are available in large quantities in the North African area . A better understanding of the fouling phenomena will permit a larger use and development of this technology .

THE REVIEW : MECHANISMS AND CHARACTERISTICS It contains the following parts : The definitions Definitions and classifications has been already proposed by (G. Jonsson and C.E. Boesen , In "Synthetic Membrane Processes ",Academic Press ,(1984) , 118-129): "Fouling" describes the precipitation of colloids, organics or surfactant micelles on the membrane surface. "Scaling" defines few solubles salts deposits : carbonates, metal hydroxides …   "Poisonning" has been already applied to ion exchange resins [27] and extended to ED. It describes the strong fixation (or "complexation") of multivalents ions or large organic ions to the ion exchange fixed sites ($SO3^-$ or NR4+)

The influence of the solution nature *influence of organic anions : The most studied are the anions of natural organic matter because directly related to drinking water production (T.R.E. Kressman and F.L. Tye , J. Electrochem Soc.116 , 1(1969)) and (E. Korngold , E. De Korosy , F. Rahav and M.F. Taboch , Desalination , 8 (1970) 198-222). and already studied with anionic resins (N.W. Frisch and R. Kunin , Ind. and Eng. Chem., 49 / 09 (1957) 1365-1372;) .Recent investigations continue to study the NOM anions (H.J. Lee , D.H. Kim J. Cho and S.H. **Moon , Desalination 151 (2002) 43.**).The DBS (dodecyl benzene sulfonate) and other large synthetic anions ,have also been largely studied by E. Korngold and (E.J. Kobus and P.M. Heertjes , Desalination 10 (1972) 383-401.) . The NMS (naphtalene monosulfonate) confirms the negative effects of large organic anions . (K Urano , Y. Masaki and Y. Naito , Desalination 58 (1986) ,177-186.).

* influence of organic cations : These studies confirm clearly that poisoning and fouling are not related only to NOM , but to large organic ions , cationic or anionic .From 1971 to 1979,in many papers , T. SATA studied the influence of dodecyl , hexadecyl pyridinium , and polyethylene imine to modify cation exchange membranes surfaces and separate Ca^{++} from Na^+. Dramatic resistances have been obtained .They increase with the alkyl chain length. *influence of inorganic ions : The affinity between multivalent ions (Al^{+++}, Fe^{+++}, Th^{++++}). and ion exchangers is well known. The membrane poisoning is the direct consequence (Urano, T. Ase and Y. Naito, Desalination 51 (1984) 213-226.).ODA

YAWATAYA studied the size effect of quaternary ammonium cations, with interesting results.

The influence of the current nature * influence of the current reversal(EDR) : The anti fouling effects of current reversal are well established and currently applied at industrial scale (W.E. Katz , Desalination 28 (1979) 31-40 .and W.E. Katz , Desalination 42 (1982) 129-139 . The main research on mechanisms are fromT. SATA , E.J. KOBUS AND P.M. HEERTJES .

* influence of the current pulsations

*influence of the current frequency.

The influence of the membrane nature

The studies compare anion and cation exchange membranes, heterogeneous and homogegeous membranes T.R.E. Kressman and F.L. Tye , J. Electrochem Soc.116 , 1(1969).The influence of the salt nature. Urano and Al .have found a very interesting result : NaCl and Na_2SO_4 solutions have opposite behaviors with the same fouling agent, the Naphtalene monosulfonate NMS^- ; Then, the composition of the solution (natural waters ...) may influence the severity of fouling . These authors propose an equation to calculate the electric resistance of the membrane and explain the difference between NaCl and Na_2SO_4 by : " ... SO_4 was disturbed by NMS^- much more than Cl^- because the SO4 is large and combines strongly ... ". Unfortunately, this does not explain the basic mechanisms of this difference. We have proposed a mechanism to explain these differences K-E. Bouhidel and M. Rumeau. Desalination (Aug. 2004).

Influence of the industrial waste waters with the industrial waste waters where the solution chemistry is many more diversified and complicated than the classical brackish waters (drinking water production). Specific studies on fouling solutes are then necessary. It is illustrated by the recent investigations :

Chromium salts in the tanning and electroplating industries M.A.S. Rodrigues, R.F. Dalla Costa , A.M. Bernardes and J . Zoppas Ferreira , Electrochimica Acta 47 (2001) 75 and R.F. Dalla Costa , J . Zoppas Ferreira and C. Deslouis , J. Membr. Sci. 215 (2003) 115-128

Organic compounds in the kraft process H.J. Rapp and P.H. Fromm, J. Membr. Sci. 146 (1998) 249. and-V. Lindstrand, G. Sundström and A.S. Jönsson Desalination, 128 (2000) 91-102.

Calcium salts in the milk industry]-L. Bazinet , D. Ippersiel , D. Monpetit , B. Mehdavi , J. Amiot and F. Lamarche , J. Membr. Sci. 174 (2000) 97-110.

Stabilizers, reducing and complexing agents in the electroless nickel plating C.L. Li , H.K. Zhao , T. Tsuru , D. Zhou and M Matsumura , J. Membr. Sci. 157 (1999) 241.

CMTDE_32

Water recycling and free amino acids recovery from wheat washing waters by an hybrid process : Microfiltration / Electrodeionization

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Introduction

The raw wheat processing needs important volumes of water for washing (1 to 2 m^3 / ton)

.The resulting waste waters are polluted by BOD , COD , bacteria ,... . A conventional treatment is not adapted : salt accumulation , chlorine organic by products ,...are serious drawbacks .

In this research work we propose to apply a clean membrane technology based on water recycling , valuable by products recovery (free amino acids , natural wheat salts ,...) . An hybrid process is proposed :

The microfiltration : after a bentonite pretreatment to remove colloids , the MF eliminates the micro organisms and remaining turbidity .

The EDI (research work in progress) concentrates natural salts , free amino acids and separates neutral organic molecules (saccharides) .

Materials

-A laboratory scale frontal MF cell with a 0.45 µm polycarbonate membrane .

-Activated bentonite ;

-Amino acids has been identified by ninhydrine ,TLC and planar electrophoresis .

-Natural salt content has been evaluated by conductimetry .

-Selected wheat have been washed with distilled water in respect to washing time and ratios .

RESULTS AND DISCUSSION

-Analytical : The washing waste waters are highly turbid , yellowish , with a 450 µS conductivity , 350 mg/l of COD , a 6 to 7 pH . TLC and electrophoresis permit to separate 4 amino acids (2 acidic and 2 basic). Ion exchange separations confirm these results.

-Micro filtration (1) ::frontal MF of waste waters gives severe fouling(filtrate-time measurements) . A pre-treatment by coagulation – flocculation improves strongly the filtrate flow rate.

-Ion Exchange: The micro filtered water is successfully treated by an IEX mixed bed . Free amino acids and natural salts are entirely fixed. The resulting water conductivity is nul with a low COD of neutral saccharides easily fixed on activated carbon. The IEX needs chemical for regeneration.

The low conductivity of washing waters is well adapted to the EDI process which may replace the IEX mixed bed .

-The EDI process : It is a well known success for demineralization of low conductivity waters . Runs with NaCl and KCl are promising **(2)**. Nextly we experiment real solutions with EDI.

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Electroplating Sludge Lixiviation : Recovery of Acids , bases and Metals by DiffusionDialysis

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Abstract

Diffusion dialysis by proton or hydroxyl leakage , through an ion exchange membrane , is a well known and largely used process . It is applied in hydrometallurgy and metal pickling to separate and recover acids and alkali from metal mixtures. It is an elegant and simple method to prevent pollution and to recycle valuable materials.

In this research we apply the same idea to solve an original problem : we recover the excess of acid or alkali issued from the selective lixiviation of the electroplating sludge.

In the electroplating industry, the conventional treatment of waste waters is based on detoxification (cyanide and chromates) , followed by a precipitation of metals. The resulting electroplating sludge, a mixture of metal hydroxides, constitutes a serious environmental problem.

In previous papers, we have used numerical and chemical methods to optimize metal separations **(1 & 2)**..

The selective recovery of metal values from this sludge constitutes an economic and environmental solution. In most cases an acidic, alkaline , complexing , ...lixiviation is a necessary step where the excess of lixiviant constitutes a problem . We propose a diffusion dialysis to separate solubilized metals from sulfuric acid.

The laboratory scale results are promising :

In a free convection two compartments cell, the efficiency of acid recovery is 45 % after 14 hours .

In the same agitated cell the efficiency increases to 95 % in less than 3 hours.

We separate cobalt from nickel by an alkaline sludge lixiviation . The recovery of sodium hydroxide , with a high efficiency , is obtained with a cation exchange membrane . This method , for cobalt recovery, is quite new .

Refernces

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The ion exchange membranes modification By weak electrolytes and glycine : Reduction and elimination of the concentration polarization plateau in electrodialysis

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Abstract

The problematic polarization plateau in electrodialysis is simply reduced and then eliminated by a weak electrolyte addition which modifies deeply the membrane behavior : we obtain a new membrane without polarization .This extraordinary result permits also to explain classical problems in electrodialysis , particularly the origin of the overlimiting current in the cation exchange membrane .

Introduction

The limiting current density (LCD) problem in electrodialysis (ED) .

In the desalination industry, the limiting current density remains one of the most important obstacles to the progress of the ED . It is illustrated by the i-v curve plateau and by abnormal phenomena (electrical noise , water dissociation,...) . The LCD limits the ED efficiency . Until today there is only one solution to increase I_{lim}: the turbulent flow . Is it possible to improve the I_{lim} by changing the membrane properties ? Yes it has already been done by the homogeneous selective and thin membranes which gives a better efficiency than the heterogeneous first generation membranes. Since this important progress , there are not new and serious improvement . Our research work presents , both , original experiments and theoretical contributions to improve efficiency and to a better understanding of polarization phenomena .

The limiting current density (LCD) and polarization theories and mechanisms .

It becomes evident that the absence of a clear explanation of the events which occur at the interface during polarization does not permit to improve the limiting current density . In effect in spite of the very important contribution of R. SIMONS to explain the water dissociation and I_{ov} , many questions are not elucidated .For example I_{ov} on the cation exchange membrane is not at all explained . We know also that the habitual equation of I_{lim} doesn't agree with experiments .

A recent congress , ICOM2005 , illustrates the nowadays contradictory theories :

*The P.PINTAURO's model : Based on the Wien effect hypothesis , the research studies the behavior of a weak electrolyte in a cation exchange membrane under an electric field ΔV.The result : the pK_a of acetic acid decreases strongly (40%) in the membrane when ΔV increases.

*The I.RUBINSTEIN electroconvection theory : does not use the Wien effect and Simons hypothesis . Often cited in the literature , this approach doesn't explain clearly many practical cases , particularly the experimental results of our present abstract where the polarization plateau is simply eliminated by a weak electrolyte addition .

Recent experimental results , described as "intricate"**[1]** ,don't agree totally with basic and well accepted definitions of polarization (depleting layer , ...)

We don't forget that the richest and deepest papers devoted to the basic mechanisms of the water dissociation have been presented by A. TANIOKA . The effects of weak electrolyte (pK_a values) are clearly demonstrated . This long serie of papers , argumented by numerous and strong experimental results , agree totally with these hypothesis : Wien effect , changes of dielectric properties of solutes and solvents in the membrane ... However these investigations have been only limited to the bipolar membranes . The extrapolation to monopolar membranes is not evident .

Our present research work

We study experimentally the influence of a very weak electrolyte on the i-v curve of K_2SO_4. The CEM has been investigated with boric acid and phenol (ICOM2005). Now we study the AEM and the effect of glycine.

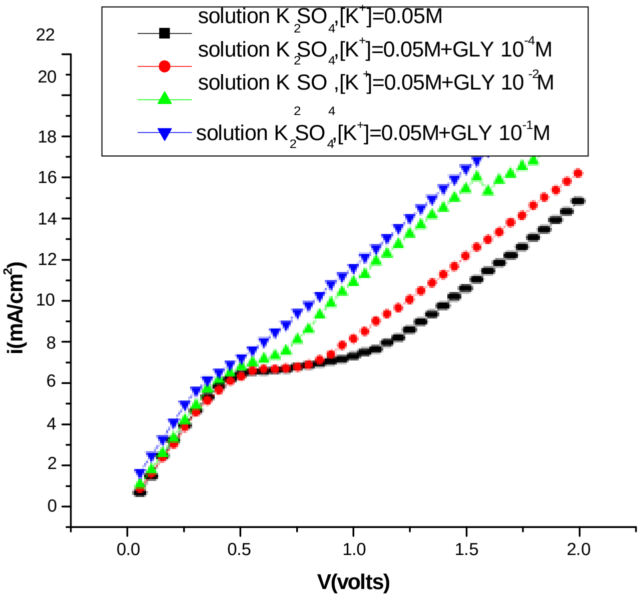
Strong similarities are observed : the I_{OV} with both , CEM and AEM , has the same origin . With the AEM also the plateau width decreases when weak electrolyte increases . Why ?

RESULTS AND DISCUSSION

Our hypothesis: We consider that the I_{OV} on the CEM is promoted by the second Wien effect

.which reduces the pK_W of H_2O in the membrane . The dielectric properties of the membrane are also changed which increases the membrane conductivity . Then ΔV_{over} corresponds to a pK_W decrease .

Our idea : if we add in the membrane a stronger electrolyte than water we will obtain a sacrificial effect .The new electrolyte dissociates before water and then reduces the plateau width . We expect also no modifications on the ohmic zone because the electrolyte is very weak and has no effects on the solution conductivity .



Our results : the following figures confirm totally these expectations .

Influence of glycine on CEM i-v curve : The figure presents the i-v curve of K_2SO_4 0.025 M at different concentrations of glycine

*the glycine has no effects in the ohmic zone.

*the I_{lim} value is not changed whatever the glycine concentration .

*the plateau width decreases if glycine concentration increases.

*the plateau slope increases with concentration.

*At 0.1M there is no plateau :the polarization is eliminated,in contradiction with the basic definitions and law of polarization in ED.

The glycine addition has the same effect as the other very weak acids on CEM (ICOM2005).

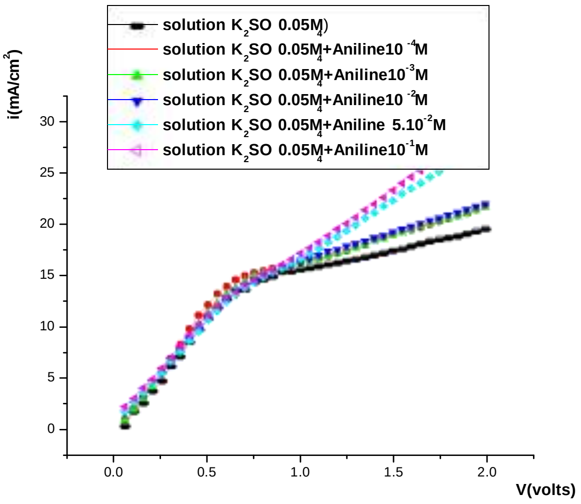
Why does the plateau width decrease with the glycine concentration increase ? a new theory will be presented.

What does it happen with an anion exchange membrane ? It is presented in the next figure.

Influence of aniline (pK_A=4.5) on a Selemion AEM i-v curve: The figure presents the i-v curve of K_2SO_4 0.05 M at

different concentrations of aniline .We obtain a symmetrical effect as with the CEM.

With AEM the aniline has a sacrificial role :it dissociates precocely and becomes a stronger base in the membrane .The local Wien effect explains easily



Conclusions:

*The i-v curve plateau has been reduced and then eliminated only by a weak electrolyte addition :the membrane properties has been simply modified .

*The I_{OV} in the CEM : At a given applied voltage ΔV_{OV} , the Wien effect reaches a threshold value which reduces the water pK_W in the membrane and increases the membrane conductivity and then the current. The I_{OV} is then explained by an important change of dielectric properties and pK_A in the membrane .

*The addition of a very weak electrolyte confirms neatly the Wien effect . The weak electrolyte plays a sacrificial role . It is dissociated sooner ,before the water molecule , because of its lower pK_A..The recent models of P.PINTAURO are an excellent confirmation .

The phenomenon occurs symmetrically , in anion and cation exchange membranes.

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CMTDE_35

Comparison of salt nature and evaluation of the ionic electrochemical mobilities in electrodeionization (EDI)

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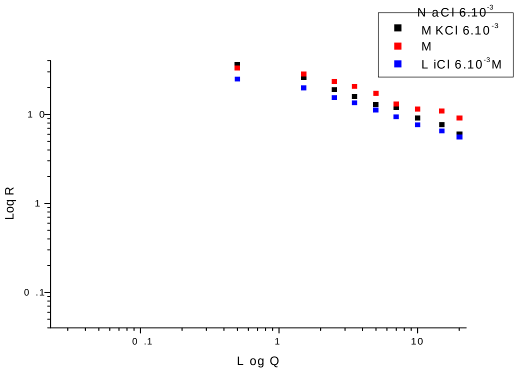
Introduction

EDI is used widely today for the production of high purity water, especially in the semiconductor industry. In spite of its rapid development, there are not established theories, design equations nor clear mechanisms of regeneration and transport [1]. The aim of this work is to improve the equation $J= KQ^n$ in EDI. In previous study [2] we have investigated the effects of voltage and flow rate. Today we present the effect of salt nature on K value. The slope of the following figure helps to determine this effect.

Experimental

We have used a three compartments cell with four electrodes monitored by an AUTOLAB PGSTAT30.

The basic cell is described elsewhere [2].



Influence of flow rate Q on the demineralization ration
during continuous electrodeionization, represented in Log/Log coordinates

Results and Discussion

Various studied salts (fig1) obey to the equation described in [2] ($J= KQ^n$).

A sample masse balance and the application of the Nernst Planck migration equation give directly the numerical value of the average ionic mobility. The mobilities in the mixed bed resin reach unexpected values.

Conclusion : We have improved the equation of $J= KQ^n$.

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CMTDE_36

Optimization of the electrodeionization (EDI) Process : Comparison Of Different Resin BED Configurations

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Introduction

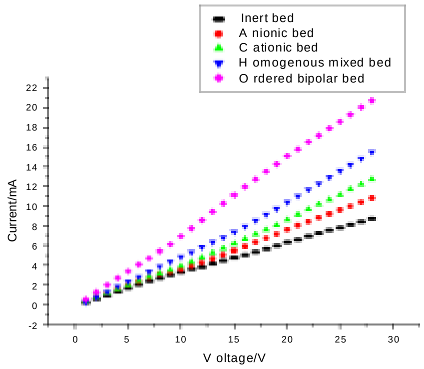
The optimization of the EDI resin bed has been and remains a serious challenge for the design [1, 2...]. What is the best design? Thin or thick cell, Single or mixed bed...This research work deals with this optimization problem. It is based on the comparison of five different configurations.

Experimental

We have used a three compartments cell with four electrodes. Two luggin probes measure the trans-bed voltage. The basic cell is described elsewhere [3]. The experiments are based on the comparison of I-V or efficiency-voltage curves of the following configurations: homogenous/mixed, cationic, anionic, inert and two layers ordered bipolar beds.

Results and Discussion

The following figure illustrates our results which are summarized by this efficiency order: Two layers ordered bipolar bed > homogenous mixed bed > (cationic, anionic, inert) bed. This is particularly due to the bipolar effect between resin layers and the polarization decrease at the CEM and AEM surfaces.



Current-applied voltage curve of continuous EDI. Cell thickness 2mm; concentration inlet of NaCl solution: 6.10^{-3}M.

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Effects of electrolytes on the noise in the over-limiting current range : (Cation exchange membrane).

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Introduction

This research work investigates the i-v curv on the noise in the over-limiting current Iov.

The overlimiting current is always accompanied by aa neat electrical noise. It is a well accepted experimental phenomenon [1,2,3,4].The study of this may contribute to a better understanding of the Iov.

This research work presents original finding : The electrical noise depends directly on the counter ion nature. The noise intensity decreases according to the Hoffmeister serie: Li $^+$ Na$^+$ K$^+$. (Figure 1 a b).

We explain this by the hydration number of the counter-ion.NH$_4^+$ presents a singular behaviour; the noise is minimal (Figure 1.c).

Acknowledgments

We are most grateful To Professors; S.H. Moon C.Gavach, J.Benavente and. Dr.F.Lutin (EURODIA),

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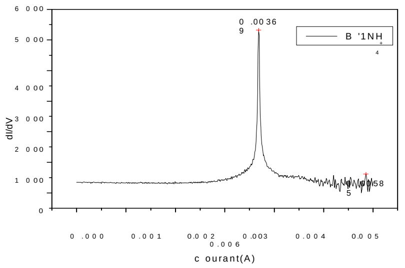
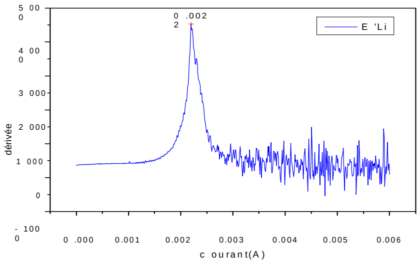
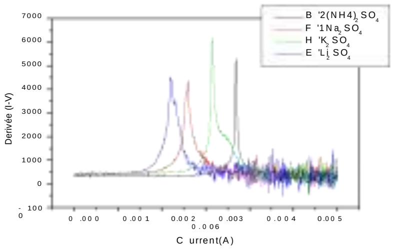


(a)



(b)



(c)

Figure 1: The instantaneous differential ddp tranmembranaire/ I at a given current. (four electrode cell, Free convection , AutolabPGSTAT30).

CMTDE_38

The chemical investigating methods of concentration polarization in electrodialysis.

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Introduction

This research work investigates the i-v curve, particularly the physical meaning of the plateau length, of the limiting current I_{lim} and the nature of the over-limiting current Iov .
In recent papers Wessling & al.(1) presented Iov as a puzzle and a non elucidated problem. They concluded that electro-convection, theory proposed by I. Rubinstein, explains I_{ov} .
Our research team has developed original experimental methods to investigate the i-v curve and related problems :
The buffer solutions method [2]$HPO_4^{=}/H_2PO_4^{-}$ used as co-ions or counter-ions [3].
The weak electrolytes method [3];The addition of phenol, boric acid,,, (Fig.1).
We consider that these experimental results constitute clear and strong contributions to the
i-v curve understanding and cannot be explained by electro-convection. Today we confirm this approach by new experiments which combine both properties: the buffer is NH_4^+/NH_3 and the neutral weak electrolyte is NH_3 (Fig.2-3). Our experiments have been obtained automatically (Autolab30) and manually with classical membranes (CMV,CMX) and a free convection four electrodes cell.

Results and discussion

We explain these results by the change of the dielectric properties of the membrane inside. Under the effect of very high local electric field (space charges), the pKa of weak electrolytes is lowered (Wien effect and Booth equation) which improves the membrane conductivity. These phenomena explain Iov. Our discussion will be based on the effects of weak electrolyte pKa values and concentrations. The research works of P.Pintauro & al (ICOM2005) and A.Tanioka constitute a strong literature confirmation of our new chemical experimental approach.

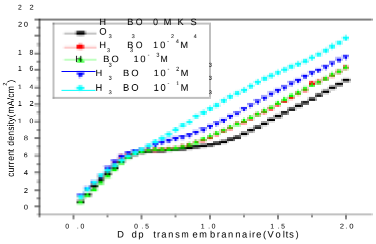

Figure 1: I-V curve.(MEC).

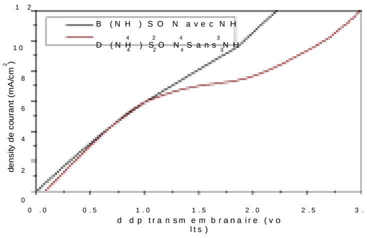

Figure2: I-V curve (MEC).

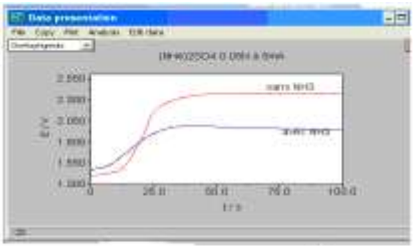

Figure 3:V-t curve (MEC)

We are most grateful To Dr.F.Lutin (EURODIA), Professors ; C.Gavach, J.Benavente and S.H. Moon.

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CMTDE_39

Unhairing waste waters from tanneries : water recycling and free amino acids recovery

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Abstract

Tannery is an old and very polluting industry; especially the unhairing operations. During the unhairing step the animal hide is treated by an alkaline solution ; mixture of calcium hydroxide Ca(OH$_2$ and sodium sulfide Na_2S . The skin proteins ; keratin and collagen ; are partialy solubilised .The resulting waste waters are very polluted by :

High COD 20000 to 80000 mg/l

High pH 13 and more

Sulfides

Catalytic air oxidation of sulfides ; followed by a neutralisation with tanning waste waters constitutes the main waste water treatment in many countries . The main result is treated waters are not recycled and important volume of sludges precipitated proteins and chromium hydroxides .

Is there a cleaner technology with water recycling and materials recovery. Until today no Ultrafiltration has tested unsuccessfully .

This research work aims to propose an original clean technology based on

An original neutralisation process which permits water recycling with a low conductivity and COD .

Analyse ; separation and recovery of free a;ino acids .

Our main results are :

Our original acidification of waste waters to pH 4 has permited to précipitate all dissolved proteins, to eliminate H_2S and to obtain very clear waters with a very low conductivity .

These clear waters contain free amiino acids and peptides easy to identify and to separate.

TLC chromatography confirms the présence of seven free amino acids. These results are in good agreement with the literature review .

Results of three months tests of vertical solar still under desert climate

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Abstract

In arid zones of Algeria lacking in pure water and endowed with an important solar potential, solar distillation represents a good solution for desalting water, man has depend on underground water reservoirs for fresh water requirements, but the use of water, from such sources is not always possible, on account of the presence of salt. The Algerian territory is particularly sunny area especially in its Saharan part. The desert of Algeria is among the most exposed regions in the world, territory may benefit from between 2500 to 4000 hours of sunshine per year.

A mixed mode (indirect and directed) vertical solar still of trapezoidal cross sectional view, the biggest height of trapeze was 0.98 m and the lowest height was 0.84 m. The lower basin of still is the base of trapeze. The solar still was fully fabricated and tested at the experimental field of the Renewable Energy Research Unity in Sahara Environment at Adrar, Algeria. Tests are carried out on the still from April to June.

Distilled water produced on inclined glass cover respectively, 3 and 4 April were 1.06 and 1.09 l/m^2.day, distilled water produced by east and west glass cover for same days are respectively 1.48 and 1.19 l/m^2.day. The total daily yield of distilled water produced by new vertical still for these days was respectively 2.54 and 2.26 l/m^2.

CMTDE_41

Phosphate Removal from aqueous solution by hydrous iron oxide freshly prepared Effect of pH, ions concentrations and competitive anions

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Abstract

Several methods are used for phosphate removal from waste water. In addition to biological elimination, ion exchange, precipitation and adsorption on activated carbon, are in general the used methods. The objective of this work, is the study of phosphate removal by hydrous iron oxide prepared in the presence of phosphate ions.

Experiments are carried out in order to study the effects of pH, iron and phosphate concentrations and the presence of sulphate, chromate and oxalate ions. Infrared spectroscopic analyses are performed to characterize the mechanism of phosphate interaction with the hydrous oxide in the absence and in the presence of competitive ions. The results of macroscopic analyses show that the phosphate uptake is related to pH. The effects of iron and phosphate ions concentrations suggest a certain saturation of adsorption sites. The effect of the presence of oxalate ions is more significant than those of chromate and sulphate ions.

The IR spectra of the solid samples obtained after phosphate ions fixation in the absence of the other anions, show a broad band in the surrounding of 1030 cm^{-1} characterizing the tetrahedral symmetry of phosphate. Among the anions studied, only the presence of chromate ions shows an effect on the mechanism of phosphate ions retention by hydrous iron oxide.

Comparison of the power of groundwater scaled by chronoamperometry

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Abstract

The drilling of Hamma is known as an important water resource, which supplies pratically all the town of Constantine in drinking water and used also for industrial plants. The major drawback of this water is that it has a very high hardness of about 59 ° F.

Our study also focused on another source that has a hardness as important as the water of Hamma. This is the drilling Negrine.

Negrine is the latest city of the town of Tébessa. It is located southeast of the border in the town of the wadi. This region is known by a very rich agricultural and drilling Negrine feeds the region with drinking water and for agricultural irrigation. Negrine water has a hardness of 56 ° F.

In this work we used the electrochemical chronoamperometry method to :

- Determine the power scaled raw water sources
- Study the effects of inhibitors like KH_2PO_4 and polyphosphates on the power of the waters of the scaled and Hamma water Negrine. The method of chronoamperometry at a temperature of 30 ° C on the raw water of Hamma water and Negrine, allowed to determine the time scale for each of them: Te (Hamma) is 10min and Te (Negrin) is 13.5 min.

The application of KH_2PO_4 inhibitor increases the time scale from the concentration of 0.1 mg / L for the water of Hamma and 0.5 mg / L for water Negrine.

By contrast, the treatment with polyphosphates affects the power of the scaled Hamma water from the concentration of 0.04 mg / L and for water Negrine from the concentration of 0.4 mg /L.

So, according to the obtained results the KH_2PO_4 and the polyphosphates have an inhibitory effect on Hamma and Negrine waters at low concentrations.

Keywords : *Water scaling, Calcium carbonate, Inhibition, Chronoamperometry.*

CMTDE_43

Effect of nitrate ion on zinc corrosion in acidic medium

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Abstract

Zinc finds numerous applications in technology and industry. Consequently, the study of its corrosion is of great importance.

In the present work, the effect of nitrate ion on zinc corrosion in 1M H_3PO_4 has been evaluated, by weight loss, polarisation measurements and open circuit potential methods. The variation of nitrate concentration leads to different corrosion states. Results revealed that the corrosion rate depends on nitrate concentration. Scanning electron microscopy (SEM) examination of the zinc surface confirmed the existence of a passive film.

Keywords : *corrosion, zinc, acid, nitrate.*

CMTDE_44

Evaluation of SEDE model for describing the retention of multi-ionic solution

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Abstract

Nanofiltration (NF) is the most recently developed membrane technology in liquid phase. This process uses membranes with pore sizes in the nanometer range to meet industrial needs in the area of small molecule (< 1 kDa) and ion separations. The complexity of ion transfer in nanoporous media is impossible to master without a suitable transport model. That is the reason why, during the last decade, the researchers' attention has been focussed to the development and optimization of transport models able to predict separation properties in NF. The most widely adopted NF models are based on the extended Nernst-Planck equation to describe the mass transfer and an equilibrium partitioning relation to describe the distribution of ions at the pore inlet and outlet. Among the continuous models, the SEDE (Steric, Electric and Dielectric Exclusion) model is the latest one developed. This one includes the dielectric exclusion mechanism, in terms of both Born dielectric effect and image forces contribution, in partitioning equations at membrane/solution interfaces. This model has proven to provide a good description of the experimental rejection rates for both symmetric and asymmetric single salts (more particularly, for salts containing divalent counterions). The present challenge is to extend the application of the SEDE model to multi-ionic solutions (3 and 4 ions) and to check its consistency.

To this end, ion rejection rate measurements have been carried out with a NF polyamide membrane and several multi-ionic mixtures: Pb^{2+} (or Co^{2+}), NO_3^- and H^+; Co^{2+}, Pb^{2+} and NO_3^-; Co^{2+}, Pb^{2+}, NO_3^- and H^+. The effective pore size and the membrane active layer thickness to porosity ratio were assessed from glucose rejection rates and water permeability, respectively. The two remaining fitting parameters of the SEDE model, namely the effective volume charge density (X) and the dielectric constant inside the membrane pores ($\square_p$), were estimated by fitting experimental ion rejection rates. Unlike single salt solutions for which different couples of values ($\square_p$, X) can lead to the same rejection rate, measurements performed with multi-salt mixtures allow determining both X and $\square_p$ unambiguously since the rejection rate may be significantly affected by charge and dielectric effects. The fitted values of X have been then compared with those determined from tangential streaming potential measurements (coupled with conductance experiments) with the membrane contacting the multi-salt solution.

The fitted values were proved to be much smaller, which is in agreement with the charge regulation phenomenon leading to a decrease in the fixed charge density inside the pores as compared to external membrane surface. The dielectric constant inside the pores was found lower than that in the bulk solution (i.e., in outside pores), which confirms that the dielectric exclusion cannot be neglected in the analysis of the filtration properties of NF membranes.

CMTDE_45

Evaluation of SEDE model for describing the retention of multi-ionic solution

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Abstract

Nanofiltration (NF) is the most recently developed membrane technology in liquid phase. This process uses membranes with pore sizes in the nanometer range to meet industrial needs in the area of small molecule (< 1 kDa) and ion separations. The complexity of ion transfer in nanoporous media is impossible to master without a suitable transport model. That is the reason why, during the last decade, the researchers' attention has been focussed to the development and optimization of transport models able to predict separation properties in NF. The most widely adopted NF models are based on the extended Nernst-Planck equation to describe the mass transfer and an equilibrium partitioning relation to describe the distribution of ions at the pore inlet and outlet. Among the continuous models, the SEDE (Steric, Electric and Dielectric Exclusion) model is the latest one developed. This one includes the dielectric exclusion mechanism, in terms of both Born dielectric effect and image forces contribution, in partitioning equations at membrane/solution interfaces. This model has proven to provide a good description of the experimental rejection rates for both symmetric and asymmetric single salts (more particularly, for salts containing divalent counterions). The present challenge is to extend the application of the SEDE model to multi-ionic solutions (3 and 4 ions) and to check its consistency.

To this end, ion rejection rate measurements have been carried out with a NF polyamide membrane and several multi-ionic mixtures: Pb^{2+} (or Co^{2+}), NO_3^- and H^+; Co^{2+}, Pb^{2+} and NO_3^- ; Co^{2+}, Pb^{2+}, NO_3^- and H^+. The effective pore size and the membrane active layer thickness to porosity ratio were assessed from glucose rejection rates and water permeability, respectively. The two remaining fitting parameters of the SEDE model, namely the effective volume charge density (X) and the dielectric constant inside the membrane pores (ε_p), were estimated by fitting experimental ion rejection rates. Unlike single salt solutions for which different couples of values (ε_p, X) can lead to the same rejection rate, measurements performed with multi-salt mixtures allow determining both X and ε_p unambiguously since the rejection rate may be significantly affected by charge and dielectric effects. The fitted values of X have been then compared with those determined from tangential streaming potential measurements (coupled with conductance experiments) with the membrane contacting the multi-salt solution.

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CMTDE_46

Simulation under an Equation Oriented Environment of a small scale hybrid Energy Production /Desalination System Powered by Renewable Energy.

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Abstract

The optimisation capacity of equations oriented environment for feasibility assessment can help to identify opportunities for reliable and competitive integration of renewable energy in medium and small scale desalination in south Mediterranean countries and particularly Algeria. The development of extended rural regions on a large territory asks for de-central solutions integrating water and power generation locally. If grid power connection is not at reach the village may have a simultaneous problem of water and power supply.

This paper presents the results from a study on an BWRO system for 48 m^3/day water production from south-west Algeria Hassi-Khebbi brackish water well(29.11°N/5.21°W) combined with up to 50 kW additional power supply to the consumers of the water. The water and power cogeneration process is powered from a fuel cell, PV solar energy conversion and a backup Diesel generator.

Keywords: *Performance, Renewable Energy, BWRO, Desalination, PV, Fuel cell, Diesel generator set.*

Limiting and critical fluxes in reverse osmosis of modified skim milks

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Abstract

The objective of this work was to study the reverse osmosis (RO) in a complex media, namely unmodified and modified skim milks more or less diluted in order to understand the role of physico-chemistry on fluxes and selectivity.

Critical and limiting fluxes were determined during RO on modified skim milks in the pH range 3,5 to 11,5. As caseins were already identified as the main components of milk responsible of flux behaviour, characterisation of size and zeta potential of these proteins were performed for a better understanding of their role on RO as it was already done for ultrafiltration. Correlations were found between (apparent) critical and limiting fluxes and the physico-chemical characteristics of caseins.

These fluids, based on skim milk, could correspond to various types of effluents from dairy industry and results shows that the management of the concentration of them must be different according to theirs pH. For alkaline effluents it must be interesting to have a regulation of the filtration based on the volume reduction ratio (VRR) to always be below the critical conditions and avoid the irreversible deposit. Contrary for neutral effluents it seems that RO at limiting flux could be the optimum way as no irreversible deposit occurred on the membrane for a large concentration range.

The retention of the COD of natural or modified skim milk is at least 99,9% with the RO TFC HR membrane. The COD retention is close for both limiting and critical fluxes. This indicates that the role of the irreversible deposit, build up on the irreversible fouling is not very important toward selectivity.

Key words : *Reverse osmosis, limiting flux, critical flux, size, zeta potential, physico- chemical environment, caseins, milk, effluents.*

CMTDE_48

Sorption of hexavalent chromium metal onto Amberlite IRA 410 Equilibrium isotherms and Kinetics studies

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Abstract

The removal of chromium (VI) from aqueous solution by a strong anion exchanger Amberlite IRA 410 has been studied. Batch mode experiments were conducted to study the effect of initial concentration of Cr (VI) and equilibrium isotherms. The adsorption process of chromium (VI) is tested with Freundlich, Langmuir and Khan models and the results shown that adsorption behaviour of chromium (VI) could be described very well by the Langmiur model. The adsorption capacity was determined to be 145.4mg/g. The Elovich equation and Ritchie model were used to represent the kinetic data and the equation parameter values were also evaluated. It was found that the adsorption following the Ritchie model, but for the concentration less than 100mg/l, the Elovich equation describes well the kinetics data. The capacity of adsorption increase with increasing initial concentration

Keywords: *sorption, anion exchanger, Freundlich and Langmuir isotherm, Batch kinetics, Elovich equation and Ritchie model, diffusion, mass transfer coefficient.*

Treatment of sludge waste for Production of biogas and protection of environment

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Abstract

This article presents the important result of the application of the anaerobic digestion process of the activated sludge of treatment plant in the mesophilic condition. This research is carried out in the pilot digester with 450 litter effective volume.

Firstly the characterization of the substrate influent was made, the obtained characterization result show that the activated sludge contains an important percentage of organic biodegradable mater, which support the utilization of this sludge in order to it valorization and production of biogas.

Secondly the characterization of the effluent coming from the pilot digester was made, in order to monitoring the anaerobic digestion process. All the stability parameters were measured according the standard methods (ammonia, pH, alkalinity, VFA…) all this parameters confirm the good behavior of the anaerobic digestion process. The biogas production volume was 0.0789 m^3/day with a 60.37% of methane, with specific gas production (SGP) equal to 0.15 m^3/KgTVSfeed.

This is a good result, and it encourage the optimization of this process with the utilization of the activated sludge substrate mixed with other organic biodegradable waste lake kitchen waste or agricultural, in order to produce more biogas.

Keywords : *Treatment, valorization, anaerobic digestion, mesophilic.*

CMTDE_50

Treatment of olive mill effluents by Osmotic Membrane Distillation

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Abstract

Olive oil industry is a very important industrial activity in the entire Mediterranean basin. This industry generates important volumes of toxic and polluting wastewaters. Olive mill effluents (OME) are seasonally generated with a highly diverse organic load that reaches values as high as 200 g of O_2/L (Chemical Oxygen Demand) and also contain large amounts of suspended solids up to about 190 g/L. Amongst other organic constituents, OME contain high concentrations of phenolic compounds up to about 10 g/L that make, along with the high organic load, OME hardly biodegradable and phytotoxic. Considering the OME polyphenols, the osmotic membrane distillation (OMD) is a non destructive process, which makes possible the recovery of these valuable compounds. The treatment and concentration of OME was carried out by using a laboratory scale system, using a microporous polytetrafluoroethylene (PTFE) membrane at 30°C (±0.1°C). 5 M sodium chloride was used as an osmotic agent in the permeate side. The results show that the PTFE membrane exhibits a flux of 3.9 $L.h^{-1}.m^{-2}$ and a separation coefficient as high as 100%. The OMD processing of OME reaches a concentration factor of 1.9 after 30 hours of operating time and exhibits a high fouling resistance since the reduction of the water flux ~~before and~~ after 3 days operating time was only 5.7%.

Keywords: *Osmotic Membrane Distillation; Olive Mill Effluents; treatment, phenolic compounds.*

A Well Water Reverse Osmosis Desalination Unit Diagnosis

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Abstract

In this present work the diagnosis results of a reverse osmosis desalination unit are reported. Since 1997, the desalination unit was supplying a 1200 bed hotel. The feed water was driven from a well situated 300 m away form the sea. The water has an approximate salinity of 6gg.L^{-1}. The unit was producing 600 m^3 per day of desalinated water with a Total Dissolved Salts (TDS) of nearly 400 mg.L^{-1}. The desalination unit has two stages with 67% and 42% yields respectively giving an average yield of (82?) 81%.

The behavior of all water streams with respect to aggressiveness and scaling tendency was assessed. The 2nd stage reject water was shown to exhibit a very high scaling behavior with an instantaneous precipitation in the absence of feed water chemical treatment. The analyses have shown that the produced water was very aggressive.

The second stage module autopsy has revealed a sharp decrease of the membrane performances because of mineral as well as organic fooling buildup. The inorganic scale was essentially made of coesite and calcite and kaolinite clay.

The presence of silica and clay could be attributed to an inadequate filtration pre-treatment process that was not able to retain all the suspended matter in the feed water. Whereas the presence calcite crystals at the membrane surface, reveals that the chemical inhibition performed at the pre-treatment process without adjusting the water pH was not able to prevent calcium carbonate precipitation. A periodic acid wash of the 2nd stage membranes is then necessary to guarantee this stage desired objectives.

Keywords : *Desalination, Water, Reverse Osmosis, Fooling, Autopsy.*

CMTDE_52

Diagnosis of small capacity reverse osmosis desalination unit for domestic water

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Abstract

Tunisian norm of drinking water tolerates a maximum TDS of 1.5 g/L, and the domestic water presents usually a salinity grater than 500 mg/L. In the last years, several small capacity reverse osmosis desalination prototypes have been marketed. They are used to desalinate brackish water with TDS lower than 1.5 g/L. This RO unit, tested with tap waters during four years, was diagnosed.

The RO unit produces 10-15 L/Houre with a recovery rate between 25 and 40 % and salt rejection in order of 90 %. The salinity of the tested domestic water is located between 0.4 and 1.4 g/L. Water pretreatment is composed of three filtration operations (cartridge filter, granulate active carbon filter and 5 µm cartridge filter). Pretreated water is pumped through RO membrane with maximum pressure of 6 bars.

At the 4th year, the RO unit performances were substantial decreased. Recovery rate and salt rejection fall down more than 50 and 100% respectively and the pressure drop increase from 1 to 2.1 bar

The membrane regeneration allowed only the rate recovery restoration. The membrane selectivity was not improved. The membrane seems irreversibly damaged by the tap water chlorine none retained by the deficient pretreatment.

An autopsy of the used RO membrane was done by different analysis techniques as SEM/EDX, AFM, XRD and FTIR spectroscopy.

The analysis of membrane (proper & used) surfaces show a deposit film on the used membrane witch evaluated to environ 2 µm, it indicates a fooling phenomenon. The SEM photos show deterioration on the active layer material of the membrane witch seems attacked by the tap water chlorine.

The X Rays Diffraction and FTIR show that the deposit collected on the used membrane contains organic and mineral (Gypsum, SiO_2 and clays) materials. Silicates and clays can exist in tap waters and reach the RO membrane when the pretreatment micro-filter became deficient. The Gypsum presence is due only to germination on the membrane.

CMTDE_53

Tunisian brackish water desalination by Electrodialyse : Opposing scaling and process optimization

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Abstract

Electrodialysis (ED) did not know a mattering development in the desalination field because of problems usually related to energy consumption, the scaling and/or precipitation phenomenon of certain mineral salts ($CaSO_4$, $CaCO_3$, etc.). and the importance of investments which they require.

So, to mitigate some of these problems and to increase the electrodialysis processes potentialities, we introduced a crystallisation inhibitor (sodium polyacrylate RPI2000) into the concentration compartment during ED's operations. Then we studied some parameters such as the applied potential or the circulation flow of studied solutions. The inhibitor addition allowed to delay the precipitation in the ED concentration compartement, confining so the brine in a small volume and decrease the frequency of replacement of membranes, which will reduce the cost of the process.

Without adding scaling inhibitors, a set of experiment was performed using synthetic water supersaturated on CaCO3 and CaSO4 at room temperature. Several flows rates are tested (80, 60, 40 and 30 L/h). We applied 20 V until the conductivity measured in the dilute compartment dropped approximately from 9000 µS/cm to 1500 µS/cm. We used the same concentrate solution to treat many synthetic water volumes. The results showed us that more the flow is important more the phenomenon of scaling is delayed.

In order to increase the performance of the elctrodialysis process we applied a pulsed electric field with different duty cycle (Ton = Toff = 1, 3, 10 and 30 seconds). Then, we compare conductivity evolution in the diluate as a function of the pulse mode. The results shows a faster decrease of the concentration in the diluate under pulsed field conditions. Pulsed electric field electrodialysis seems to be very promising for future development in brackish water desalination, to some extent it can remove some well known limitations of electrodialysis. Experiments on desalination of brackish water by pulse field electrodialysis showed that chronoamperogram contains a lot informations. We decided to treat the data by principal component analysis. During a long time electrodialysis it's possible to describe the evolution of the current by a linear combination of only three principal factors (CP1,CP2,CP3). If something goes wrong during electrodialysis (scaling, fouling, membrane rupture, etc.) an additional principal component is necessary to describe the time evolution of current. This give us a new tool for monitoring ED or the aging properties of membranes.

We also tried to describe the phenomena that occur during an operation and predict ED behavior. To do this we implemented numerical methods to integrate explicitly the differential equations governing the transport in the case of a simple solution of NaCl. We have thus evaluated, by calculation, the concentrations at any time in the compartments of dilution and concentration. The electric field and the current are estimated. This model is being refined to better describe the experimental data accumulated, integrating the complex composition of real solutions and also the precipitation phenomena.

CMTDE_54

Performances of nanofiltration (NF) and reverse osmosis (RO) in textile industry waste water treatment

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Abstract

Textile industry process (dyeing, bleaching, printing and finishing) require a high-water consumption generating high amounts of water. Reactive dyeing of 1Kg of cotton requires about 150 Litres of water and 40g reactive dye resulting in a large volume of strongly coloured effluents. This fact in combination with the current water scarcity makes necessary textile waste water reuse.

In this paper experimental results obtained from the treatment by different membranes Microfiltration (MF), Nanofiltration (NF) and Reverse Osmosis (RO) of Sitex industry waste water pretreated by biological activated sludge are presented and compared.

The results obtained from direct Nanofiltration performed at different transmembrane pressures ($8<\Delta P<14$ bars) and at a temperature (T=25°C) show that the permeate flux decreased from initial value of 19 to 9 $Lh^{-1}\ m^{-2}$ for a Volumetric Concentration Factor (VCF) of 4 and that the osmotic pressure π= 4Bars.

A high quality of treated effluent in term of colour removal and desalination was obtained for a VCF of 2: salinity retention rate (RR) 57 % and decolourization almost 100 % at pressure of 12 bar. While, the permeate flux obtained using the combination MF/RO at a different pressures $25<\Delta P<40$ bars decreased from initial value of 43 to 20 $L.h^{-1}m^{-2}$ for a VCF of 6 indicating an important fouling. In this case, the osmotic pressure varied from 6 to 28 bars. The optimum salinity and colour retention rate (RR) were 86% and 100% respectively obtained at a VCF of 2.

Keywords: *Textile industry waste water, Nanofiltration, Reverse Osmosis, Salinity, Decolouration, Retention Rate.*

CMTDE_55

Ammonia removal from an aqueous solution by the use of a natural clay

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Abstract

A series of batch experiments were conducted to ascertain the ability of a natural clay (smectite clay) to remove ammonia from synthetic wastewater samples composed of ammonium acetate ($CH_3CO_2NH_4$). The reaction with ammonia was observed to be very rapid, with half the amount of ammonium ions being sorbed in the first minute in all instances. Estimated ammonia adsorbed was favoured by low sorbate concentration, small particle size of sorbent, and an alkaline medium. The sorption kinetics studies strongly indicated that the sorption process was largely governed by interfoliaire spaces diffusion and that ten minutes are sufficient to adsorb a maximum of ammonia. The temperature is without effect on the sorption from 20°C to 40°C. The equilibrium data fitted the Langmuir sorption model, a possible indication of a monolayer coverage of ammonium ions on the surface of the particle. The Langmuir correlation of the equilibrium data suggested that ion exchange might have been the dominant sorption mechanism. The smectite clay seemed to have some fairly good potential for ammonia removal with the sorption capacity being about 0,5 mmol (NH_4^+) per 100 mg of sorbent. However, this needs to be investigated further through flow- through conditions and in the presence of other ions as in real wastewater.

Keywords*: Adsorbent, ammonia, smectite clay, synthetic wastewater.*

CMTDE_56

Optimisation of the marine dispersion of the brine issuing from the seawater desalination plant of Jerba (South East of Tunisia)

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Abstract

Although seawater desalination is starting to be a remedial approach to water shortage in many areas of the world, little care has been paid to the impact of the brine issuing from seawater desalination plants on marine ecosystems. In Mediterranean Sea, potentially the most affected ecosystems are meadows of the endemic seagrass Posidonia oceanica regarding its proved low tolerance to salinity increments [6].

Thus, the discharge of the brine issuing from seawater desalination plants requires a special environmental appraisal in order to minimize its impact on ecosystem as they are considered toxic and pollutant effluents

Under this frame, this study aimed to optimise the dilution of the brines issuing from the projected seawater desalination plant of Jerba (SE of Tunisia) in order to choose the most appropriate outfall sea site where to discharge the brines. The outfall site is chosen among three alternatives where we changed the distance to the shore (350m, 1100m, and 1750m) and consequently the depth of the discharge. Each alternative has three different scenarios based on three different proposed concentrations of the brines (46g/l, 70g/l, and 76g/l). The choice of the outfall is mainly based on:

Environmental and economic criteria according to the impact of the rejected brines on Posidonia oceanica which is an endemic Mediterranean species that do not tolerate salinity increments above 41 g/l.

The costs of the construction of the emissary and the diffuser system.

The optimisation was carried out through CORMIX modelling, the software integrates the ambient characteristics and the discharge data in order to predict the behaviour of the effluent and its mixing processes beyond the discharge point. The simulation results have shown that throwing the brines near the shore does not show the desired dilution results although it seems to be economically effective. However, discharging in far distances allows having the desired result which is the minimum distance where water salinity decreases down to 41 g/l.

The best alternative is found to be at -9m depth (1750m to the shore) where no Posidonia is proliferating in the prospected area. This choice appears to be the least damaging to the environment although it is more expensive than alternative 2 (1100m).

CMTDE_57

The study of oxidation by H_2O_2 of a polluted water by dye (MB), by adsorption, onto a actived montmorillonite

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Abstract

The pollution generated by water of industrial wastes textile of dyeing represents one of the threats of deterioration of the environment. The increasingly large importance that one attaches today to the protection of the natural environments and the improvement of water quality does not cease growing and the various international authorities charged to inspect and supervise the environment sound alarm at the time of each catastrophe and propose increasingly strict regulations.

Our work consists in studying the adsorption of the Methylene blue chosen like model of dye rejected into the industrial effluents and at the same time like a polluting organic molecule on containing soda and calcined clay (during 12 h). Then, the tests of oxidation by H_2O_2 on aqueous dye MB on activated clay were carried out.

A series of experiments was carried out in order to study the influence, on the kinetics of adsorption, certain parameters such as: clay mass, the temperature, initial concentration while coloring, as well as the pH of the solution.

The results of the adsorption of the methylene blue (MB) by these two clays, show that the capacity of adsorption of this molecule is important: it is about 200mg/g. Indeed, thermically activated clay eliminates the MB from 97% whereas rough clay does not exceed the 50%.

The study of the kinetics of adsorption reveals rather fast kinetics about 30min.

Also, the variation in the temperature of the reactional medium influences considerably the adsorption of the methylene blue. Indeed, when the temperature increases, adsorption becomes favorable and spontaneous. The isotherms of adsorption show an important affinity adsorbate-adsorbent with neutral pH = 6.6. The study of the kinetics of elimination of the MB revealed that the apparent kinetics of adsorption is of order 2 with a diffusion intra-particular. The tests of oxidation of the MB in the presence of H_2O_2 show that after 12 hours of agitation, the quantity of the dye is degraded completely.

Finally, we can say that thermically activated Montmorillonite presents very significant adsorbent properties. Thus our material could be effective to contribute to the depollution of contaminated water.

Keywords: *Montmorillonite, thermic activation, adsorption, Methylene Blue, oxidation,* H_2O_2

CMTDE_58

Fixing of heavy metals by some inflated Tunisian clays

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Abstract

At the time of discharge of the water polluted in a natural environment and thanks to the properties of retention, adsorption and exchange of ions, clays constitute a natural barrier which will be able to limit the toxicity and the propagation of the pollutants.

To contribute to the development of clays layers of Tunisia in the field of water treatments, we undertook with a mineralogical and physicochemical characterization of some inflating clays. The characteristics of these clays will be exploited for the study of the retention by adsorption of some heavy metals. The isotherms of adsorption, of heavy metals in aqueous solution by these natural clays before and after acid activation, are studied.

The influence of several parameters on the fixing of heavy metals on clay such as the factors relating to the medium of adsorption (agitation, pH, time of contact, temperature... etc) and those relating to the adsorbent (mass, granulometry, impurities... etc) was studied in order to optimize the operating conditions of adsorptions.

Keyword *: heavy metals, smectic clay, polluted water, adsorption, Tunisia.*

CMTDE_59

Characterization and anaerobic treatment of a dairy effluent

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Abstract

The application of anaerobic technology in the treatment of industrial wastewaters is becoming an attractive way to reduce the level of organic pollutants (BOD_5, COD) and other pollutants from wastewater to an acceptable level on the environment.

In several cases industries are not equipped with sewage treatment plant and wastewaters are directly discharged into the receiving middle (sea, river). This aim of this study was to examine the anaerobic biological treatment wastewater from a dairy located in the east of Algiers (50km). The wastewater rejected into a river caused serious damage by release of odors due in particular to the decomposition of organic matter and other substances causing a major pollution of the site and thus degrading the quality of the receiving middle. The characterization of physicochemical parameters (BOD_5, COD, TSS, DO, NO_3^- and PO_4^{3-}) of the effluent was carried out upstream and downstream of the river.

The obtained results of analysis of physicochemical parameters of pollution have shown that their content exceed widely the standards of rejection. The biological wastewater treatment at the laboratory scale was achieved through pilots. The pilot consists of four digesters with a capacity of 2 liters each in anaerobic culture free with and without seeding. Both digesters are placed at a temperature 20 ° C and the other both are placed at 35 ° C. In all cases the influence of agitation and pH was studied. The best yields for the elimination of pollution are achieved at pH between 6.5 - 7.5 with agitation and at 35 ° C.

***Keywords**: sewage, pollution, mesophilic temperature, anaerobic treatment, dairy effluent.*

Operation of desalination plants using hybrid control

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Abstract

This paper presents a control system for the operation of desalination plants powered by locally generated renewable energy. To cope with the variability of the water demands and the available energy, the amount of water produced must be manipulated optimally. This is carried out by regulating a variable speed pump, using hybrid predictive control, which takes into account the operational limits of both the pump and the process. The operation is complex because the scheduling of the cleaning operations and the optimization of the energy consumption must be performed simultaneously to the control of the plant, fulfilling a set of additional constraints. The paper uses a continuous reformulation of the problem in order to simplify the optimization process. Simulations of a specific plant show that an optimal operation reduces the extra energy consumption, and makes it possible to supply the variable water demand.

***Keywords**: Reverse Osmosis, Desalination Plants, Hybrid Control, Dynamic Optimization, Model Predictive Control.*

New Dynamic Library of Reverse Osmosis Plants with Fault Simulation

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Abstract

This paper presents an update of a dynamic library of reverse osmosis plants (ROSIM). This library has been developed in order to be used for optimization, simulation, controller testing or fault detection strategies and a simple fault tolerant control is tested. ROSIM is based in a set of components representing the different units of a typical reverse osmosis plant (as sand filters, cartridge filters, exchanger energy recoveries, pumps, membranes, storage tanks, control systems, valves, etc.). Different types of fouling (calcium carbonate, iron hydroxide, biofouling) have been added and the mathematical model of the reverse osmosis membranes, proposed in the original library, has been improved.

Keywords *: Reverse Osmosis, Desalination Plants, Simulation Library, Dynamic Simulation, Fault Simulation, Fouling Modeling.*

CMTDE_62

Elimination of mercury ii in aqueous solution By the sawdust of okoume

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Abstract

Mercury is identified as one of the most toxic metals to the environment. It can link into the body to the molecules forming the living cell (proteins, nucleic acid ...) changing structure or inhibit their biological activities.

The toxicity by mercury hydrargie called, it causes especially nephrological and neurological diseases. In this respect this work was born.

This work presents the results of the use of sawdust as a carrier of okoume adsorbent for the removal of mercury (II) in wastewater. This use could be a valorization for the waste of the forest industry which is sawdust.

The characteristic of the adsorbent material is covered. Its implementation in a batch reactor to study the influence of some parameters (time of equilibrium, the mass of sawdust, pH, etc..) On the rapid elimination of mercury (II), and its ability to fixation on sawdust were evaluated.

Key words: *water treatmnent, Remediation, mercury II, sawdust, valuable.*

CMTDE_63

Valorization by isothermal evaporation of reverse osmosis discharge : experimental studies and thermodynamic modeling

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Abstract

The recovery or disposal of mineral wastewater and wastes is an emerging problem for the construction of sustainable societies in terms of environmental protection and resource recovery.

In our work, and to remedy this problem, we tried to enhance the discharge of the reverse osmosis station through isothermal evaporation (25°C) and isobaric (atmospheric pressure).

All along the evaporation, physicochemical analysis of liquid are performed at different stages and the salts recovered are identified by X-ray diffraction and Scanning Electron Microscopy.

Considering the complexity of the system under study (water and several ions in equilibrium with one or more minerals), we used the Pitzer model that takes into account all the interactions between different ions, which will allow us to calculate the ionic strength, the osmotic coefficient for the different stages of evaporation and the activity coefficients of all electrolytes present in solution.

The Pitzer model is employed to simulate brine evaporation and to forsee the solid phases deposed during the process.

This simulation method helps us to establish rules to navigate through the diagrams and to draw crystallization paths with the algebric solution of material balances. Understanding the full scope of the studied hexary diagram and the thermodynamics of the phase relationships is important for obtaining the most cost-effective process design.

Keywords *: Pitzer model, Hexary diagram, Reverse Osmosis .*

Numerical and experimental study on heat and mass transfers in a humidifier intended for a humidification-dehumidification desalination system

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Abstract

This paper deals with a comparative study between numerical and experimental results on the coupled heat and mass transfer with phase change in a humidifier intended for a humidification- dehumidification desalination system. A vertical parallel-plate channel constitutes the humidifier. The channel walls are wetted by liquid water films and thermally insulated. An upward airflow enters the channel with constants temperature, humidity and velocity. The effect of the air temperature at the channel entrance is investigated both numerically and experimentally. The results are compared in term of the thermal field in the gas phase, the axial evolution of temperature on the wetted walls, and the evaporated mass flow rate. This comparison is essentially satisfactory. The results show that the increase of the airflow inlet temperature increases the liquid film evaporation.

Keywords *: Desalination, humidifier, numerical and experimental study, heat and mass transfer,*

Topic : *Thermal desalination processes,*

Reuse of waters of process

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Abstract

The station of the ENIP (National Enterprise of Petrochemical Industry) at Skikda (Algeria) gathers all industrial wastewater of the film to be treated before their reject.

As part of our study, they pushed cleanup by a supplementary treatment to answer the quality of water asked to be reused in water of process (system of cooling of closed circuit).

To characterize waters intented for the treatment and to follow the quality of produced water, a series of physicochemical analyses was accomplished in the Central Laboratory of CP_1/K (Complex of Plastic Materials) according to the directives and normalized methods.

The controls of following appropriate parameters were permanently made to a program of studied sampling :

temperature, pH, electrical conductivity, salinity, turbidity, solids suspensions , dissolved oxygen, alkalinity, hydrometrics, chlorides, sulphates, sodium,potassium, free carbon dioxide, chemical oxygen demand , biochemical oxygen demand, silica, oils, phenols, nitrites, nitrates, cyanides, phosphate, iron,copper and quicksilver.

The results of monitoring of the quality of some contents of waters purified in the station of the ENIP can be suitable for their use in water of process.

Parameters not answering the quality asked waters of circuit studied cooling are delayed in conformity by an activated carbon treatment.

Tries on this well characterized material gave results of quality of water shape in her usefulness, and besides, to confirm the quality of produced water they performed tries of corrosion to show its impact on circuit.

These tries revealed of satisfactory results. The procedure of reuse of waters in the firm will assure a lesser supply in energy and important savings of silver can be accomplished.

Keyswords *: wastewater, treatment, reuse, quality control, process.*

CMTDE_66

Speciation of Chromium in Bottom Ash Obtained by the Incineration of the Leather Waste Shavings

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Abstract

The evolution of bottom ash morphology and chromium metals behaviour during incineration of leather waste shavings at different incineration temperature has been studied. The Cr, Ca, Mg, Cl rates in bottom ashes, flay ashes and emitted gases in different incineration temperature of the tannery wastes are also determined. The morphology of the bottom ashes obtained by incineration at different temperature from the leather waste shavings was examined by MEB.

The result show that the Incineration tests of the leather waste shavings show that 1100°C is the most efficient temperature for incineration to reduce chromium content in the atmosphere and that 85% of the chromium in the leather waste shavings can be found in the bottom ash. The morphology and the composition of the bottom ashes obtained by incineration at different temperature from the leather waste shavings was examined by different technique and the results gotten watch that Chromium repartition in the bottom ashes is nearly equitable between the exchangeable form, carbonate bound, oxides bound and organic bound. A part of trivalent of trivalent chromium (Cr+3) changes in hexavalent chrome (Cr+6) under shape of Na_2CrO_4 when one increases the time of incineration.

***Key words**: Chromium, incineration, bottom ash, characterization, leather waste shavings.*

CMTDE_67

Physicochemical Characterization of Groundwater (Foggara) of the Region of Timimoun (Algéria).

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Abstract

This study aims to determine the physicochemical composition of water intended for human consumption and irrigation in the region of Timimoun (Southern Algeria). Minerals' salts in excess, such as calcium, magnesium, sulphate and chloride in these waters play an important role in the prevention against the rising phenomenon of salt in this region. This ever-increasing phenomenon constitutes with its recurrence, a real problem for rural development that threatens the region and the oasis.

In order to characterize the water of "Foggara" which is used as drinking water and irrigation, this experimental study was to perform a physicochemical analysis of the key elements. The results showed that chlorides exceed 1600mg/l, the rate of sulfate ions exceed the maximum permissible concentration recommended by l'OMS ($[SO_4^{2-}] > 250$ mg/l) and reached 800mg/l, the content of Ca^{2+} is higher than150 mg/l, the maximum concentration was 252mg/l and magnesium higher than ($[Mg^{2+}] > 75$ mg/l), noting a high conductivity up to 4030µS/cm.

Keywords : *Groundwater, (Foggara), physicochemical analysis, (Timimoun) Algérie.*

CMTDE_68

Contribution to the Study of Sand Dune (Western Erg) of (Taghit) Algeria used as Bed Filter.

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Abstract.

Because of the known advantages and expected potentialities, the study, the exploitation and the valorization of the sand filter was chosen as a simple and effective process in its implementation and operation; moreover sand is virtually the only material available in South West Algeria.

Physicochemical characterization of various used sands is presented and a granular metric analysis, which allow to determine the main parameters (coefficient of uniformity and effective diameter). Their chemical and mineralogical analysis has enabled us to quantify the chemical elements contained in a studied porous environment and a comparison of spectra IRTF of sand (raw and washed) was realized. As well, observations by electronic microscope (MEB) of different samples of sand are made.

Monitoring the filtrates absorbance after passage through the filter and a comparison of the absorbance of various fractions of porous crude and washed environment under agitation allowed us to confirm the use of dune sand for filtration.

Keywords: *Sand, filtration, porous environment, (Taghit) Algeria.*

Use of thermally modified orange peels for the elimination of copper ions from industrial waste waters

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Abstract

The present study concerns the test of orange peels as adsorbents for the elimination of copper ions from industrial wastewaters. This solid support is a priori subject to a thermal modification to enhance its retention capacity.

In fact the use of orange peels without any pretreatment leads at the most a copper retention percentage of the order of 68%. This has encouraged a thermal pretreatment of this material which was calcinated enabling to achieve a copper retention percentage of 99%.

The effect of key parameters like the contacting time, the metal initial concentration, the temperature and the ionic strength, on the copper ions removal was also investigated, for the calcinated orange peels as adsorbent.

The results showed that the adsorption of Cu(II) onto the calcinated orange peels reached saturation after only ten minutes . The results indicated that the copper initial concentration value did have an influence on the retention capacity. However the temperature and the ionic strength did not show an important influence on the retention capacity.

The obtained equilibrium data were best fitted to the Langmuir model with a correlation factor close enough to unity.

Keywords: *Water treatment; Depollution, Heavy metals, Orange peels, Adsorption.*

CMTDE_70

Application of RBF for prediction of efficiency extraction liquid- liquid of phenol

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Abstract

The water treatment waste charged with organic substance poses a serious problem in the chemical industry. During the twenty last years, increasing efforts were provided by the researchers in order to limit pollution to the sources with measurement such as the improvement of the process, the recycling of the products and the reduction of waste dices their production.

In this work, the liquid - liquid extraction was used. This technique standard of the chemical industry which based on the transfer of mass between two not or partially miscible liquids : a contaminated aqueous phase and an organic phase called solvent which is selected according to its affinity and its selectivity for the elements to extract.

In practice, it is difficult to establish a model of knowledge for the prediction of the parameters influencing the output of extraction. To extract the maximum of information from the results obtained, we then propose to model the output of extraction by a new method which combines at the same time the advantages of the polynomial traditional models and of the recent models the basic function radial (RBF).

The results resulting from this model show a good agreement with experiments measured values. On the light of these results which prove to be encouraging, we propose to use it for the modelling of the output for other techniques of fight against the pollution (adsorption, liquid membrane, electrochemical oxidation…).

Keywords : *Liquid-liquid extraction, Phenol, radial base function.*

CMTDE_71

OPEN-GAIN Project: Simulation and Analysis of an Autonomous RO Desalination and Energy Production Systems Integrating Renewable Energies.

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Abstract

The study focuses on the simulation under the HOMER environment of a hybrid installation for simultaneous production of water and energy (electricity) integrating renewable energy (wind and solar) to power the site of Bordj Cedria in Tunisia within the framework of the European project FP6 “Open-Gain ". This site is autonomous (not connected to the grid) with 480 people and a reverse osmosis desalination plant to produce fresh water. The power supply is provided by three types of generators: 20 kVA Diesel Genset (AC), 15 kW Wind Turbine (DC) and 15 Photovoltaic modules(DC).

A conversion system (converter) power is required to swing between AC and DC buses and a storage system (batteries) for hours with low production capacity (because the site is independent) and peak load.

The sensitivity study helped assess the functioning of hybrid system for the weak and / or high potential renewable periods. The optimal configuration corresponds to a contribution of more than 70% of renewable energies (wind, PV) for a mean contribution of the Diesel Genset of 28%.

CMTDE_72

Separation of water from metal working emulsions by high shear ultrafiltration system

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Abstract

Separation of water from water in oil emulsions is of importance in several industries. The standard method for the treatment of emulsions is chemical de-emulsification followed by gravity settling. This process requires the use of a variety of chemicals and the water phase from chemical treatment needs secondary purification. This will therefore entail additional energy requirements and hence higher cost. Several effective methods have been recently developed for oil-water emulsion separation such as coalescence of dispersion in fibrous beds, biodegradation and biotransformation of oily wastes, and application of electric field to coalesce droplets.

During the last decade, the development of membranes technologies has most embodied applications in the processing of emulsion treatment. It was reported that cross flow membrane ultrafiltration is effective process in concentrating oil-water emulsions. However, they do have several limitations. Foremost among these are the accumulation of retained oil drops and the adsorption of surfactants at the membrane surface. To reduce the concentration polarization and fouling, several methods were proposed. Recently, it has been reported that the dynamic membranes reduce concentration polarization because they generated the largest shear rates. Shear enhanced or dynamic filtration consists in creating the shear rate at the membrane by a relative motion between the membrane and a moving part such as a rotating disk or an impeller. This method has shown to be very effective in ultrafiltration of dilute oil-in-water emulsions. The reason for its good performance is that very high shear rates are produced with a low inlet flow, and therefore, a low pressure drop in the module.

Thus the purpose of this work is to investigate the application of a rotating disk for the separation of water from oil-in-water emulsions reconstituted from a concentrated cutting fluid. This paper compares the performances of ultrafiltration using two types of disks.

The critical flux for stable operation was investigated by increasing the permeate flux in steps while monitoring the transmembrane pressure. By using a membrane of 50 kDa, the flux is very significant. However, when a disk equipped with vanes was used, the flux increases strongly and the oil concentration in permeate becomes negligible. It was shown that the flux is mainly governed by the maximum shear rate and not by details of internal flow and can be increased to very high levels by increasing the rotating speeds of the disk.

Keywords *: Emulsion, ultrafiltration, rotating disk, turbidity.*

CMTDE_73

Biosorption of Cd^{+2} ions by a residuum of fungous biomass (pleurotus mutilus)

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Introduction

The great développement of urbanisation togeteher with the concentration and focussing of both industrial and agricultural activities during the last two centuries, have consequently urged to a great growth of pollution. The increase of toxic heavy metal contamination in the environment urged a prime concern to reduce the effects of the impact of their toxicity and imply measures that could be more reliable. Heavy metals, and particularly, plomb, and cadmium, nickel and zinc belong to the category of polluant substances which present a real danger to the human health.

The release of heavy metals into environment by industrial activities has become a great problem. Numerous studies on metal biosorption have been reported, the recent use of modern techniques such as physical and chemical methods for the treatment of industrial polluted waters (effluents) loaded with heavy metals (précipitation, exchange of 'ions, electrolysis, reverse osmosis, the adsorption alumine or on active carbon,) however, these conventional methods have shown inadequate efficiencies and often very expensive when used for the reduction of heavy metals ions especially in low conentration (of 1 to 100mg/l). Our study reports removal of heavy metals and the retention of Cd^{2+} ions through a residual fungus biomass (Pleurotus mutilus) in batch mode.

Experimental section

The residue of fungus biomass (Pleurotus mutilus) has been colllected after a process going on of fermentation during the production of an antibiotic Pleuromutiline. This residue is used in the form of particles under a grading included in between 315-400 m in order to extract Cd^{+2} ions in aqueous solution in a closed system.

Results

The best conditions are to be find : A balanced time of about 15min, a biomass concentration of 3 g/L, an agitation speed of 250 tr/min and an initial pH equal to 5. The given data of balance and the modelling are given through Langmuir model. Under these specific conditions of balance 85 mg de Cd^{+2}/g of biomass was fixed. The cell wall of the biomass contains a grouping of anions (-COOH,-OH) which presents an efficient adsorbant power as compared with Cd^{+2} ions.

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Chromium reduction by photocatalysis on an oxide semiconductor in a stirred reactor

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Abstract

The photocatalysis is being gradually imposed as an alternative technology for water decontamination. It is part of a sustainable development using the sun as a renewable source of energy. The Chromium is a metal that is widely used in industry. This is the so-called hexavalent form which is more problematic because in this form, chromium is very toxic. Photocatalytic treatment is based on the absorption, by a semiconductor, of a light radiation of energy greater than the optical gap of the semiconductor. This energy absorption causes an excitation of an electron from the valence band to the conduction band generating an electronic deficit, giving the sound of oxido-reducing properties towards the absorbed pollutants. The photoelectrons, located in the conduction band, have a high reducing power capable of reducing metal ions in solution and water into hydrogen.

This work involves the synthesis and the studying of various physical and chemical properties of two semiconductors $CuFe_2O_4$ and CdS and their application to the reduction of bichromate and the photo-oxidation of salicylic acid. Different characterization's techniques were used. All these characteristics allowed us to propose an energy diagram of the bands' structure and to predict the hexavalent chromium reduction in thermodynamic point of view. A thorough study of the photocatalytic properties of the $CdS/CuFe_2O_4$ heterojunction, concerning the hexavalent chromium reduction, has been carried out. Photoactivity tests have been made on samples contaminated by dichromate. Furthermore this work presents a double interest, because with the chromium photoreduction reaction in water, there is simultaneously the appearance of the photoproduction of hydrogen.

CMTDE_75

Kinetics Study of the reaction of chloromethyl metaxylène. Application to water treatment.

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Abstract

The petrochemical industry has an extensive use of liquid hydrocarbons, particularly aromatics as raw material for the synthesis of organic products. A large amount of benzene, toluene, xylenes and naphthalene is used for petrochemical synthesis of synthetic fibers. These hydrocarbons are obtained by catalytic reforming of gasoline or extraction by solvent. Among the aromatic C8, only the para and ortho-xylene are widely used in petrochemical industry. The meta-xylene is the most abundant, but its market demand remains relatively low. The big part of this product is being left in the form of liquid xylene which is isomerized, or used as an additive in gasoline. The most important chemical manipulation of meta- xylene is the manufacture of isophthalic acid mixed and with high purity. A small part of this material is used in pesticides industry. On the basis of mono-and di-chloromethyl meta-xylene, we have obtained quaternary ammonium salts that were tested in waste water treatment and have proven to be very good extraction agents of heavy metals. Quaternary ammonium salts, based on meta-xylene, positively charged can fix the anionic metal complexes. In this work, we determined the formation of associats from quaternary ammonium salts, very soluble in chloroform. As a result, we came to extract metals (Cu, Zn, Cd, Hg), which form stable complexes with thiocyanide. It has been shown that the extraction takes place entirely in a wide range of pH (1-10).

Keywords : *chloromethyl, meta-xylene, formaldehyde, dichloromethyl meta-xylene, quaternary ammonium sal*

CMTDE_76

Characterization of spinal $CuFe_2O_4$ oxide semiconductor, Application to metal ions and water reduction

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Abstract

This work concerns the synthesis and characterization of a semiconductor $CuFe_2O_4$which absorbs almost the entire solar spectrum due to its black color (Eg = 1.6 eV). So as to access to the $CuFe_2O_4$ energy diagram, we determined the potential of both, the valence and conduction band compared to that of water, the physical characterizations were made: (The thermoelectric power: to identify the type of semiconductor, the electrical conductivity to obtain the activation energy and the photoelectrochemical study to determine the potential of flat band which characterizes the material). All these parameters allow us to predict the evolution of hydrogen at the semiconductor / electrolyte (SC / electrolyte) interface. The photoelectrons, located in the conduction band, have a high reducing power capable of reducing metal ions in solution and water into hydrogen. The photoreduction of water was conducted in a double-walled reactor containing a known mass of catalyst in KOH, and $Na_2S_2O_3$. To do this, we vary the mass of catalyst; the optimal value obtained is 250 mg with a production speed of 0.085 cm^3 /s at pH ~ 13.

Keywords: *Semi-conductor, Hydrogen, photoreduction.*

CMTDE_77

Removal of uranyl ions UO_2^{+2} by Bêta zeolite

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Abstract

The adsorption of uranium (II) from aqueous solutions onto porous solid materials as Bêta zeolite was investigated in batch. The effects of parameters as initial concentration, pH, solid-liquid ratio (S/L) and temperature on the uranium adsorption were studied. The optimal conditions were then determined (uranium initial concentration 100 mg/L, pH 5,0±0.5, temperature 343 K and Solid-liquid ratio 1/100 g/ml). Freundlich, Langmuir and Dubinin- Radushkevich (D-R) models have been applied and the adsorption kinetics followed Freundlich adsorption isotherm. The adsorption of uranyle ions (II) was chemical type with adsorption energy E_{ads} = 10 KJ/mole. The adsorption capacity of Bêta zeolite was found 4 mg/g and Kinetic follows the pseudo second order. Thermodynamic parameters were calculated and showed that adsorption enthalpy was endothermic nature and the reaction was spontaneous at high temperatures.

Key-words : *Uranium ; Zeolite Bêta; Adsorption ; Environment ; Isothermes.*

CMTDE_78

Comparison of polyacrylic acid and polyethylenimine in crystal violet removal from wastewaters by Polyelectrolyte Enhanced Ultrafiltration (PEUF)

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Abstract

Polyelectrolyte-based separation of toxic dyes is studied to estimate the potential of polyelectroyte enhanced ultrafiltration (PEUF) using polyacrylic acid (PAA) (anionic polymer) and polyethylenimine(PEI) (cationic polymer). PEUF experiments are conducted to study the retention characteristics of crystal violet (CV) in the continuous cross flow system. Effects of the operating conditions, e.g., transmembrane pressure, feed polyelectrolyte concentration, feed dye concentration, ionic strength and pH on the permeate flux profile and observed retention have been investigated.

The PEUF experiments showed that polyacrylic acid (PAA) allowed retention of CV in the order of 99%. The enhancement is primarily due to the formation of complexes between the anionic polymer and dye molecules However, when the cationic polyelectrolyte (PEI) was applied, the CV removal can reach around 60%. In the case of PAA, the retention of CV decreases with ionic strength, a high retention was obtained at pH range from 2 to 13; this effect was attributed to the increase of electrostatic interaction. The ionic strength and pH have no effect on the removal of CV in the case of PEI.

Keywords: *Crystal violet ; polyacrylic acid ; polyethylenimine ; Ultrafiltration ; PEUF.*

CMTDE_79

Intensification of selective desalination of brackish waters comparing nanofiltration and reverse osmosis : Case Study Of Tan Tan, Morocco

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Abstract

The possibility of producing drinking water from brackish groundwater using nanofiltration (NF) process and the use of this process to remove excess of chloride and fluoride ions from brackish drinking water was studied to a pilot scale. Brackish groundwater was taken from the south of Morocco (Tan Tan city). The performances of few commercialized spiral wound elements NF and low pressure reverse osmosis (LPRO) were compared. The following parameters were determined : hydraulic permeability, total salinity rejection, Cl^-, F^- and SO_4^{2-} removal were compared under the influence of various experimental conditions such as flow yield, transmembrane pressure and initial ions content. Our study showed that NF was actually better efficient vs LPRO since it permits to reduce partially the total salinity of a high fluoride content brackish water with a higher flow yield and a lower pressure. This study confirms the potentialities of NF for a selective desalination of brackish waters to a large scale experiments (membrane surface 7,6 m^2 (4")).

Keywords

Water Treatment, Desalination, Defluoridation, Nanofiltration, Reverse osmosis

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Predictive fouling of MF/UF membranes for drinking water production intensification

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Abstract

Membrane (MF/UF/NF/RO) processes for drinking water production are increasingly employed for removal of bacteria and other microorganisms, particulate materials, and soluble material (i.e. natural organic matter, salt). For the increasing demands of Environmental, Ecological, Energy saving and Economical Water Purification System, we need to develop high efficiency membrane filtration system.

Factors determining the fouling performance of UF or MF membranes are numerous (membrane structure, operating conditions, feed water quality, etc) and the relationship between these factors and the fouling performances is too complex to formulate them quantitatively. Then predictive tools to a better management of membrane fouling in order to better sizing large scale experiments were recently engaged (1-3).

The present work is dedicated to the determination of specific fouling indexes dedicated to a better description of all the parameters attached to the dramatic decrease of hydraulic permeabilities of MF/UF membranes under cross flow filtration conditions (4).

Four feed waters from France (2 dam waters from Ribou's and St Nicolas's lakes, Maine-et-Loire, 1 estuarine water from Gavy St Nazaire, 1 dam water from south-west of France, Plaisance-du-Gers) were filtered in MF/UF and the following parameters determined : hydraulic permeability, limiting flux, fouling resistance and the modified fouling index.

MF and UF crossflow filtration operations were conducted under the following conditions: flow rate 6 m/s, membrane SCT in C/ZrO_2, efficient transmembrane pressure range between 0-8 bars. In MF the pore size was 0.14 µm as in UF the molecular weight cutoff was 300 kDa. We combined both operations in order to manage in MF the particulate fouling and with the permeate of MF the feed of UF membrane to better manage fouling properties of each waters studied.

The results obtained help us to validate a protocol to determine easily the parameters: limiting flux, fouling resistance and MFI, under crossflow filtration.

Such approach is the first step of the way to a new and original approach dedicated to seawater pre-treatments for few applications, i.e. desalination, shellfish growing protection.

Keywords *: MF/UF; seawater; pre-treatment; fouling indexes; predictive fouling.*

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CMTDE_81

Application of the experimental designs for modelling the mass transfer in micellar enhanced ultrafiltation

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Abstract

Pollution by toxic metal compounds is a deep concern in all industrial countries. A process based on micellar enhanced ultrafiltration is one of the efficient techniques to separate metal ions from wastewater. Successful utilization of membrane technology has been greatly limited by membrane fouling. Fouling increases operation and maintenance costs by deteriorating membrane performance (flux decline vs time) and ultimately shortening membrane life. We propose in this work to study the possibility and the limits of the application of the methods of the experimental designs for modeling the mass transfer in ultrafiltration enhanced by the most common of surfactant: cetyltrimethylammonium bromide (CTABr). The experimental designs make it possible as well as possible to organize the tests which accompany a scientific research or industrial studies. The results obtained of the mathematical model representing the permeate flux according to the operating parameters show a perfect harmony with the experimental results. The established model answers perfectly the experimental values inside the field of study : between 2 and 3,5 bars for the transmembrane pressure, 30 and 45°C for the temperature, 5 and 50mmol/l for the upstream concentration of CTABr and 1 and 4m/s for the feed velocity. The validity of the model in the experimental field and the possibility of its extension out of this domain were examined. The upper limit of the concentration field of CTABr whose average deviation is higher than 1.5% is included in the interval of tolerance mentioned in the literature and whose error is estimated at 3% (Lespes.G, 1998).

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CMTDE_82

Removal of cadmium from aqueous solutions by adsorption onto coffee grouds

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Abstract

In this paper, results of Cadmium sorption from aqueous solutions by coffee grounds is presented. Batch kinetic and equilibrium experiments were conducted to study the effects of pH, contact time, adsorbent dose, initial concentration of Cadmium, particle size and temperature. Three adsorption isotherm models namely, Langmuir, Freundlich and Dubinin–Radushkevich were used to analyze the equilibrium data. The Langmuir isotherm provided the best correlation for Cd^{2+} onto the coffee grounds. Adsorption capacity was calculated from the Langmuir isotherm as 15.64mg/g. Thermodynamic parameters were evaluated and the adsorption was endothermic showing monolayer adsorption of Cd^{2+}. The equilibrium was achieved less than 120 min. The adsorption kinetic data was fitted with first and second order kinetic models. Finally it was concluded that the cadmium adsorption kinetics onto the coffee grounds was well explained by second order kinetic model rather than first order model. The results suggest that coffee grounds have high possibility to be used as effective and economical adsorbent for Cd^{2+} removal.

CMTDE_83

Facilitated transport of the zinc by liquid membrane containing the organophosphates carriers

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Abstract

he discharge of heavy metals into environment is a serious problem facing numerous industries. So the search for extraction techniques to remove those heavy metals are increasing interest. Liquid membranes have shown great potentiel in this way especially in cases where metal concentrations are relatively low and other techniques cannot be applied efficiently. The solvent extraction is largely used, it became one of the techniques which experienced the most significant development, consequently to the rise of the raw material prices mineral and to the generalized preoccupation with an environmental protection. It is profitable for recovery, the separation and the purification of metals.

The fundamental parameters influencing the transport of the Zinc(II) have been examined (the acidity, nature and concentration of the extractant).

The chemical parameters have allowed us to obtain the variables giving the optimum extraction efficiency for diluted solutions of Zn(II) in aqueous phase were taken into account in the analysis of extractions. Some performances have been gotten to the level of the extraction. In this study, the mechanisms of extraction of Zn(II) from sulfuric acid and nitric acid solutions with the kerosene solution of Tributyl phosphate (TBP), Tri-n-octylphosphine oxyde (TOPO) and of Di(2-ethylhexyl) phosphoric acid (HDEHP) were investigated. The determination of the distribution coefficients permitted to identify the mechanism of extraction and transfer.The process purification would be particularly judicious in the case of the treatments of the industrial wastes containing heavy metals, it is very sparing out of water and raw materials (recycling of the reagents and extractants).

Key words*: zinc, purification, treatment, recovery; wastewater.*

CMTDE_84

Solvent extraction of the zinc from the acid effluents by organophosphate extractants

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Abstract

The discharge of heavy metals into environment is a serious problem facing numerous industries. So the search for extraction techniques to remove those heavy metals are increasing interest. Liquid membranes have shown great potentiel in this way especially in cases where metal concentrations are relatively low and other techniques cannot be applied efficiently. The solvent extraction is largely used, it became one of the techniques which experienced the most significant development, consequently to the rise of the raw material prices mineral and to the generalized preoccupation with an environmental protection. It is profitable for recovery, the separation and the purification of metals.

The fundamental parameters influencing the transport of the Zinc(II) have been examined (the acidity, nature and concentration of the extractant).

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***Key words**: zinc, purification ,treatment, recovery; wastewater.*

Biosorption of Ni^{+2} ions by a solid waste containing pleurotus mutilus biomass on a fixed-bed column

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Abstract

Liquid wastes from various industries such as mining and surface treatment industries are charged in heavy metals particularly in nickel. In order to treat these liquid wastes, various techniques are available. Very often cheaper methods using granular adsorbents are preferred. In this aspect, a solid pharmaceutical by-product containing Pleurotus mutilus biomass has been tested and its capacity to remove Ni^{+2} ions evaluated. The test were run on a laboratory scale column in order to study the effect of various parameters such as the flow rate , initial pH, Ni^{+2} concentration, the bed height on the sorption capacity of the solid waste. The biosorbent was then regenerated using an HCL (0,1 M) solution.

Results shows that the nickel adsorption capacity of the solid increases (from 9,30 mg/g to 26 mg/g) with pH (from 2 to 6) and decreases (from 36 mg/g to 26 mg/g) with an increases of flow rate (from 5 to 20 ml min^{-1}). The increase of the bed height (from 10,6 to 16,6 cm) and Ni^{+2} concentration (from 10 to 50 mg /l) produce an increase of the biomass sorption capacity (from 26 mg/g to 39 mg/g) and (from 11 mg/g to 26 mg/g) respectively.

Ni^{+2} ions are easily removed from the sorbent (>88%) with a HCL (0,1 M) solution.

Results fitted the BDST and THOMAS models whose parameters were then evaluated.

The samples of industrial effluents were treated with this method one of which is concentrated, the other dilute. Results show clearly a fairly good sorption capacity of 478 mg/g and 19 mg/g respectively of the solid biomass containing a Pleurotus mutilus biomass towards Ni^{+2} ions.

Keywords: *Biosorption, Ni^{2+}, Pleurotus Mutilus, Fixed-bed column, THOMAS and BDST models.*

CMTDE_86

Zinc sorption by Tunisian Smectite : effet of ionic strength and pH.

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Abstract

Smectite is a clay with a wide range applications derived from its specific proprieties i.e. adsorption and surface charge. This work

The adsorption of Zn(II) onto a suspension of Na-saturated smectite from Elfahs (Tunisia), was studied as a function of the pH (3.0, 5.0 and 7.0) and ionic strength (0.5M and 0.01M NaCl). The results show that the adsorptive behaviour of Zn^{2+} ions was strongly dependent on the pH and the ionic strength with maximum Zn removal occurring at pH 7.0 and 0.01M NaCl ionic strength with ion exchange as the basic mechanism. The adsorption data was then fitted to Freundlich and Langmuir isotherms models.

Key word: *Adsorption, point of zero charge, Clay, Acidity.*

CMTDE_87

Biosorption Properties of Copper Ions from Aqueous Solutions by Tamarix gallica bark

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Abstract

Toxicological effects of heavy metals on the environment and in drinking water is well recognized. Several approaches have been studied and developed for the effective removal of heavy metals by biosorption from aqueous solutions for the treatment of industrial wastewater, which utilized naturally occurring waste materials derived from biomass, using biosorbents like peat, fly ash, algae, soya bean , hulls leaf mould, sea weeds, coconut husk, sago waste, peanut hull, hazelnut, bagasse, rice hull, sugar beet pulp, plants biomass and bituminous coal. It has also been observed that these biosorbents need further modifications to increase the active binding sites and also made them readily available for sorption.

Copper (Cu) is one of the most important heavy metals often found in effluents discharged from industries and not biodegradable and travels through the food chain via bioaccumulation, which is potentially toxic. The excessive intake of copper results in its accumulation in the liver causing haemolysis, liver and kidney damage, irritation of the upper respiratory tract, gastrointestinal disturbance, anemia and diarrhoea

Continuing our effort on the valorisation of Algerian Sahara plants as biomaterials for the biosorption of toxic heavy metals from water, We report herein our results on the use of the locally available tree Tamarix gallica bark (Tamaricaceae family) as an adsorbent for removal of copper ion from aqueous solution.

So, the objective of this study was to determine the effects of operating conditions like Initial metal concentration, pH and Temperature, on copper biosorption. The relation between the phytochemical composition on natural compounds of the bark part of Tamarix gallica and the percent of adsorption for copper ion was examined. Thus, biosorption of copper ion occurs as a result of ion exchange or complex formation between metal ions and functional groups (hydroxyl, amine, carboxyl...) occuring in natural compounds on the cell surface of the biomass.

Keywords: *Biosorption, Tamarix gallica, Copper, Wastewater, Phytochemical, Sahara*

CMTDE_88

Comparative study of the kinetics of the aromatic amines adsorption on coals prepared with apricot cores

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Abstract

The objective of this work is the development new adsorbent supports of vegetable origin and their use in the water treatment polluted by organic compounds.

In this context, we considered the fixing of the aromatic amines on coals prepared with apricot cores, treated beforehand with the acids mineral sulphuric, hydrochloric and phosphoric at a temperature of 100 ±2°C. The samples treated by chemical way are carbonized in a muffle furnace with a law of heating of 5 °C at 800 °C.

The adsorption of aniline and its derivative (parabromoaniline) on these supports according to several physicochemical parameters was studied and optimized. The tests of adsorption were conducted in a batch stirred reactor; the residual concentration is analyzed by spectrophotometry UV.

It appears from these results that the acids hydrochloric and phosphoric have a very positive effect on the development of porous texture. The kinetic study showed that the process of elimination of aniline and its derivative is fast and that the best yields of elimination of the molecules considered are obtained with the coals treated with the acids phosphoric and hydrochloric.

The ultimate capacities of adsorption of aniline on the coals three coals treated in an optimal way (HCl; H_3PO_4 and H_2SO_4 are 101, 01 - 90, 909 - 59, 523 $mg.g^{-1}$ respectively, and those of the parabromoaniline are 285.714 - 212.765 - 192.307 $mg.g^{-1}$ respectively.

CMTDE_89

Biological filtration on sand of dunes – Characterization of the sand

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Abstract

Slow biological filtration is a waste treatment booming field. However, function of the pre-treatment efficiency, the filter receives a non negligible amount of suspended matter, leading to a biological clogging, owing to the colonization of the pores of the filtration media by the biomass and the by-products resulting from bacterial activity [1].

The use of sand of dunes as a filtration support for the treatment of domestic wastewaters demonstrated at pilot scale its efficiency [2]. The objective of this work was to compare between sands from several quarries which can be found in the septentrional Sahara.

The sand of 15 quarries were analysed and displayed the following characteristics: an unrounded shape, an effective diameter D_{10} in the range 0.09 – 0.15 mm, an uniformity coefficient in the range 1.58 – 2.70, a range of porosity of 38 – 57 %, a range of permeability of 0.13 – 0.41 m h^{-1}, a range of pH of 7.10 – 8.46, an electric conductivity in the range 0.10 – 7.64 mS cm^{-1} and a range of organic matter content of 0.05 – 1.22%.

The bio-filtration unit was constituted from Polyvinyl chloride columns of 1 m height and 0.242 m diameter. They were filled with 0.1 m gravel of approximately in the bottom of the unit to ensure correct draining according to Guagne and Brissaud [3], 0.7 m of sand and another layer of gravel (0.05 m) at the top of the unit to ensure homogeneous water distribution. The wastewater flow rate was 3 L j^{-1}.

Analysis for the various sands tested showed more than 83 and 88 % yield of removal of the suspended solids (SS) and the chemical oxygen demand (COD) respectively, after 55 days of discontinuous feeding. This demonstrated the efficiency of sand of dune for biological filtration of urban wastewater

Keywords *: Sand bio-filtration, Wastewater treatment, Physico-chemical characterization.*

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CMTDE_90

Treatment of tuna cooking juices by nanofiltration

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Abstract

Canned tuna is among the largest commercial canned fishery product in Tunisia. This industry rejects many aqueous effluents (washing, thawing, rinsing and cooking waters). Cooking juice represents 50 % of the total effluent volume. It has a high organic load and a very high salt content. For consequence, discarding directly the effluent in the environment is not possible and need further treatment. However, the juice seems to contain interesting flavour compounds. In this work, a membrane process system consisting in nanofiltration was used to reduce the pollution load and to concentrate flavour compounds of tuna cooking juice. The NF membrane tested in this work concentrate the organic matter since the retentions are high, starting at 74% for total circulation and increasing up to 85 % for volume reduction factor (VRF) of 5. The membrane undergoes severe fouling, it can be effectively cleaned through a complete basic-acid washing cycle. The effect of three chemical reagents was studied for the regeneration of the fouled membrane.

In the future, we will focus on the concentrates obtained by NF: sensory analysis with a panel of trained tasters and analysis of aromatic molecules should allow to value the quality of the flavouring concentrates.

CMTDE_91

Evaluation of pre-treated agricultural wastes (coffee husks) as potential biosorbent for treatment of pesticide contaminated waters

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Abstract

Diazinon (O,O-diethyl O-[2-isopropyl-6-methylpyrimidin-4-yl] thiophosphate) is used as an insecticide for different types of cultivation such as fruit trees, rice, sugarcane, corn, tobacco and horticultural plants because of its inhibition of the acetylcholinesterase of most kinds of insects [1] [2].

The objective of this work was to propose an alternative use for coffee husks (CH), a coffee processing residue [3], as pre-treated sorbent for the removal of Diazinon from aqueous solutions.

The effects of solution temperature, pH, biosorbent dosage, Diazinon concentration and contact time on Diazinon removal were investigated. The experimental adsorption equilibrium data were fitted to both Langmuir and Freundlich adsorption models. The biosorption kinetics was determined by fitting first and second-order kinetic models to the experimental data, with the second-order model providing the best description of Diazinon adsorption onto NaOCl- pre-treated coffee husks. Boyd's ion exchange model, which assumes exchanges of ions to be a chemical phenomenon, also fitted the kinetic data precisely.

The compositions of the pre-treated coffee husks were characterized by Fourier transform infrared spectroscopy, scanning electronic micrograph and fluorescent X-ray.

The maximum sorption of NaOCl-pre-treated coffee husks was observed near neutral pH.

Pre-treated biosorbent showed a very high adsorption affinity value, which helps predict its high ability to adsorb pesticides at high concentration.

The experimental data obtained in the present study demonstrated pre-treated coffee husks to be suitable candidate for use as biosorbent in the removal of Diazinon.

The comparison of the biosorption behaviour between pretreated coffee husks and other

adsorbent materials indicated that the experimented pre-treated biomass, showed a good biosorption capacity toward the pesticide. Besides, chemical low cost treatments of the biomass could be a promising research work to more enhance the pesticide removal ability of this biomass. Studies in this subject are in progress.

Key words: Diazinon, pesticide, adsorption, agricultural wastes

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Simultaneous elimination of lead and nickel present in water of industrial wastes by complexation with a lacunar heteropolyanion

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Abstract

Importance of water in economy does not cease growing, considering industrial development and l' increased use of water by the urban population. But water quality knew these last years, various problems because of the industrial wastes not controlled. Heavy metals such as Lead, cadmium, nickel, copper etc count among the most widespread agents of pollution in the areas with strong urban centre and industrial. Indeed water of industrial wastes collects these various pollutants in notable quantity; these last constitute a main issue for environment.

In this context we were interested in elimination of heavy metals (Pb^{2+}, Ni^{2+}, Cd^{2+}) being couples some in aqueous solution, by a reaction of complexation by using a ligand called hétéropolyanion lacunar mixed of $P_2W_{15}Mo_2$ chemical formula. For that one called upon the method analyzes UV-Visible spectrophotometry to be able to determine the optimal conditions with the formation of these complexes namely:

- Stability according to the pH of the reactional medium.
- Stability according to time of complexation
- Determination of stoichiometry or ligand ratio/metal

These various conditions enabled us to calculate the constants of stability of each formed complex.

Key words: *waters pollution, heavy metals, complexation, hétéropolyanion.*

CMTDE_93

Carrier-facilitated transport of Cd(II) through a supported liquid membrane containing thiacalix[4]arene derivatives as ionophore

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Abstract

The feasibility of a facilitated transport process of cadmium ions through a SLM system incorporating new extractant agents, thiacalix[4]arenes, was studied. These molecules have sulfur atoms instead of usual methylene bridges. The chemical modification of the upper or the lower rim provides a great variety of supramolecules having different complexation ability and different conformational behaviour. The efficiency of the transport across the inner membrane organic liquid phase is shown to depend on the chemical (affinity) and structural (conformational states possible) parameters of these complexing molecules.

In this work, two different thiacalix[4]arenes were selected as effective ionophore for the treatment of liquid media loaded in Cd(II). The results show that these thiacalix[4]arenes derivative ensure facilitated transport of cadmium cations through supported liquid membranes. Especially, the non-substituted thiacalix[4]arene can be considered as an effective extractant agent.

The incidence of several parameters on transport efficiency such as pH of both aqueous solutions and carrier concentration was studied. The permeation of the species is due to a proton potential gradient (the driving force of the process) existing between the two opposite sides of the SLM. The initial flux, J, is found to be equal to $6.7.10^{-7}$ $mol.m^{-2}.s^{-1}$, under optimal experimental conditions.

Keywords: *Supported liquid membrane, Facilitated transport, Thiacalix[4]arenes, Cadmium(II).*

CMTDE_94

Removal of crystal violet from wastewater using micellar enhanced ultrafiltration

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Abstract

Micellar enhanced ultrafiltration (MEUF) is a separation technique which can be used to remove metals ions or dissolved organics from water. In this study MEUF has been carried out to investigate the retention of crystal violet (CV) (molecular weight 407.98), a cationic dye, from aqueous stream. Regenerated cellulose membrane of molecular weight cut-off 10 kDa was used in a cross-flow ultrafiltration unit. Sodium dodecylsulfate (SDS) and NaCl were used as surfactant and electrolyte, respectively. The removal of CV and permeate flux were studied as a function of dye and surfactant concentrations, ionic strength and pH.

The ultrafiltration experiments showed that anionic surfactant SDS allowed retention of crystal violet in the order of 99% in the whole range of dye and surfactant concentrations considered. High retention was also obtained at pH range from 2 to 12. Permeate flux decreases when surfactant concentration or ionic strength increases.

Keywords: *Crystal violet; Micellar enhanced ultrafiltration; Sodium dodecylsulfate; Permeate flux.*

Modeling and simulation of a New Design of the SMCEC Desalination Unit Using Solar Energy

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Abstract

The aim of this research is to parametrically study a new process working design with Humidification/Dehumidification (HD) technique using solar energy which is developed to ameliorate the production of the SMCEC unit (Solar Multiple Condensation Evaporation Cycle). The SMCEC unit is currently operating at Sfax's national engineering school in Tunisia. The improvement of the production consists in increasing the capacity of air to load water vapor with heating and subsequent humidification of air at the exit of the condensation tower instead of rejecting or recycling it. So, to attend our objective, we need to integrate into the SMCEC unit a flat plate solar air collector for heating air and a humidifier for its humidification. Then, the newly designed system is basically composed of a flat plate solar air collector, a flat plate solar water collector, a humidifier, an evaporation tower and a condensation tower. A general model based on heat and mass transfers in each component of the unit is developed in a steady state regime. The obtained set of ordinary differential equations is converted to a set of algebraic system of equations by the functional approximation method of orthogonal collocation. The developed model is used to investigate both the effect of different operating modes on the water condensation rate and the steady state behavior of each component of the unit and the entire system exposed to a variation of the entrance parameters and meteorological conditions.

Keywords: Solar energy, water desalination, steady state, operating modes, modeling and simulation.

Electrochemical treatment of Fishery wastewaters

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Abstract

The electrochemical treatment with an electrode of SnO2 of industrial wastewaters from a fish canning (COD and DBO5 are respectively 13433 and 7786 mg.L^{-1}) located in Agadir city, Morocco, can be realized with an important efficiency. It proved during experiences that the choice of the temperature and the current, during the treatment, are to optimized to reduce the cost of treatment, the fact that the effluent to treated of a fish canning is discharged with a temperature ranging between 17° and 35°C, a value of the average pH oscillates of neutrality and an in particular high salinity useful and lends well to an electrochemical treatment, whereas these conditions would be very unfavorable, for other types of treatments. The best efficiency was obtained, in terms of abatement of DCO was 77%, for a temperature of 35 °C, an intensity of current about 60mA, an electrolysis time of 3h, and with an energetic cost of 1 KWh.Kg^{-1}.

***Keywords**: Electrochemical treatment, Wastewaters of fish canning, SnO2, DCO*

CMTDE_97

Recovery of phenol from aqueous solution through TBP supported liquid membrane: feed phase concentration effect and membrane stability study

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Abstract

Phenol and its derivatives are among the most prevalent forms of chemical pollutants in the industrial wastewater. The extraction of phenol from acidic solution (pH = 2) with mixtures of tributyl phosphate (TBP) and some selected organic solvents was studied by solvent extraction method. This method has advantages on treating high concentrated phenol wastewater. The most efficient organic solvent, the equilibration extraction time and the optimal concentration of TBP were determined.

Furthermore, the transport of phenol through a flat sheet supported liquid membrane (FSSLM) containing a mixture of TBP-kerosene as liquid membrane has been investigated. Complete stripping was achieved using aqueous NaOH solution. The permeation of phenol was carried out by varying the concentration of phenol in feed phase from 100 to 1200 ppm and flux increases from 0,00000177 to 0,0000531 $mol.m^{-2}.s^{-1}$, respectively. The stability of the membrane system used was also investigated in continuous run showing more than 4 days stability.

CMTDE_98

Etude du vieillissement des membranes échangeuses d'ions utilisées dans les procédés de séparation

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Résumé

Actuellement, l'application la plus importante des membranes échangeuses d'ions (MEI) est l'électrodialyse. Cette technique consiste en une séparation par membrane à l'aide d'une succession de membranes alternativement échangeuses d'anions et de cations, souvent utilisées pour le dessalement des eaux saumâtres.

Ces membranes sont confrontées aux problèmes du vieillissement. En effet, plus elles seront utilisées plus leurs propriétés physico-chimiques vont évoluer.

Une étude comparative du comportement des deux MEI neuves et les mêmes mais usées est menée par la mesure d'une grandeur caractéristique de transfert : Perméabilité ionique.

La perméabilité ionique est une grandeur physique permettant d'avoir une idée sur la sélectivité de la membrane vis-à-vis des espèces chargées et de la « porosité » de la membrane. Elle consiste à un transport d'ions (cations + anions) à travers la membrane. Ainsi, la détermination de la perméabilité ionique consiste à déterminer le flux de diffusion d'un électrolyte fort à travers une membrane qui sépare deux compartiments (l'un contenant l'électrolyte et l'autre de l'eau initialement ultra pure qui se chargera progressivement de l'électrolyte traversant la membrane).

La technique de mesure utilisée est celle par détection conductimétrique vu la facilité de sa mise en œuvre et sa précision. Ainsi, la variation de la concentration de l'électrolyte est suivie en continu en mesurant la conductivité de la solution diluée en fonction du temps.

Les courbes $\sigma = f(t)$ des MEA et MEC neuves et usées en faisant varier la concentration de l'électrolyte montrent que les membranes usées laissent passer moins d'électrolyte fort (NaCl et HCl) que les neuves. Ceci peut être expliqué par:

Les sites fonctionnels se combinent avec des ions polyvalents présents même en état de trace dans la solution à traiter et deviennent inactifs. La membrane perd alors son caractère hydrophile et se transforme en un film presque hydrophobe.

Les attaques chimiques et les opérations d'électrodialyse ont dégradé et éliminé une grande partie des sites fixes aboutissant aux mêmes effets sur le caractère hydrophile des membranes.

Ces deux hypothèses ont été confortées par la mesure des capacités d'échange de ces mêmes membranes neuves et usées. En effet, on observe une baisse très sensible de cette grandeur dans le cas des membranes usées.

L'utilisation intensive de ces membranes en présence de milieux chargés en molécules organiques engendre un colmatage des interstices laissés libres par les chaînes macromoléculaires. De tels interstices constituent l'espace de déplacement et de diffusion des électrolytes.

L'étude comparative de la perméabilité ionique des MEI neuves et usées a permis de constater que plus la membrane est usée plus sa perméabilité aux électrolytes est faible. Ceci a été attribué à l'inhibition de certains sites fonctionnels et au colmatage des interstices par des molécules organiques. Des tests en IRTF sont en cours pour confirmer la présence de ces macromolécules dans les membranes usées.

CMTDE_99

Study of the calcium carbonate scaling in the desalination units by electrodialyse: natural inhibition by magnesium ion

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Abstract

The processes based on the separation by membranes seem to become very powerful tools for the purification and the retraining of the fluids. Competed by the inverse osmosis in the domain of the desalination of waters, the electrodialyse (ED) occupies a large place in the agroalimentary industries to treat the co-products on the one hand and to contribute to the retraining of containing sewages of the heavy metals and toxic, on the other hand. Although it is appreciable for cost and reliability in several domains, the ED suffers to scaling problem caused by the concentration of some ions. Since the technique is used currently for the desalination of water in some industries, we have opted to study mechanisms of membrane scaling by calcium carbonate, one of salts the more frequently met in the stations of desalination in Tunisia. The survey uses a method of accelerated scaling of a pilot unit of electrodialyse. By means of this method, we studied the effect of the initial pH and the composition of water on the kinetics of the scaling formation. The treated waters are synthetic solutions. The results showed that the CO_2 quantity initially dissolved in the solutions is an important factor in the scaling process. According to the composition of water, domains of CO_2 pressure were defined in whom a small variation can generate the rupture of the metastability state in the compartment of concentration and provoke $CaCO_3$ nucleation in the compartment of concentration and/or on the membranes and conducts. The presence in solution of magnesium in only a Ca/Mg ratio of 0,5 delayed considerably the $CaCO_3$ nucleation. This ratio is considered like a low bottom limit of magnesium action, ion to natural inhibitory effect present in the natural waters.

Keywords: *electrodialyse / scaling / calcium carbonate / thermodynamic state / magnesium.*

Etude par simulation numérique du colmatage des membranes lors de la récupération d'un cation métallique par complexation-ultrafiltration

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Résumé

Depuis quelques années la pollution par les métaux lourds est devenue un problème important pour la protection de l'environnement et de nombreuses méthodes ont été développées pour éliminer les métaux toxiques présents dans l'eau. Parmi les différents procédés utilisés, la complexation-ultrafiltration est bien connue et de nombreuses études sur ce sujet sont décrites dans la littérature. Cependant, le problème de colmatage des membranes persiste. Le principe de ce procédé repose sur le couplage d'une complexation d'ions usuels (métalliques) par un macroligand et d'une filtration du complexe formé par une membrane d'ultrafiltration. Contrairement aux ions qui traversent la membrane, le complexe macroligand/cation est retenu par celle-ci. Le procédé permet alors de récupérer une solution épurée d'une part, et une solution concentrée en complexes d'autre part. Nous nous intéressons dans cette étude à la simulation numérique de la récupération de quelques cations métalliques par ultrafiltration (à travers un module cylindrique poreux) en déterminant les concentrations du ligand en écoulement dans un module cylindrique à la surface de la membrane d'ultrafiltration et d'étudier l'influence de la vitesse de circulation du liquide sur le colmatage de cette dernière. Le model mathématique consiste à résoudre les équations de continuité (i), de Navier Stockes (ii) et de transport (iii). La résolution des équations est faite par la méthode des volumes finis. Les résistances obtenues sont comparables aux résultats expérimentaux cités dans la littérature. Les concentrations de l'alginate de sodium près de la paroi augmentent considérablement le long du module cylindrique et elles diminuent en augmentant la vitesse de circulation du liquide à traiter.

Mots clés *: Alginate de sodium, Complexation, ultrafiltration, volumes finis, cations métalliques.*

Mesures de la capacité haute fréquence lors de la déposition calcomagnésienne en eau de mer.

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Résumé

La précipitation du dépôt calcomagnesien sur la surface métallique par voie électrochimique est provoquée par la réduction de l'oxygène dissous dans l'eau de mer et par ricochet par l'augmentation du pH interfacial. Ceci est réalisé suite à un potentiel imposé au métal à l'aide d'un potentiostat. L'objectif de ce travail est donc de préciser clairement l'influence de chaque paramètre susceptible d`intervenir sur la cinétique et la nature des dépôts calcomagnesiens. Ces paramètres sont le potentiel, la vitesse de l'écoulement, la température et la composition de l'eau de mer. La cinétique de la déposition calcomagnésienne a été suivie par la technique électrochimique Chronoampérometrie et les différentes couches de dépôts formés ont été caractérisées par l`impédance électrochimique. Cette cinétique de déposition a été également suivie par la détermination de la capacité haute fréquence CHF qui caractérise la capacité à l'interface métal /solution, sachant que la capacité haute fréquence est proportionnelle à la surface active du substrat (métal). Cette capacité est égale à la capacité de double couche dans le cas d'une électrode entièrement active. Dans le cas d'une électrode recouverte par un dépôt, elle correspond à la somme de la capacité de la double couche et de la capacité du dépôt.

Mots clés : Dépôt calcomagnesien, Chronoampérometrie, Impédance électrochimique, Mesure de la capacité haute fréquence, Titane, Eau de mer.

CMTDE_102

Elimination d'un colorant antraquinonique (Acid Blue 25) par ultrasons de haute fréquence

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Résumé

La présence de plus en plus fréquente de substances colorantes dans l'environnement constitue une pollution émergente. L'existence de ces polluants même en quantités relativement faibles dans l'eau, constitue un sujet de préoccupation majeure. Par conséquent, il s'avère très important de mettre au point des méthodes de traitement des eaux usées chargées en colorants par des procédés d'oxydation avancés (POA) car les méthodes classiques sont inefficaces.

Les dernières années ont fait apparaître un intérêt considérable pour l'application des ultrasons comme POA pour le traitement de polluants dans l'eau. Les ultrasons créent dans l'eau des microbulles qui quand elles implosent produisent de grandes quantités d'énergie. Cette énergie favorise les réactions thermales et aussi l'homolyse de l'eau et de l'oxygène. La sonolyse de l'eau produit des radicaux comme OH qui sont capables de dégrader la matière organique.

Dans ce travail, l'irradiation ultrasonore à 1,7 MHz a été utilisée pour l'élimination d'un colorant anthraquinonique modèle, l'Acid Blue 25 (AB25). Les colorants anthraquinoniques représentent la catégorie la plus importante des colorants commerciaux, après les composés azoïques, et sont principalement utilisés pour teinter la laine, le polyamide et le cuir. Les effets des paramètres opératoires tels que la concentration initiale du colorant et le pH de la solution ont été étudiés. Les résultats obtenus montrent que la décoloration de l'AB25 est plus rapide à pH 1. Pour tout l'intervalle de concentration choisi, l'élimination de l'AB25 suit une cinétique de pseudo–premier ordre. De plus, les vitesses de disparition du colorant dépendent de la concentration initiale.

Mots clés *: Décoloration, Ultrasons, Acid blue 25, Traitement de l'eau*

CMTDE_103

Approche du phénomène de l'intrusion des eaux Marines par les techniques isotopiques et hydrogéochimiques : cas de la vallée de l'oued Nador

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Résumé

Les zones côtières ouest de l'algérois (région de Tipaza), objet de notre investigation sont à vocation essentiellement touristique et agricole. Elles sont composées de trois vallées alluviales (Oued El-Hachem, Oued Mazafran et Oued Nador). Elles présentent toutes un aspect exoréique d'où le risque déjà au départ d'une contamination par les eaux salées.

Le développement industriel et agricole d'une part, et la croissance démographique incontrôlée d'autre part ont induit des besoins en eau très importants ce qui, avec le concours de conditions climatiques défavorables, a inévitablement conduit à une contamination quasi-générale des eaux des aquifères côtiers par l'eau de mer due à l'avancée du biseau salin (interface eau douce/eau salée).

Les pratiques de pompage intensif à des fins d'alimentation en eau potable et d'irrigation dans les zones côtières algéroises posent le problème de la surexploitation et de la baisse des niveaux piézomètriques conduisant à une contamination des eaux douces par les eaux marines. C'est en effet en période des basses eaux que l'on assiste à une remontée significative de l'interface eau douce/eau salée.

L'étude de par les investigations isotopiques (oxygène-18, deutérium, tritium) et hydrogéochimiques (Teneurs en ions majeurs et traces) permet de développer une méthodologie qui repose sur une approche intégrée et améliorée pour quantifier l'impact de l'intrusion d'eau de mer sur la dégradation de la qualité de l'eau dans cette zone côtière, ce qui permettra :

Une meilleure connaissance du mécanisme de salure des nappes découlant directement des pompages accentués et continus.

Une Localisation des secteurs les plus sensibles à l'interface qui est suffisamment proche de la surface du sol afin de prévenir la remontée des sels.

L'établissement d'une carte d'orientation permettant de délimiter dans le temps les fluctuations de l'interface.Une harmonisation des dispositifs et méthodes de pompages surtout durant les périodes sensibles.

Mise au point d'un système de protection de la qualité des eaux souterraines et de surface en liaison avec l'agriculture.

***Mots clés** : Intrusion marine, isotopes stables, radioactif, géochimie, interface, bande côtière.*

Réduction du chrome par photocatalyse sur un oxyde semi conducteur dans un réacteur agité

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Résumé

La photocatalyse s'impose progressivement comme une technologie alternative pour la dépollution de l'eau. Elle s'inscrit dans une perspective de développement durable utilisant le soleil comme source d'énergie renouvelable. Le chrome est l'un des métaux les plus largement utilisés dans l'industrie. C'est la forme dite hexavalente qui est la plus problématique car sous cette forme le chrome est très toxique. Le traitement photocatalytique repose sur l'absorption par un semi conducteur d'une radiation lumineuse d'énergie plus grande que le gap optique du semi conducteur. Cette absorption d'énergie engendre l'excitation d'un électron de la bande de valence vers la bande de conduction générant ainsi un déficit électronique ou 'trou', donnant au solide des propriétés oxydo-réductrices vis-à-vis des polluants absorbés. Les photoélectrons, localisés dans la bande de conduction possèdent un pouvoir réducteur élevé capable de réduire les ions métalliques en solution et l'eau en hydrogène.

Ce travail consiste en la synthèse et l'étude des différentes propriétés physico-chimiques de deux semi-conducteurs $CuFe_2O_4$ et le CdS, ainsi que de leur application à la photo réduction du bichromate et la photo oxydation de l'acide salicylique. Différentes techniques de caractérisations ont été utilisées. L'ensemble de ces caractéristiques nous a permis de proposer un diagramme énergétique de structure de bandes et de prévoir d'un point de vue thermodynamique la réduction du chrome hexavalent. Une étude approfondie des propriétés photocatalytiques d'une hétérojonction du $CuFe_2O_4$ et du CdS a été entreprise pour la réduction du chrome hexavalent. Des tests de photo activité en milieu contaminé par le bichromate ont été réalisés. Par ailleurs le présent travail présente un double intérêt car avec la réaction de photo réduction du chrome présent dans l'eau il se produit simultanément la réaction de photo production de l'hydrogène.

***Mots clés** : photocatalyse, semi conducteur, hétérojonction, Chrome (VI).*

Elimination des amines aromatiques par adsorption sur des charbons préparés à base de noyaux d'abricot

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Résumé

L'objectif de ce travail est l'élaboration de nouveaux supports adsorbants d'origine végétale et de leur utilisation dans le traitement des eaux polluées par des composés organiques.

Dans cette optique, nous avons considéré la fixation des amines aromatiques sur des charbons préparés à base de noyaux d'abricot, préalablement traités aux acides minéraux sulfurique, chlorhydrique et phosphorique à une température de 100 ±2°C. Les échantillons traités par voie chimique sont carbonisés dans un four à moufle avec une loi de chauffe de 5 °C à 800 °C.

L'adsorption de l'aniline et son dérivé (parabromoaniline) sur ces supports en fonction de plusieurs paramètres physico-chimiques a été étudiée et optimisée. Les essais d'adsorption ont été menés en batch dans un réacteur agité, la concentration résiduelle est analysée par spectrophotométrie UV.

Il ressort de ces résultas que les acides chlorhydrique et phosphorique ont un effet très positif sur le développement de la texture poreuse. L'étude cinétique a montré que le processus d'élimination de l'aniline et son dérivé est rapide et que les meilleurs rendements d'élimination des molécules considérées sont obtenus avec les charbons traités aux acides phosphorique et chlorhydrique.

Les capacités ultimes d'adsorption de l'aniline sur les trios charbons traités de manière optimale (HCl, H_3PO_4 et H_2SO_4) sont 101,01 - 90, 909 - 59, 523 $mg.g^{-1}$ respectivement, et celles de la parabromoaniline sont 285.714 - 212.765 - 192.307 $mg.g^{-1}$ respectivement.

Mots clés *: Adsorption; Aniline; 4-bromoaniline; Charbon actif; Noyaux d'abricot; Pollution de l'eau ; Déchets industriels.*

Dégradation des phtalates en milieu aqueux par procédé d'oxydation avancée, photo-fenton

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Abstract

Une méthode photochimique pour la dégradation des polluants organiques persistants présents dans les effluents liquides de l'industrie du plastique ainsi que dans les lixiviats est décrite. Cette méthode, dite "photo-Fenton" consiste en la génération des radicaux hydroxyles par couplage entre la réaction de Fenton et la photochimie, Les radicaux •OH ainsi formés réagissent, avec des vitesses très élevées, sur les substances organiques polluantes conduisant à leur oxydation jusqu'à minéralisation totale.

Dans cette étude, nous avons appliqué le procédé photo-Fenton au traitement des plastifiants, Phtalates. Pour cela, une optimisation des paramètres expérimentaux (a savoir le rapport entre les concentrations du peroxyde d'hydrogène et du fer et la concentration du catalyseur) a été réalisée. Dans les conditions optimales ainsi déterminées, la cinétique de minéralisation de l'anhydride phtalique par les •OH a été étudiée.

L'ensemble des résultats obtenus confirme l'efficacité du procédé photo-Fenton pour la dépollution des effluents liquides chargés de composés organiques persistants (POP's).

CMTDE_107

Etude Cinétique de la réaction de chlorométhylation de metaxylène Application au traitement des eaux.

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Résumé

L'industrie pétrochimique, utilise largement des hydrocarbures liquides, en particulier, les aromatiques comme matière première pour la synthèse des produits organiques. Une grande quantité de benzène, de toluène, de xylènes et du naphtalène est destinée pour la synthèse pétrochimique des fibres synthétiques. Ces hydrocarbures sont obtenus par le reforming catalytique des essences ou l'extraction par solvant.

Parmi les aromatiques en C_8, seul le para et l'ortho-xylène sont largement utilisés en pétrochimie. Le métaxylène étant le plus abondant, mais sa demande sur le marché reste relativement faible. Une grande partie de ce produit est laissée sous forme de xylène liquide qui est isomérisée, ou utilisée comme additif dans l'essence. La plus importante manipulation chimique de métaxylène est la fabrication de l'acide isophtalique mélangé et de haute pureté. Une petite partie de ce produit est utilisée dans l'industrie des insecticides. Sur la base du mono et di-chlorométhyle metaxylène, nous avons obtenu des sels d'ammonium quaternaire qui ont été testés dans le traitement des eaux usées et se sont avérés être de très bons agents d'extraction de métaux lourds. Les sels d'ammonium quaternaires à base de metaxylène chargés positivement peuvent fixer des complexes anioniques de métaux. Dans ce travail, nous avons déterminé la formation d'associâts issus de sels d'ammonium quaternaire, bien solubles dans le chloroforme. De ce fait, nous sommes arrivés à extraire des métaux (Cu, Zn , Cd, Hg) qui forment des complexes stables avec le thiocyanure. Il a été démontré que l'extraction se déroule totalement dans un large intervalle de pH (1-10).

Mots clés : *chlorométhyle, m-xylène, formaldéhyde, di-chlorométhyle m-xylène, sel d'ammonium quaternaire.*

Decoloration of an azo dye Red Methyl by gas-liquid gliding arc discharge plasma of humid air

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Abstract

This paper reports on using non-thermal plasma provided by an electric gliding discharge in humid air to the treatment of Red Methyl. The main advantage of this system is that reactive species like OH° produced by the Glidarc can be used for the treatment of wastewater. Additive amount of ferrous ions and titanium oxide increase the decoloration rate. The degradation efficiency is around 97,8%. This implies that the majority molecules of Red Methyl are destroyed. The hydroxylation reaction of Red Methyl can then be treated as a kinetic pseudo-first order.

Keywords*: Humid air plasma, Red Methyl, Decoloration.*

Récupération du chrome hexavalent issu du bain de chromage du complexe pelles et grues de la ville de Constantine (Algérie) : Etude comparative entre adsorption et couplage complexation-adsorption par l'EDTA et l'acide salicylique

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Résumé

La récupération des métaux est importante pour le contrôle de la pollution de l'environnement, pour la protection des ressources de l'eau et pour la protection de la santé de la population.

Il y a un grand nombre de procédés de séparation qui s'appliquent au traitement de résidus, parmi lesquels l'adsorption sur un support naturel. Notre travail porte en premier lieu sur l'étude expérimentale de l'adsorption du chrome hexavalent sur charbon actif, en mettant en évidence certains paramètres expérimentaux, notamment le pH, la température, l'agitation et la masse du charbon. En deuxième partie, notre travail a porté sur la complexation de Cr^{6+} par l'EDTA (Ethylène diamine tétra-acétate) et l'acide salicylique, ensuite l'adsorption du complexe formé sur le charbon actif du fait que ce dernier a une grande affinité d'adsorption des substances organiques, donc une étude comparative a été entreprise.

L'ensemble de nos résultats permet de confirmer que le charbon actif adsorbe préférentiellement le constituant organique, et que dans le cas du cuivre et l'EDTA l'adsorption de Cr^{6+} est plus importante que l'adsorption des complexes EDTA-Cr^{6+} et Acide salicylique-Cr^{6+}, car ces derniers se sont formés en faibles proportions à différentes valeurs du pH. L'analyse du cation libre en solution est réalisée par spectrophotométrie UV-Visible

Mots clés: *adsorption, métaux lourds, Chrome, complexation, EDTA, acide salysillique, UV-Visible.*

Study of the kinetic adsorption of 2-nitrophenol On activated carbon of origin vegetale.

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Abstract

Increasing pollution, due to industry causes a greater need for processes able to eliminate from the specific pollutants the such organic substances. The active coal-burning in secondary or tertiary treatment makes it possible to obtain an effluent of quality. However this conventional method to reach the concentrations imposed for the liquid effluents is often extremely expensive. To this end the lignocellulosic preparation of activated carbon containing precursors (date cores) is a way economically interesting which makes it possible to develop materials considered often as waste.

In this work, we proposed to work out locally new adsorbents starting from materials available, abundant and inexpensive in fact the date cores coming from the Algerian south and to contribute the extension of their employment in the field of water treatment contaminated by 2-nitrophenol.

In order to evaluate the performances of this activated carbon for the elimination of 2-nitrophenol in solution aqueous of the tests of adsorption were realized in batch in an agitated engine. The residual pollutant is analyzed by spectroscopy UV.

The effect of the various parameters (concentration of coal, initial pH of the solution, initial concentration of the pollutant and temperature) was studied. The analysis of the results of the kinetics of adsorption shows that the reaction of adsorption of 2-nitrophenol is of order 2; speed notes decreases with the increase in the temperature and the 2-nitrophenol concentration and increases with the increase in the pH and the activated carbon concentration. We noticed, during the experimental tests, that adsorption is controlled by the diffusion intraparticulaire.

Keywords: *Environment, pollution, 2-nitrophénol, adsorption, activated carbon.*

Chromatographic Analysis of organic water pollutants using a new bonded Poly-benzyl-L-Glutamate stationary phase

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Abstract

Liquid crystals were first introduced as stationary phases in liquid chromatography (HPLC) in 1989 [1] and applications have been developed for difficult separation problems towards geometric and optical isomers taking advantage of the strong shape selectivity of liquid crystal stationary phases.

Pollution is caused by various industrial and agricultural processes and high performance liquid chromatography (HPLC) is a useful analysis technique to separate a mixture of these components.

In this work, we have grafted the liquid crystal poly-benzyl-L-glutamate on silica in order to use it as a new HPLC bonded liquid crystal stationary phase.

It was largely demonstrated that liquid crystal stationary phase have good molecular recognition capabilities towards geometric isomers [2-5]. The bonded material can successfully be used to separate mixtures of pollutants such as polyaromatic hydrocarbons and phenols that are commonly done by both reversed and normal phase materials.

In this work, separation of PAHs with 2 to 8 rings is described using hexane and chloroform mixtures as mobile phase and total resolution of 22 PAHs is made by gradient elution.

Primary analytical properties were obtained with the PAHs using hexane and chloroform mixtures as mobile phase. The PAHs are eluted according to their rings number. Remarkable results were observed in the separation of high PAHs such as coronene, rubrene, dibenzo(a,h)anthracene in less than 10 minutes using $CHCl_3$ / hexane , 85/15 , v/v as mobile phase. Other classical PAHs are well resolved with hexane or hexane/$CHCl_3$, 95/5 , v/v. Total resolution of the 22 PAHs studied was made by gradient elution. The bonded material exhibits a liquid crystal-like behaviour: the more retained solute is the more stretched solute. Using acetonitrile/water, in reversed phase satisfying separation of priorities phenols is obtained.

Keywords: *Bonded liquid crystal stationary phases; HPLC, PAHs, Phenols.*

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CMTDE_112

Traitement anaerobie des boues de station d'epuration pour la production du biogaz et la protection de l'environnement

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Résumé

Les boues de stations d'épuration sont des sous produits organiques de l'assainissement des eaux usées d'origine industrielle ou domestique. Lorsque leur recyclage s'avère impossible en agriculture, les boues constituent un déchet humide difficile à brûler et à valoriser par voie thermique. La valorisation énergétique regroupe différentes technologies permettant de convertir la fraction organique des boues en énergie.

Ce travail de recherche vise l'étude et l'optimisation du procédé de traitement des boues issues de station d'épurations par voie biologique (procédé de digestion anaérobie) dans le but de réduire le volume de boues ainsi que leurs valorisation sous forme de biogaz et la protction de l'environnement.

Ce travail est réalisé dans un digesteur pilote complètement agité, de 500 litres de volume et alimenté en semi continue en phase thermophile.

Lors de la période de déroulement de l'expérimentation, des analyses concernant la mesure des paramètres de stabilité du digesteur ont été faites. Parmi ces paramètres, on peut citer les acides gras volatils (AGV), le pH, l'ammoniac, l'azote organique total, le sulfure d'hydrogène (H_2S), la demande chimique en oxygène (DCO) soluble et total, le volume du biogaz ainsi que sa composition.(CH_4 et CO_2), l'alcalinité totale et partielle, le carbone inorganique et l'azote inorganique.

Les résultats obtenus montrent que la quantité de boues traitées et le volume de biogaz produits sont importants. En effet, la production spécifique moyenne de biogaz (SGP) obtenue est de l'ordre de 0,33 m3/KgTVS par contre elle ne dépasse pas la valeur de 0,14 m3/KgTVS dans le cas de la digestion anaérobie en condition mésophile (température=37°C).

Mots clefs *: Valorisation, Boues, Biogaz, Energie, digestion, Thermophile.*

CMTDE_113

Improving Seawater Desalination Plants Availability by Multi-Decision Approach Based on Bayes Networks.

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Abstract

Production capacity of drinking water by desalination of seawater in Algeria are experiencing a significant increase. It has been assessed an increasing number of locations of medium and large-capacity desalination units distributed along the 1600 km of Mediterranean coast. This program follows the drought experienced by the country in 1991. It is likely that some aspects of maintenance operations of the desalination facilities given the urgency and choice of sites and technologies adopted to induce a number of failures due to the operation and age of equipment that will result in additional costs of maintenance and hence the cost of cubic meter of water produced. The analysis and decision making is a key to preventing outbreaks of malfunctions and ensure optimum operation of equipment in a safe and optimum cost. It is to check the systems to identify vulnerabilities of unavailability, and implement where appropriate the maintenance required. These vulnerabilities are the result of negligence or weaknesses in the control of experience gained during the monitoring of facilities. Many analysis tools are available in maintenance to enable appropriate decisions based on the performance we want to achieve equipment. The approach to decision making for the type of maintenance to be applied (preventive, predictive or corrective) by the application of Bayesian networks opens new opportunities to address this problem by allowing the design of systems that support interaction of various parameters of reliability, maintainability, availability and security (RMAS). The aim of this paper and present a model of decision-making by designing a multi-chart decisions, using Bayes networks and feedback to achieve the type of maintenance to be considered and plan actions to increase the availability of facilities. The approach offers a very interesting managerial point of view to model and analyze the relevance of the different maintenance strategies in improving the reliability and maintainability of desalination plants.

CMTDE_114

On the use of renewable energies in sea/brackish water Greenhouse desalination unit: a case study from algeria

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Abstract

In Algeria arid and semi arid lands represents more than 85% of the total surface area. In these arid regions fresh water is very scarce and inhabitants leave to the coast where lands are more fertile and fresh water is more available. The establishment of a human habitat in these arid areas affected by dryness strongly depends on how such water can be made available. Brackish water Greenhouse desalination unit is one of the most promising techniques, due to the coincidence that in many parts of the world suffering of fresh water scarcity, brackish water are available and renewable energies potential is important. The aim of our paper is to propose a new Sea/Brackish Water Greenhouse Desalination Unit powered by renewable energy resources (Solar, geothermal and wind) projected to the development of the arid region in Algeria. Theses renewable resources can both be used to heat the greenhouses and to provide fresh water needed for irrigation of the crops cultivated inside the Greenhouses. A review of the Algerian renewable resources and weather distribution is also outlined.

Keywords : *Brackish water Greenhouse desalination, renewable energy, Algeria, fresh water.*

Synthèse et caractérisation des membranes Polymère/gypse et leurs applications au prétraitement de l'eau

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Résumé

La présente étude est basée sur la synthèse et la caractérisation des membranes organiques à base de polyéthylène basse densité (PEBD) et de gypse local issu de la région de Chlef (Algérie). Dix chantillons différents de membranes polyéthylène basse densité et gypse avec des proportions différentes de gypse ont été utilisés pour étudier leurs capacité de filtration en vue de les utilisées dans les procédés de prétraitement.

Mots clés : *Gypse, Eau, Polyéthylène basse densité, membrane, Elaboration, Filtration.*

A study of characteristics of activated carbon produced from Algerian date stones "*DEGLET NOUR*"

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Abstract

Agricultural by-products, such as date stones, contribute large quantities of waste to the environment each growing season. The objective of this study was to convert date stones to activated carbon for use in adsorption of organic pollutants, such as **2Chlorophenol** and **2Nitrophenol**. Milled date stones was pyrolyzed in an inert atmosphere of nitrogen gas, and activated with different acids at different temperatures ranging from 300 to 800°C. Scanning electron microscope (SEM) revealed that high porosity was obtained at 800°C when the raw material was impregnated with H_2SO_4 at 100°C which was proved by the surface area measured by nitrogen adsorption at 77 K and calculated by ***BET*** equation. The prepared carbons were evaluated for their adsorption capacity of phenolic pollutants. The adsorption isotherms were measured in batch experiments. The experimental data were analyzed by both Freundlich and Langmuir isotherm models. The maximum adsorption capacity of pollutants was around **70 %** using combined activation.

This study demonstrates that date stones can serve as a source for activated carbon with phenolic pollutants removing potential and may serve as a replacement for coalbased commercial carbons in applications that warrant their use.

Keywords : *Activated carbon; Adsorption; Date stones; Porosity; 2chlorophenol, 2nitrophenol.*

CMTDE_117

Prediction of scaling limit in saline water

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Abstract

The understanding of the scaling process from natural waters is of major importance in a great variety of domains, especially in the field of water exploitation and treatment. In many cases, scale is primarily formed by calcium carbonate. Depending on the conditions, calcium carbonate may crystallize as three anhydrous polymorphs: calcite, aragonite and vaterite. The thermodynamics of the calco-carbonic system $CaCO_3$ - CO_2 - H_2O equilibrium has been studied by various authors. Experimental investigations showed the occurrence of a large super-saturated domain with respect to calcite called the metastable domain, where the precipitation does not occur even for supersaturation coefficients f greater than one (Roques; 1964; Elfil and Roques; 1999, Dèdek; 1966; Legrand et al.; 1981; Abu-Sharar;

1990 ; Amerhein et al.; 1993; Elfil and Roques; 2004; Gal et al; 2002 ; Ben Amor et al.; 2004; Tlili; et al. 2006,). In addition to the usual polymorphs, three hydrated calcium carbonate varieties have also been previously observed: the amorphous calcium carbonate, $CaCO_3.6H_2O$ and $CaCO_3.H_2O$. It has been advanced that the breakdown of the metastable state of a supersaturated solution is initiated by the nucleation of the hydrated forms after one or several dehydration and crystallization steps.

It is noteworthy that in most cases, the investigations of the metastable domain were carried out by using either pure calcocarbonic solutions or solutions containing low concentrations on foreign salts, equivalent to drinkable waters. The aim of this paper is to delimit the extended of the metastable domain when precipitation occurs in calco-carbonic solutions containing 0 to 40 g/L of NaCl. For this purpose, the thermodynamic equilibrium conditions for the various anhydrous and hydrated varieties were used as a basis for the interpretation of the experimental results. Calculations were made using the Pitzer ion specific interaction model and considering the ionic strength, the ions pairs, etc. This approach has been experimentally illustrated by inducing calcium carbonate precipitation by a CO_2 degassing method.

Like for fresh water (Elfil and Roques, 2001; Gal et al; 2002), the major role played in $CaCO_3$, precipitation by monohydrated forms are démonstrate. The difference appears in the highly shifting of equilibrium curves to high TCa concentration when the salinity rises.

Keywords: calco-carbonic equilibrium, pitzer model, metastable state.

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Synthèse du complexe organo-pyrophyllite et son application dans le traitement des eaux chargées en métaux lourds

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Résumé

Les argiles modifiées sont des matériaux en plein développement, particulièrement intéressants en raison de l'amélioration de leurs propriétés physicochimiques, et de leur intérêt dans le domaine de l'adsorption.

Etant donné le vif intérêt porté à ces matériaux ces dernières années, nous avons voulu tester ce concept sur la pyrophyllite qui est une argile abondante au Maroc.

Ainsi nous avons réalisé un traitement à base d'une molécule organique pour synthétiser le complexe organo-pyrophyllite. Au cours de ce travail nous avons d'abord caractérisé le matériau obtenu par différentes techniques d'analyse avant d'aborder son application dans l'élimination des métaux lourds en solution. Il a été suggéré, sous la lumière des résultats de la caractérisation du complexe organo-pyrophyllite, que des liaisons hydrogène sont formées entre les groupements hydroxyle et/ou les atomes d'oxygène de la pyrophyllite et les groupements hydroxyles de la molécule organique. Ainsi, les groupements aminés fonctionnels de cette dernière seraient disponibles pour une éventuelle adsorption de métaux lourds, donc présents à la surface d'interaction où les atomes N de la molécule organique agissent comme donneurs de la paire d'électron.

Relativement à l'adsorption de Pb (II), il a été constaté qu'elle dépendait principalement du pH de la solution. Ainsi un maximum d'adsorption des ions Pb(II) sur la pyrophyllite naturelle et sur la pyrophyllite modifiée a été réalisé à pH 5,5 pour une concentration initiale en plomb de 5.10^{-4}M. L'influence de la densité de pulpe sur l'élimination du Pb(II) a été également mise en évidence. Ainsi, le pourcentage d'adsorption augmente en rajoutant le matériau. Pour une concentration en plomb de 5.10^{-4}M, le taux d'élimination des ions de Pb (II) a été beaucoup plus important dans le cas de la pyrophyllite modifiée en comparaison avec le matériau naturel. Ainsi le taux 82% d'élimination de Pb(II) exige une densité de pulpe de plus de 45g/l de pyrophyllite naturelle et de seulement 10g/l de pyrophyllite traitée.

L'étude cinétique de l'adsorption du plomb indique que l'équilibre pourrait être atteint dans les 30 premières minutes pour la pyrophyllite et à seulement 15 minutes pour la pyrophyllite traitée. Les données expérimentales coïncident parfaitement avec le modèle de Langmuir, de la sorte que les coefficients de corrélation de tous les isothermes d'adsorption ont été trouvés favorables.

Les études d'adsorption de Fe(III) et de Cu(II) sur nos argiles ont montré que le fer a été fortement adsorbé en comparaison avec le Pb(II) et le Cu(II) ce qui est due à sa forte valence par rapport aux deux autres cations. Cependant, la forte adsorption du Pb(II) en comparaison avec celle du Cu(II) est expliquée par leurs différents rayons ioniques.

Manifestement, il a été confirmé que la faible capacité d'adsorption de l'argile naturelle serait renforcée par sa modification en utilisant des agents de couplage tel que notre molécule organique. Par conséquent, la modification chimique de l'argile serait utile pour la préparation de nouveaux adsorbants dans l'objectif de traiter des eaux chargées en métaux lourds toxiques.

CMTDE_119

Retention of Cadmium and Zinc from aqueous solutions by Poly (acrylic Acid) Assisted-Ultrafiltration

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Abstract

The continuous increase of world needs for most of the known metals, the decrease in grade of the available ores, and strict environmental regulations, make it interesting to find effective and efficient methods for processing waste solutions containing metal ions, even at very low concentrations.

The use of membrane, separation process in wastewater treatment, containing toxic metal ions, is today an attractive and suitable technique, and it has to be easily included in whole process, which is the reason behind the rise of membrane separation use. A promising process for the removal of heavy metal ions from aqueous solutions involves bonding the metals to a bonding agent (such as macromolecular species), and then removing the loaded agents from wastewaters by separation processes such as membrane filtration.

Enhanced ultrafiltration by the addition of poly (acrylic acid), for the removal of Cd(II) and Zn(II) from aqueous solutions has been studied. The solution is processed by ultrafiltration using a membrane with pore sizes (10 kDa) small enough to block the passage of the polymer and adsorbed metal ions.

At best operating conditions (pH, transmembrane pressure and polymer concentration) using poly (acrylic acid), the removal of Cd^{2+} and Zn^{2+} is was more than 85% and 90% respectively.

The study of ionic strength effect shows the decrease of ions retention and the increase the permeate flux. The study of pH effect on the cadmium and zinc recovery reveals retentions almost around 85% and 97% respectively at pH 6.

When both metals are present in the same solution, retention decreases compared to single metal solutions, which is more significant in the case of cadmium ions.

Keywords: *Cadmium, Zinc, poly (acrylic acid), Removal ions, Polyelectrolyte Enhanced-UltraFiltration.*

CMTDE_120

Modeling the effect of various parameters on sewage treatment

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Abstract

A study on wastewater treatment in sewage treatment plant in Sirte, Libya was carried out. The sewage chemical analysis for various parameters for raw wastewater and after biological treatment was closely monitored. Regression analysis has shown good correlations between biochemical oxygen demand (BOD) inlet i.e. of incoming raw wastewater and BOD outlet i.e. after biological treatment, suspended solids (SS) outlet and chemical oxygen demand (COD) inlet values with correlation coefficients of 0.81, 0.78 and 0.792 respectively. These correlations could be applied to predict the respective characteristics of the raw wastewater and the treated effluent to reduce the analytical work load. All other tested parameters of treated wastewater were in good agreement with expectations based upon the standard and accepted characteristics of sewage for disposal. BOD, COD and SS treatment efficiency had been, on an average of 87, 84 and 89 % respectively.

Keywords: *BOD, COD, SS, Sewage treatment, Regression analysis.*

The cost of desalination in Algeria

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Abstract

According to recent demographic statistical data, the number of inhabitants in Algeria should double in the next thirty years where as conventional water resources will not change. The hydrologic situation especially for the coastal areas reflects severe drought conditions that is lasting since two decades. Seawater desalination could be a n efficient alternative in order to tackle the serious problem of water shortage. In fact, due to rural depopulation a large majority of the people and the economic activities are nowadays concentrated in the coastal cities of the Mediterranean sea along ~1200 km of coast. The good physico - chemical features of Mediterranean seawater (19°C and medium salinity as compared to Persian golf seawater which exhibits 30°C and much higher salinity) make of Mediterranean desalination plants more profitable with less operating costs and better efficiencies.

The reverse osmosis has been chosen as the best desalination process because it has seen many improvements of its technology especially with regard to better performance and longer lasting membranes. The latter was found lower than 0.5 euro, which is quite interesting. All in all, the desalination option seems to be a good alternative to deal the most urgent matters in terms of ensuring durable water allocation in the present climatic context prevailing nowadays.

Keywords: *Desalination, reverse osmosis, plant, drought, resource, cost*

Application of membrane technologies for the treatment of textile wastewater and synthetic textile dyes

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Abstract

Textile industry is characterized by using a great variety of chemicals and by large water consumption. In this way, textile effluents contains many types of dyes, detergents, solvents and salts depending on the particular textile mill processes (dyeing, printing, finishing...) and on the raw matter. For those reasons, textile industry is one of the main sources of industrial pollution, producing effluents discharges characterized by high conductivities and chemical oxygen demand (COD) values and strong colour. Process selection and operating conditions are important issues to optimize technically and economically the textile effluent treatment.

This work presents the results of the laboratory-scale membrane experiments of textile industry effluents and synthetic textile dyes. Different types of Ultrafiltration (UF) and Nanofiltration (NF) membranes were evaluated for permeate flux and their suitability in separating COD, colour, conductivity. Experiments demonstrated that membrane treatment is a very promising advanced treatment option for pollution control for textile industry effluents.

The results of this work show that the direct ultrafiltration seems to be a realistic method in the pretreatment of the textile wastewater. In fact, NF process was successfully used to improve permeate quality of synthetic dyeing textile wastewater, but this process presented some limitations in the treatment of textile industry effluents because of membrane fouling problems. So, this process requires an efficient and appropriate technique such as ultrafiltration as a pre-treatment step for textile wastewater reuse.

For direct nanofiltration of synthetic textile dyes aqueous solutions, with a weak salt concentration (500 ppm), good results were obtained. More than 95% of color was removed from the treated water accompanied with a reduction of 92% of conductivity and COD. Based on the experiments; NF membranes are suitable for producing permeate of reusable quality.

CMTDE_123

Recovery of salicylic acid from aqueous solution by solvent extraction and supported liquid membrane using TOMAC as carrier

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Abstract

Conventional sewage treatment plants do not fully degrade residues of pharmaceuticals, so that they are introduced into the aquatic environment. On this basis, the demand for the development of efficient systems for removing these compounds from water has assumed a great research interest. Membrane operations are increasingly employed in many industrial sectors as important alternative technologies to the classical processes of separation. Among membrane-based separation processes, the use of supported liquid membranes (SLMs) has received growing attention during recent years.

In our work we had tried to recover a pharmaceutical product, salicylic acid (S.A), from an aqueous solution by solvent extraction and supported liquid membrane using an ionic liquid: the trioctylmethylammonium chloride (TOMAC) as carrier. Ionic liquids has been revealed as interesting clean alternatives to classical solvents and their use as a liquid phase results in the stabilization of the SLMs duo to their negligible vapour pressure, the possibility of minimising their solubility in the surrounding phases by adequate selection of the cation and anion, and the greater capillary force associated with their high viscosity.

For this reason we had studied the influence of different parameters which could affect the efficiency of the transport: pH of the feed phase, the nature of the strippant, the concentration of the strippant, the nature of the support and the initial concentration of the salicylic acid in the feed phase. We had noticed that the pH of the feed solution had no effect of the percentage extraction and after 24 hours we can extract completely our solute.TOMAC seemed to be a good extractant but we found difficult to strip salicylic acid from the TOMAC phase and this could be related to the formation of water microenvironments in the ionic liquid membrane.

CMTDE_124

Simulation of vacuum membrane distillation coupled with solar energy

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Abstract

This work focuses on solar energy coupled with vacuum membrane distillation (VMD) for brackish water desalination. VMD is an evaporative process, using porous and hydrophobic membranes, permit to obtain the gaseous permeate, under vacuum, from the aqueous liquid feed. The aim of this work was to simulate the influence of operating conditions (feed flow, feed temperature, permeate pressure) and hollow fibres membrane characteristics (pitch, radius of curvature) on the permeate flux. In order to enhance the performance of the VMD process in desalination to get more permeate flux, we have choose a new module, placed in the absorber of the cylindro-parabolic concentrator, containing hollow fibres wrapped around rod in helical geometry. The model formulation allows for variation of the physical characteristics of brackish solution and the water permeability of membrane. The numerical results showed the important effect of the helical geometry on the enhancement of the permeate flux.

Keywords *: Desalination ; Vacuum membrane desalination ; Solar energy ; helical fibre*

CMTDE_125

Measurements and correlation of viscosities and conductivities for the mixtures of ethylammonium nitrate with organic solvents

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Abstract

Room temperature ionic liquids (IL) as a new class of organic molten salts have been considered as an alternative of traditional organic solvents (OS). The physico-chemical transport properties of mixtures IL/OS were investigated and described by ion-ion, ion-solvent and solvent-solvent interactions.

Ethylammonium nitrate (EAN) was studied in presence of two types of organic solvents: the dimethylcarbonate (DMC) and the formamide (FA). The variation of the viscosity with salt concentration and temperature shows that EAN ions behave as a structure breaker for the DMC. However, no effect was recorded in the case of FA. Concentrated electrolyte solutions behave as very structured media and checked a theory of pseudo-lattice. The existence of a conductivity maximum indicates two competing effects; the increasing number of charge carriers and the higher viscosity of the electrolyte as the salt concentration was raised.

The use of the Walden product to investigate ionic interactions of EAN with both solvents was discussed. A study of the effect of temperature on the conductivity and viscosity reveals that both systems (EAN/DMC and EAN/FA) obey an Arrhenius low. The activation energies for the tow transport process ($E_{a,}$ and $E_{a,}$) as a function of the salt concentration were evaluated.

CMTDE_126

Study of chemical inhibition of gypsum germination at various temperatures

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Abstract

Scaling formed by calcium sulfate dehydrate are often met in water desalination processes. Membranes scaling with gypsum are one of the problems met in reverses osmosis process.

In a first place, the temperature influence on the induction time of gypsum nucleation (homogeneous and heterogeneous) was studied. The zone gypsum homogeneous nucleation witch take place at supersaturation values superior than 4 is distinguished from heterogeneous one witch occurred at low supersaturation .

Gypsum nucleation chemical inhibition was also studied at different temperatures. The MPA (Nitrilotri (methyl-phosphonic acid) efficiency against gypsum precipitation was tested by following the induction time determined by the Quartz-microbalance.

The MPA presents a very good efficiency as inhibitor against $CaSO_4.2H_2O$ formation. Indeed, at low concentration (approximately 6 ppm), the MPA delay considerably gypsum germination and slow down its kinetics.

Keywords: *Gypsum, nucleation, Scaling, chemical inhibition, quartz microbalance.*

CMTDE_127

On the use of renewable energies in the treatment and valorisation of waste water contaminated by waste solids: case study from chlef

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Abstract

One of the main aims of this paper was to characterize the waste solids of Chlef region located in the northern part of Algeria. The determination of the waste solids mass percentage composition and the lixivia analysis were carried out in aim to propose the best treatment process adapted to the case study region. Both the influence of the lixivia in the waste water pollution and a review of the wind and solar energies potential in the case study region were also outlined. An adequate waste water treatment process using renewable energy resource was proposed.

Keywords : *Waste water, waste solids, treatment , renewable energies.*

CMTDE_128

Application of the photo-fenton process to the mineralization of phthalic anhydride in aqueous medium

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Abstract

A photochemical method for the oxidation of persistent organic pollutants (POPs) present in liquid effluents of plastic industry is described. This method, called "photo-Fenton", involves the generation of hydroxyl radicals by coupling the Fenton reaction and photochemistry, ·OH radicals thus formed react rapidly with organic pollutants leading to their oxidation until their total mineralization.

In this study, we applied the photo-Fenton process for the removal of phthalic anhydride (plasticizer). In this way, an optimization of experimental parameters (namely the ratio R = $[H_2O_2]/[Fe^{3+}]$ and Fe^{3+} initial concentration) was performed.

Under optimal conditions, the kinetic of mineralization of phthalic anhydride by ·OH has been studied.

All results confirm the efficiency of photo-Fenton process for the decontamination of liquid effluents loaded with plasticizers.

Keywords: *phthalic anhydride, hydroxyl radicals, Advanced Oxidation Process, photo-Fenton, mineralization.*

Use of the sawdust in the treatment of waste water industry textilles.

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Abstract

The objective of this work is to use and to appreciate the wood sawdust in the removal of colours from water by adsorption. Sawdust has been chemically treated. The static adsorption method was used to monitor the behaviour of the aqueous solution containing the dye. The adsorption capacity of sawdust treated is compared against that of a commercial activated carbon.

Preliminary results show that the adsorption equilibrium is quickly reached. The results of adsorption isotherms modelled using different approaches show that the chemical treatment improves the adsorption capacity of sawdust.

Keywords *: adsorption, sawdust, isotherm, chemical modification*

Bioavailability of heavy metals in sediments And mollusc species from the western coast of algeria

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Abstract

In the aim to assess the toxicity of harbour sediment of Beni Saf, western Algeria coast, and the Zn, Cu, Cd, Fe, and Pb bioavailability bound to these sediments, two complementary studies were carried out: a field study, focused on the sediments, another on the molluscs *(Patella ferruginea).* A preliminary study allowed us to select stations with some similar characteristics (salinity, organic-matter, clay) and presenting a gradient of heavy metals contamination.

The concentrations of metals were determined using atomic absorption spectroscopy (AAS). The results obtained during the sampling period showed a contamination of the sediments. The calculated the pollution index (PI) of some metals analysed in sediments have revealed data exceeding the normally admitted values and presenting risks for the environment. A transfer risk from sediment to mollusc exist, and this bioavailability depends to each heavy metals.

Keywords *: Heavy metals, sediments, molluscs, Beni-Saf, Algeria.*

CMTDE_131

Sorption of 2, 4, 5-trichlorophenol on modified hydrotalcites

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Abstract

Layered double hydroxides (LDHs) can be structurally described by the stacking of positively charged layers with host anionic species in the interlayer domain. These materials can be used as an alternative adsorbent to remove pollutant anions from waste waters. In this work, we have studied the influence of the pH, temperature, initial concentration, adsorbent mass and ionic strength on the adsorption of anionic surfactant (sodium dodecyl benzene sulfonate (SDBS)) on hydrotalcite (HT) and the adsorption of 2,4,5-trichlorophenol (TCP) on HT and its modified forms from aqueous solutions. The modification was carried out by calcinations (heat treatment) and hydrophobisation using an anionic surfactant. The anionic surfactant isotherms were of the H-type. It was assumed that first the ion exchange mechanism takes place until approximately the anion exchange capacity of HT is reached and hereafter, the hydrophobic mechanism occurs forming surfactant bilayers. While the TCP adsorption was very poor on HT, significant uptake of TCP took place on calcined HT which was attributed to the simultaneously occurring rehydration and adsorption during the reconstruction of the layered structure. On anionic surfactant-HT complexes (organo-hydrotalcite) TCP was considerably adsolubilized in the anionic surfactant layers intercalated in HT. The SDBS-HT complex appeared the more effective adsorbents for TCP.

Keywords: *Hydrotalcite ; Anionic surfactant ; organic pollutant ; Adsorption ; UV-visible Spectrophotometer*

The adsorption of anionic surfactant (sodium dodecyl benzene sulfonate (SDBS)) on hydrotalcite (HT) and the adsorption of 2,4,5-trichlorophenol (TCP) on HT and its modified forms from aqueous solutions was studied. In this work, we have studied the influence of the pH, temperature, mass adsorbent, initial concentration and ionic strength on the adsorption of TCP in Mg-Al-CO_3-LDH.

CMTDE_132

Adsorption of 2, 4, 5 trichlrophenol on acid-activated-montmorillonite

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Abstract

Adsorption equilibrium and kinetic of 2, 4, 5 trichlorophenol (TCP) onto acid activated-montmorillonite was studied in a batch system. Variables of the system include contact time, pH, ionic strength, temperature and initial TCP concentration. The increase in temperature resulted in a lower TCP loading per unit weight of the organophilic montmorillonite. Langmuir, Freundlich, , Sips, Langmuir-Freundlich, , and Radke-Prasnitz isotherm models were applied to experimental equilibrium data of TCP adsorption depending on temperature. The effect of contact time at different temperatures and initial concentration were fitted to pseudo-second-order kinetic model. Linear regressive method and nonlinear regressive method were used to obtain the relative parameters. The error analysis was conducted to find whether linear method or nonlinear method was better to predict the experimental results and which model was better to fit the experimental data. Both methods were suitable to obtain the parameters. The Langmuir-Freundlich equation was best to fit the equilibrium data. The pseudo-second-order kinetic model can be used to describe the adsorption behavior. The nonlinear method may be better with the absolute error as limited condition. The adsorption process was spontaneous and endothermic.

Keywords: *Montmorillonite, Acid, Adsorption isotherm, kinetic model, Regressive analysis, Error analysis, UV-visible Spectrophotometer*

Economical and ecological optimization of reverse osmosis seawater desalination for power producing industry

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Abstract

The reverse osmosis demineralization method is increasingly being applied for water treatment processes at nuclear and heating plans in recent years. Water treatment technologies in this case usually include one or two-stage reverse osmosis or combined technology utilizing reverse osmosis and ion exchange stage, which consists of cation exchange on strongly acidic cation exchange resin and anion exchange on strongly basic anion exchange resin. The choice of the technology for second stage strongly depends on the demineralised water salinity from previous stage. In both cases, the final treatment provides mixed-bad filtration or electrodeionization.

Preference for a particular technology is determined from the costs analysis, which includes dependence of the treatment price for treating 1m^3 of raw water, characterized by definite raw water Total Dissolved Solids (TDS), using different technologies and methods. It has been demonstrated by Dow Chemical Company specialists that using reverse osmosis at the second stage of demineralization process becomes economically preferable, comparing with ion exchange technology, at raw water TDS higher than 400 ppm for plant productivity 200 m^3/h (typical for water demineralization in heating and nuclear industries).

The present work attends to evaluate the possibility of increasing in economical and ecological efficiency of water demineralization process, applied for production of makeup water on power plants, by choosing optimal technology and membrane type considering permeate specifications.

Three types of waters are usually considered as feed water sources: law salty water – with TDS up to 1000 ppm (mostly from surface sources), brackish water – with TDS 1000-10 000 ppm and seawater – with TDS 10 000-45 000 ppm. For demineralization of the first two water types reverse osmosis membranes with 97-99% salt rejection and 7-40 bar boost pressure or nanofiltration membranes with 90% salt rejection and 3-15 bar boost pressure are traditionally applicable. For the last water type special membranes with 99.7-99.8% salt rejection and 55-70 bar boost pressure are convenient. Obviously, utilizing the last membrane type allows achieving higher demineralization degree, comparing with other membrane types, but at the same time, it needs maximum energy costs.

Recent investigations have shown feasibility and usefulness of all membrane types application in a wide range of feed water TDS. For instance, the economic feasibility of high-pressure reverse osmosis membranes application was demonstrated for demineralization of 6000-8000 ppm raw water up to 100 ppm permeate in one stage. At the same time, application of nanofiltration and low-pressure reverse osmosis membranes for demineralization of Baltic Sea water provides permeate with significantly lower cost than using high-pressure reverse osmosis technology.

In current work comparative calculations on the choice of optimal conditions for reducing Black Sea water mineralization from initial value 15 000 ppm to permeate TDS 50 ppm have been carried out. All calculations were performed using Reverse Osmosis System Analysis (ROSA) and Computer Assisted Design for Ion Exchange (CADIX) software, developed by Dow Chemical Company. The adequacy of the calculations was verified on a single desalination module pilot installation.

Different demineralization technologies have been considered as research objects: two-stage membrane-based flowsheets based on Filmtec pairs of elements NF-LE, BW-BW; one-stage

flowsheets based on Filmtec SW elements; hybrid flowsheets, which include reverse osmosis on first stage, based on Filmtec BW, LE, NF elements, and ion exchange on second stage – H-OH cycles with upflow regeneration.

Element types on each stage and demineralization method on second stage were considered as varied parameters.

All calculations were performed for productivity of 200 m^3/h by demineralized water.

An economic criterion for comparing was Main Operating Costs (MOC), which includes for reverse osmosis stage – specific energy costs and membrane elements costs, adjusted for total life cycle, for ion exchange stage – ion exchange materials costs, regeneration reagents price and energy costs. Volume and TDS of the waste waters were considered as ecologic criterion. The calculation results are presented in Table 1.

Table 1 - Economic and ecological rates of different water demineralization technologies

Technology description		MOC, $\$/m^3$	Demineralized water TDS, ppm	Waste water TDS, ppm	Waste waters, m^3/h
Stage I	Stage II				
One-stage technologies					
SW30XHR-400i		0,135	18,65	28967	200
SW30XLE-400i		0,106	52,11	28899	200
Two-stage technologies					
BW30LE-440	BW30-400	0,1	6,09	26881	233
NF90-400	LE-400	0,081	33,39	27202	285
NF270-400	LE-400	0,087	191,47	21930	285
BW30LE-440	Ion Exchange	0,119	50	32257	340
NF90-400	Ion Exchange	0,225	50	32642	390
NF270-400	Ion Exchange	0,857	50	26316	390

Performed calculations shown that two membrane technologies are optimal for demineralization of seawater with 15 000 ppm salinity to TDS level 50 ppm:

based on Filmtec BW30LE-440 and BW30-400 elements, which allows to obtain demineralized water with TDS 6.09 ppm at the main operation costs 0.1 $\$/m^3$ and waste water volume 233 m^3/h with TDS 26881 ppm;

based on Filmtec NF90-400 – LE-400 elements, which allows to obtain demineralized water with TDS 33.39 ppm at the main operation costs 0.081 $\$/m^3$ and waste water volume 285 m^3/h with TDS 27202 ppm.

The economic feasibility of the low-pressure membrane technology application have been shown in this work for seawater salinity 15000 ppm, which allows to reduce main operating costs of 5-40% comparing with high-pressure membrane technology and of 16-91% comparing with technologies utilizing ion exchange method. At the same time, application of low-pressure membranes is preferable from ecological point of view – mineralization and volume of wastewaters significantly decreases.

Effect of temperature and concentration principle on gypsum scaling in desalination units.

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Abstract

Tunisia (North Africa) is currently confronted to the crucial problem of the public, agricultural and industrial feed water supply, in particular in the center and south areas. Production of fresh water by seawater and brackish water desalination has proved to be an alternative for these regions. However, all the desalination processes are based on the concentration principle of waters already presented higher salinity. So, scale problem can occurs by the accumulation of minerals such as $CaCO_3$ and $CaSO_4$. These salts form hard and strongly adhering deposits on the surfaces and their formation is favoured by the decrease of their solubility with increasing temperature.

The main object of this investigation is the study and the control of calcium sulphate deposition causes and conditions in the thermal desalination plant. For this purpose, the effect of different water temperatures (30-90°C) and saturation states (3-10), on homogeneous nucleation and growth of gypsum, variety usually met, was examined. Gypsum was precipitated by mixing aqueous $CaCl_2$ and Na_2SO_4 solutions.

It was found that, with increasing temperature or supersaturation, the induction time decreases and the growth rate increases. At the same saturation state, the effect of temperature on reducing induction time is more significant for $T<50°C$ whereas the growth rate of gypsum crystals is more influenced when the temperature exceeds 50°C. This value can be considered as a critical temperature; once reached the gypsum scaling threat becomes serious. By using classical nucleation theory, the interfacial tension and the nucleation rate values were estimated. It was shown that the interfacial tension is, as well, temperature dependent.

The calculation of nucleation rate showed that: i) by increasing temperature, the number of formed nuclei does not change. The effect of this parameter is limited at the kinetic of formation and growth of these nuclei, ii) the water concentration principle influences, simultaneously, the number of gypsum nuclei and their rate of formation and growth.

Poly(vinylalcohol)/poly(ethyleneglycol)/poly(ethyleneimine) blend membranes – Structure and CO_2 facilitated transport

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Abstract

Poly(vinylalcohol) (PVA)/ poly(ethyleneimine) (PEI) / poly(ethyleneglycol) (PEG) blend membranes were prepared by solution casting followed by solvent evaporation. The effects of the blend polymer composition on the membrane structure and CO_2/N_2 permeation characteristics were investigated. IR spectroscopy evidenced strong hydrogen bonding interactions between amorphous PVA and PEI, and weaker interactions between PVA and PEG. DSC studies showed that PVA crystallization was partially inhibited by the interactions between amorphous PVA and PEI blend, in which PEG separated into nodules. The CO_2 permeability decreased with an increase in CO_2 partial pressure in feed gas, while the N_2 permeability remained constant. This result indicated that only CO_2 was transported by the facilitated transport mechanism. The CO_2 and N_2 permeabilities increased monotonically with the PEI content in the blend membranes, whereas the ideal selectivity of CO_2 to N_2 transport showed a maximum. When CO_2 is humidified, its permeability through the blend membranes is much higher than that of dry CO_2, but the change in permeability due to the presence of humidity is reversible.

Keywords: *Blend membranes, poly(ethyleneimine), CO_2/N_2 separation, ideal selectivity, facilitated transport.*

CMTDE_136

Removal of chromium from aqueous solutions by adsorption on activated alumina

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Abstract

The increasing contamination of urban and industrial wastewaters by toxic metal ions causes significant environmental pollution. All over the world, chromium is abundantly available in nature (rocks, soil, plants); it is present in aqueous solutions mainly in Cr III and Cr VI oxidation states which are commonly used in various industrial processes. Chromium especially in its VI oxidation state is considered as a very toxic ion; thus, its elimination from aqueous solutions should be considered an environmental primary target.

The removal of chromium VI from aqueous solutions by activated alumina has been investigated as a function of solution pH, initial chromium concentration, adsorbent dose of alumina and temperature. The pH and the adsorbent dose of activated alumina are the most significant parameter affecting chromium VI adsorption.

The Freundlich and Langmuir models have been applied and the equilibrium adsorption was found to best fit the Freundlich and Langmuir adsorption isotherm.

A comparison of kinetic models applied to the adsorption of chromium VI on activated alumina was evaluated for the pseudo first-order and the pseudo second-order models respectively. Results show that the pseudo second-order kinetic model was found to correlate the experimental data well.

Keywords*: Cr (VI), adsorption, activated alumina, Freundlich, Langmuir, kinetic models.*

Removal of nitrate by electrodialysis in the presence of acetate.

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Abstract

In order to remove nitrate selectively from different salt-loaded water, we have studied the electrodialysis of a solution containing nitrate and acetate ions through an original ion-exchange membrane. We have showed that NO_3^- was removed more effectively than CH_3COO^-.

We realized electrodialysis of synthetic solutions containing first of all a single kind of anion, the ion nitrate or the ion acetate, and in the second place the mixture of both kinds of ions and at the same concentration. The ion-exchange membrane (MEA) was obtained from the company ERAS Labo [1], designed initially for use in alkaline fuel cells. We wanted to test its behavior for electrodialysis. The results show that this MEA behaves practically in the same way towards both kinds of ions when the solution contains only a single kind of anion, the migration rate being linked to the value of the current. But once the anions are mixed, we noticed that the migration of the ion nitrate of the central compartment into the anodic compartment was much faster than that of the ion acetate. NO_3^- migrating easily while the CH_3COO^- stops practically migrating during 10 min approximately of time of electrodialysis. This demonstrates a selectivity of this kind of membrane towards the anion nitrate. The ion mobility, the hydrated ionic radii as well as the conductivity of the ionic solution may influence the transfer through the utilized membrane.

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CMTDE_138

Treated clay as adsorbent for the removal of Zn^{2+} ions from the aqueous system

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Abstract

The present study investigates the adsorptive interactions Zn^{2+} ions with treated clays in aqueous medium. In this work, it was aimed to quantify the effect of acid treatment clay on the removal of zinc. Mechanism of adsorption of Zn^{2+} ions onto natural and treated clay were investigated and discussed on the basis of the results: adsorption capacity and physical characteristics of clay using x-ray diffraction, infrared spectroscopy and surface area analysis. Equilibrium studies of adsorption of Zn^{2+} ions from aqueous solution onto clay showed good potentiality for acid treated clay to be used as adsorbent for removal of heavy metals ions from aqueous system.

Keywords: *Clay, Acid treatment, Characterization (FT-IR spectroscopy, BET, DRX), Zn^{2+}, Removal, Kinetics.*

CMTDE_139

Algerian montmorillonite clay as adsorbent for the removal of aniline from the aqueous system

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Abstract

This study concerns with the development of modified montmorillonite (MM) as adsorbents for water treatment. Aromatic amines such aniline and its derivatives compounds are potentially toxic in the environment. Their removal remains a difficult problem in treating water. The aim of this work was the use of exchanged montmorillonite (MM) clay with diethylamine (DEA), as a sorbent for purifying aniline contaminated water. Diethylamine was protonated in situ with HCl to obtain diethylammonium cations. The effect of the ratios amine / clay and HCl / amine on the adsorptive behaviour of aniline by exchanged montmorillonite clay was examined.

Keywords: *Montmorillonite, diethylammonium, removal, pollutant, aniline, water treatment.*

Elimination of Co cations from H_3PO_4

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Abstract

The program articulated around the experimental study of the effect of several parameters on the elimination of co-cations existing in the phosphoric acid by using different supports, and on the other hand to show the effect of several parameters on this keeping back such as: the effect of the time (kinetic) of contact, speed of excitement, initial concentration of the pollutant, Solid report / liquid, temperature, the isotherms. At selected best parameters for better one capacity we calculated the capacity of purification for the different supports, the sawdust and the waste of cereal. The kinetic study and the thermodynamics of the keeping back of existing pollutants in the phosphoric acid is still presented.

In this other hand a numerical study of the adsorption phenomenon of these metals is presented. The governing equations for the adsorption phenomenon are discretisized by finite differences method using the explicit scheme where the conditions of stability are checked and solved by Gauss Seidel method using the language programation FORTRAN.

A computing code was developed to determine all the structures of diffusion of heavy metals solutions into the pores of adsorption particles.

In order to examine the code reliability, the obtained results were compared to the values reported in the literature and a maximum deviation of 1.49 per cent was shown.

The application of the program code for the case of the adsorption of copper, cadmium and zinc onto the two supports and using our experimental data enables the calculation of the superficial intraparticule diffusion coefficient Ds, as well as the mass transfer coefficient K_f.

Keywords: *purification of H_3PO_4; adsorption; kinetics, Exchange of ions, Superficial Diffusion; Mass transfer coefficient; Adsorption; Cations*

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CMTDE_141

Evaporation of binary liquid film by forced convection into humid air and superheated steam

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Abstract

This paper deals with a numerical analysis of the evaporation of binary liquid mixture by forced convection inside a channel constituted by two plates. The first plate is externally insulated and wetted by an extremely thin water ethylene glycol film while the second one is dry and isothermal. First, the effects of inlet ambiance conditions and the liquid concentration of ethylene glycol on the distribution of the velocity, temperature, concentrations profiles and the axial variation of the evaporation rate are analyzed. The second part concerns the inversion temperature point of the evaporation of binary liquid mixture. Results show that the inversion temperature exists in an interval of the liquid concentration of ethylene glycol and it was found that the liquid concentration of ethylene glycol increases with the inversion temperature increases. Therefore, outside this interval, the inversion temperature doesn't exist.

Keywords : *Binary liquid film; evaporation; inversion temperature; forced convection; combined heat and mass transfer*

CMTDE_142

The effect of Fe(II) AND Fe(III) on calcium carbonate scale crystallization

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Abstract

Scale formation is a serious problem encountered in many industrial plants including natural water desalination units. Scales are mainly formed by calcium carbonate [1]. In some ground waters, the presence of some species such as Mg^{2+}, SO_4^{2-} and Fe^{2+} influence significantly the $CaCO_3$ precipitation. In the present work, the effects of Fe^{2+} and Fe^{3+} on the kinetic precipitation and the microstructure of $CaCO_3$ were investigated. The calcium carbonate was precipitated by using the degassing CO_2 method. This technique is based on the elimination of the dissolved carbonic gas CO_2 in solution by air or N_2 bubbling according
to the following precipitation reaction of calcium carbonate:

$$Ca^{2} \quad 2HCO_3 \quad CaCO_3(s) \quad CO_2 \quad H_2O$$

In ground Water, iron usually occurs in its ferrous state (Fe^{2+}), but once exposed to air, it will be oxidized to Fe^{3+}. The effect of iron (II) on the carbonate calcium precipitation was been reported under an azote bubbling condition.

The experimental procedure used in this work allowed us to study the effect of Fe(II) and Fe(III) on the $CaCO_3$ precipitation. It was shown that the iron ions with these different degrees of oxidation (II or III) improved the kinetic precipitation of calcium carbonate. XRD analysis shows that the presence of iron (II) favoured the formation of aragonite instead of vaterite phase. The microscopic observation by SEM showed that the presence of the iron (II) in the solution affects the morphology and the size of the carbonate calcium precipitate.

Keywords: *Scale, calcium carbonate, precipitation, Fe(II), Fe(III).*

Batch study of liquid-phase adsorption of Crystal Violet using *Posidonia oceanica* L. fibers

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Abstract

This paper presents a study on the batch adsorption of crystal violet dye from aqueous solution onto *Posidonia oceanica* L. fibers in order to explore their potential use as low cost adsorbents for wastewater dye removal. A series of batch tests were conducted and the influence of contact time, initial dye concentration, pH of the solution and adsorbent dosage on crystal violet removal was investigated. FT-IR spectroscopy analysis of the *Posidonia oceanica* L. fibers before and after dye sorption was also investigated to confirm the mechanism of the removal of crystal violet. Results indicate that crystal violet uptake increased with increased initial dye concentration and decreased with increased pH values. The results showed that the highest dye adsorption capacity (11.75 mg/g) was found at pH = 6, for an adsorbent dosage of 5 g/L, initial dye concentration of 60 mg/L, under a constant temperature of 23 ± 02°C, and the equilibrium state was reached within 10 min of exposure time. The relatively low cost and high capabilities of *Posidonia oceanica* L. fibers make them potentially attractive options for dye removal from dilute industrial effluents.

Key-words *: Sorption; Crystal violet; Batch tests; Posidonia oceanica L. fibers; Adsorption capacity.*

Composition of brine discharge from tunisian desalination plants

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Abstract

Use of unconventional water resources such as desalination is becoming inevitable sources to alleviate water scarcity in the world.

Desalination of brackish water is one of the non conventional water resources that the Tunisian government developed in order to enhance the quality of water distributed in the south.

Despite the many benefits desalination technology has to offer a list of potential environmental like the emissions of air pollutant, the energy demand, land use but the main impact of desalination plant is caused by the discharge of an effluent of very high salinity. The constant discharge of reject streams with high salinity and temperature can be fatal for marine life.

The purpose of this study is to evaluate the chemical composition of reject brine from Gabès desalination plant and Jerba desalination plant. Both desalination plants are planted to securing the fresh water supply for consumer consumption to the respectively government Gabés and Jerba when the level of salinity is exceeded 3g /l.

The average capacity of these plants varied between 25000m3 /d and 30 000m ^{3}/d.

Water samples were collected from several locations at reject site of both desalination plant Jerba and Gabès. All samples have been analysed for major, nutritive and minor constituents

The analyses reveal a difference between the compositions of brine of the both stations,

The comparison between quality of the effluent discharged and Tunisian norms of reject in hydraulic areas (NT 106 002) showed that the concentration of calcium, chlorides sodium sulphates are higher than the allowable limits the norms.

***Keywords**: Desalination plant, brine discharge, site of reject*

Efficacité du traitement biologique pour réduire les substances nutritives issues d'une laiterie.

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Résumé

L'industrie agroalimentaire consomme une quantité considérable des ressources hydriques. Ce domaine d'activité génère des quantités importantes d'eaux usées. Le plus souvent ces eaux usées rejetées dans les milieux naturels (lac, mer, oued) ne sont ni traitées ni valorisées ce qui constitue d'une part un facteur de pollution considérable pour les milieux récepteurs et d'autre part il contribue de façon considérable à la limitation des ressources hydriques.

Le procédé le plus adapté pour éliminer la pollution organique et physico-chimique issue de l'industrie agroalimentaire est d'appliquer un traitement biologique par voie aérobie ou anaérobie. Notre travail a pour objectif d'analyser et à traiter une eau usée provenant d'une laiterie. La laiterie produit du lait et du fromage camembert. Cet effluent est déversé dans un oued sans aucun traitement préalable.

La caractérisation de l'effluent a porté sur l'évaluation quantitative et qualitative de la charge polluante. Les résultats d'analyse ont montré que la teneur des paramètres physico-chimiques de pollution dépassait largement les normes de rejet. Les différents paramètres de pollution ont été analysés par spectrophotométrie UV. Visible.

L'application d'un traitement biologique à l'effluent de la laiterie a pu être réalisée au moyen de pilotes. Le pilote est composé de quatre digesteurs travaillant en milieu anaérobie et en culture libre. L'influence de la température, de l'agitation et du pH a été étudiée. Le suivi de l'évolution des ions PO_4^{3-}, NH_4^+ et NO_3^- avec l'optimisation des conditions physico-chimiques (pH, température, agitation) durant le traitement ont montré une importante dégradation de la matière organique et les ions PO_4^{3-}, NH_4^+ et NO_3^- ont atteint des rendements d'élimination de l'ordre de 98, 85 et 70%.

Mots clés *: Eau usée, pollution, laiterie, substances nutritives, traitement biologique.*

Surface modification of Nanofiltration and Ultrafiltration commercial membranes by adsorption of polyelectrolyte multilayers: Surface characterization and desalination performances.

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Abstract

Recent developments in membrane technology are made essentially in the field of surface modification in order to tune selectivity and to decrease fouling. In the present study, we investigate the surface modification and the characterization of two thin film composite membranes made of polyamide.

The selected membranes belong to Nanofiltration with opened pores (GH) and to Ultrafiltration with tight pores (GM). The surface modification of both membranes was made chemically in the first step by grafting acrylic acid and physically in the second step by alternating adsorption of oppositely charged polyelectrolytes.

The active surfaces of the bare commercial membranes and of the modified ones were morphologically characterized by atomic force microscopy; and by FTIR-ATR.

Desalination performances of these membranes were determined with synthetic salt solutions with different ion valences before and after surface modification. Hydraulic permeability of NF membranes dropped for all salt solutions. Retention rate of salt solutions containing divalent cations is reduced while those containing divalent anions and monovalent ions have seen their retention rate increased.

With UF membranes, hydraulic permeability is increased globally. Retention of salt solutions containing divalent anions is improved whereas retention of salts with divalent cations and monovalent ions is decreased.

Keywords: *Thin film composite membranes, surface modification, layer by layer, polyelectrolyte and desalination.*

Effect of salt on the interactions between biopolymer and surfactant using response surface method

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Abstract

The effect of salt on the biopolymers and Surfactants nature's interactions has very broad ranges of applications. Their combined occurrence is found in diverse formulated products such as wastewater treatment, food, drugs (pharmaceuticals), cosmetics, paints, detergents, pesticides and also in processes such as polymer synthesis, and enhanced oil recovery (EOR).

This work was devoted to the study of the interactions between systems containing a biopolymer (the Xanthan gum) which used in agro alimentary and pharmaceutical industry and two surfactants of opposite charges (SDS and CTAB) and the effect of sodium chloride (NaCl) on the physic-chemical and rheological properties of these systems.

To this end, the method of experiments planning was adopted and a comparative study of two systems containing each type of surfactant was investigated. The results show an important effect on surface tension, interfacial tension and rheological properties; they also indicate that the synergetic action of the surfactants (SDS, CTAB) and biopolymer greatly influences these physicochemical properties.

Keyswords: *interaction, polymer, surfactant, experiments planning*

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Soil Biological Characteristics Under Long-Term Wastewater Irrigation In North-eastern Tunisia

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Abstract

In this study, sites irrigated with treated wastewater for 15, 13, 09, 07, 02, 01 years and site non-irrigated taken as control were sampled for soil analysis. The objective of this work is to study the long-term effects of treated wastewater irrigation on the soil microbial activity, on the density of microbial soil communities and on the organic matter mineralization. Results showed that, soil pH were not consistently affected. Soil salinity, measured as electrical conductivity (EC), appeared significantly high and proportional to the duration of wastewater irrigation. Also, concentrations of total Ni, Zn, Cu, Pb, Cd and Fe increased appreciably according to the number of irrigation years ($P \leq 0.05$), but are usually under standards. Quantitative modifications in microbial communities were evaluated by the characterization of DNA directly extracted from the soil, using. Statistical analysis of soil DNA for soil horizons 0-20, 20-40 and 40-60 cm show that, totally there is more DNA in the field irrigated with wastewater for fifteen years. The increase of the soil DNA is probably related to the soil organic matter content. On the whole, results indicate that nutrient, microorganisms and organique matter from treated wastewater were beneficial to microbial respiration.

It can be concluded, based on these results that proper management of wastewater irrigation and periodic monitoring of soil fertility and quality parameters are required to ensure successful, safe and long term reuse of wastewater irrigation.

Key words : *treated wastewater; irrigation; soil microbial activity; soil microbial DNA; organic matter mineralization.*

CMTDE_149

Control of the residual aluminum in drinking water by optimization of the coagulation process

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Abstract

Coagulation-Floculation is an unavoidable stage in water treatment. It permits to reduce the color and the turbidity, normally caused by the organic and inorganic contaminants to acceptable levels for drinking water or for wastewater. The used coagulants can be organic or inorganic nature.

The main goal of this work is to make the follow-up of water quality parameters and the optimization of the clarification stages in the drinking waters treatment station, by determination of the break point in the stage of the prechloration and optimization of the coagulant (aluminum sulphate) proportion.

The determination of the anions concentration by means of the ionic chromatography before and after coagulation-flocculation shows that the stability and the solubility of the aluminum species are strongly affected by the presence of these anions. Consequently, the content of the anions affects the process of coagulation and must be taken into account in the optimization of this process.

We present in this communication, the results of the pH, concentration of the coagulant, time of coagulation effect on the coagulation process .These factors show optimum values.

The research of residual aluminum in the two water studied during this work shows that the aluminum content is lower than 200 µg/L at the pH optimum (Table1).

In fact the optimization of coagulation –flocculation for two raw waters (CANAL Madjerda and Oued Ellil) shows that the best results in terms of turbidity and quantity of residual organic matter are obtained under the following optimal conditions :

Water	**pH**	**[$Al_2(SO_4)_3,18H_2O$] coagulant (mg/L)**	**Time of coagulation (mn)**	**Concentration of polyelectrolyte Floculant (mg/L)**
Canal Madjerda	6	40	40	0,06
Oued ellil	7	85	40	0,06

Table (1): Results of the coagulation stage optimization in the treatment of some Tunisian waters

Keywords: *clarification, coagulation-flocculation, aluminum sulphate (coagulant), ionic chromatography.*

CMTDE_150

Electrochemical process for the treatment of water contaminated with organophosphorus pesticides

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Abstract

The aim of this work is the use of electrochemical process for the total mineralization of water contaminated with organophosphorus pesticides like chlorpyrifos. This pesticide is widely used both for agricultural pest control and in households as a termiticide. The process was studied under galvanostatic polarization mode using Ta/PbO_2 anodes and graphite carbon bar as cathode. The kinetic of organic matter decay and the mineralization efficiency were evaluated by means of the chemical oxygen demand (COD) measurement. The influence of the experimental parameters such as the initial concentration of chlorpyrifos, temperature, and current density, on the electrochemical process performance was investigated. The experimental results showed that COD removal always follows a pseudo-first-order kinetics. The degradation rate *increased* drastically with *increasing current density* and temperature. However, it decreased with the increase of the initial pollutant concentrations. Very high organic matter *degradation, approximately* 90% in 10 h experiments, was obtained.

Caractérisation physico-chimique des boues résiduaires de la tannerie de Jijel

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Résumé

Le traitement des eaux, qu'il s'agit de production d'eau potable ou d'épuration d'eau usée d'origine urbaine ou industrielle, conduit toujours à la formation de boues que l'on sépare de l'eau traitée. Ces boues se présentent à la sortie de la station comme un liquide à forte teneur en eau mais d'aspect souvent peu agréable. La teneur élevée en substances polluantes interdit le plus souvent leur rejet dans le milieu naturel sans précaution. A cet effet, nous nous sommes intéressés à la caractérisation physico-chimique des boues résiduaires de la tannerie de Jijel (située au nord-est de l'Algérie). L'estimation de la qualité de ces boues a pour but de :

Connaître la teneur des différents types de polluants présents dans la boue et estimer les risques de pollution.

Connaître leurs possibilités de réutilisation agricole.

Dix compagnes de prélèvements ont été effectuées. L'analyse a été faite pour les boues fraîches récupérées aussitôt leur production et les boues stockées au niveau de la décharge de la station. Les analyses physiques nous ont permis de déterminer la siccité des boues, le taux du résidu sec et le taux des matières volatiles. Par ailleurs, plusieurs paramètres chimiques ont été étudiés à savoir : l'acidité, les matières organiques, les composés azotés, les phosphates, le calcium, ainsi que les éléments traces
(Cr, Cd, Pb, Zn, Cu et Fe)

Mots clés : *boues résiduaires, tannerie, pollution, valorisation agricole.*

RBCOD estimates in ASM1 modelling : divergence between respirometry and physico-chemical methods

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Introduction : Several COD fractionation methods are proposed in the literature for wastewater (WW) characterization in the context of activated sludge modeling (Mamais et al., 1993; Henze et al., 2002; Roeleveld and van Loosdrecht, 2002; WERF, 2003). One of the main differences between the various fractionation approaches is the way by which the readily biodegradable fraction (S_S or rbCOD) is determined, either by respirometry (S_S- respiro) or by physico-chemical tests (Ss-phys). When modeling a WWTP, it is expected that the model outputs behave insensitive to the variations in fractionation in the different methods. Respirometry is considered as the reference method (conceptually), but the physicochemical options are faster and easier than the biological tests. However, there has not been sufficient rigorous and wide comparison about the equivalency of the methods (WERF, 2003), in particular outside typical European or US municipal WW. The main goal of this study was to investigate the performance and significance of accepted characterization protocols, considering representative wastewaters in the context of tropical and developing countries, with emphasis on Mexico.

Methods: The work was performed at a major WWTP plant in Mexico ($5m^3/s$ influent flow), which name is “Dulces-Nombres, D-N”. The parallel reactors (R1 to R5, 20000 m^3 each) of the activated sludge plant were operated in plug flow mode (4 compartments A to D, for each). A sampling and measurement campaign was undertaken (24h-composites, 7 days). Different physico-chemical procedures (filtration at 0.1, 0.45 and 1.2 μm, flocculation- filtration, ff), biotests (respirometry, BOD kinetics, batch tests) and detailed chemical analysis were performed, to characterize the influent, effluent and sludge. Also, the in-tank profiles (OUR, D.O and soluble COD) were measured. The specific methods used to characterize the wastewater were chosen such as to fulfill the data requirements for the STOWA protocol (Roeleveld and van Loosdrecht, 2002), as well as producing the information needed by other fractionation methods (WERF, 2003). The “Influent advisor” module of GPS- X (Hydromantis, 2003) was used conjunctly with the characterization by 0.45-μm filtration. The respirometric tests were performed following low-F/M test procedures (Vanrolleghem et al., 1999).

Results

Characteristics of the wastewaters. Based on the aggregate parameters, the characteristics of the raw influent (940 mg/L COD, 143 mg/L ISS, 65mg/L TKN, 36 mg/L $NH4^+$ and 17 mg/L P) were near, or much higher, than the upper limits of typical municipal wastewater depicted by WERF, 2003 (700 mg/L COD, 45 mg/L ISS, 70 mg/L TKN, 30 mg/L NH_4, 15 mg/L P) or by the ASM report (Henze et al, 2002). Table 1 shows some of the characteristics of the settled influent. Many of the calculated ratios were inside the published ranges, but near to the borderlines of the reported intervals (WERF, 2003; Envirosim 2006) for typical US municipal WW: *ivt* (0.77, compared with typical US-range of 0.75-0.83), and *frNH* (0.77 in the WW, against 0.65-0.75). Some others ratios were clearly outside the US standard ranges: high *icv* (2.48, in

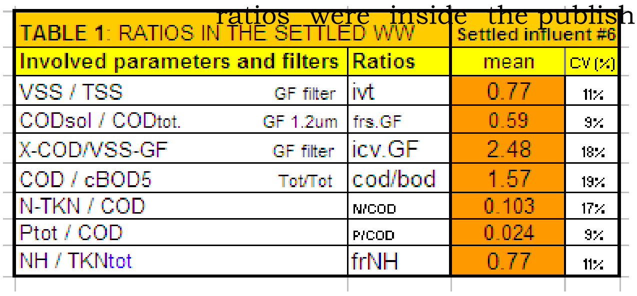


TABLE 1: RATIOS IN THE SETTLED WW			Settled influent #6	
Involved parameters and filters		Ratios	mean	CV (%)
VSS / TSS	GF filter	ivt	0.77	11%
CODsol / CODtot.	GF 1.2um	frs.GF	0.59	9%
X-COD/VSS-GF	GF filter	icv.GF	2.48	18%
COD / cBOD5	Tot/Tot	cod/bod	1.57	19%
N-TKN / COD		N/COD	0.103	17%
Ptot / COD		P/COD	0.024	9%
NH / TKNtot		frNH	0.77	11%

comparison with the typical range of 1.9 to 2.1) and low *COD/BOD* ratio (1.6, more biodegradable, less than the 1.9-2.0 normal U.S. range). This was anticipating an unusually low fraction of inert particles (low X_I and high X_S).
The proportion of NH4 in the TKN (0.77) and the 59% soluble COD were not too different from the typical values, which supports that the WW was not more hydrolyzed than normal, as it would be expected under higher temperatures. The tropical conditions were maybe not a main factor for WW differences. On the contrary, the N/COD ratio in the raw influent (not shown) was relatively low (0.07, against 0.10 typically), indicating a significant contribution of industrial wastewaters. 20 % of the influent at the WWTP is supposed to be from the industries. Monterrey is a major industrial center (> 10000 units, INEGI, 2006), being food products (23%) and steel-machinery & metal parts (24%), the dominants sectors. The bakeries and tortilla manufactures (1798 in total) lead the alimentary sector (2440), followed by dairy and ice cream processing (470). This was coherent with the COD levels, biodegradability index and colloidal fraction found in the WW, which were all higher. Also, emulsified or colloidal particles of fats (icv of 3.4) and oil & grease may have been increasing the overall icv (COD/VSS) of the WW. These are too small to be removed by gravity flotation in the clarifiers. Fats and oil & grease are typical pollutants of the food and metal sectors.

Filter pore-size effects and estimates of the rbCOD. Figure 1 is comparing the COD of the filtrates produced by 4 different kinds of filters or treatment. The difference that exists between the CODs was significant in the case of the influent (Fig.1), but insignificant in the case of the effluent (not shown). Flocculation (ff) was the physico-chemical treatment that produced the lowest COD, 80 mg/L or 30% less than the GF-filtrates (1.2 μm).

Figure 1: COD of the filtrates (settled influent)

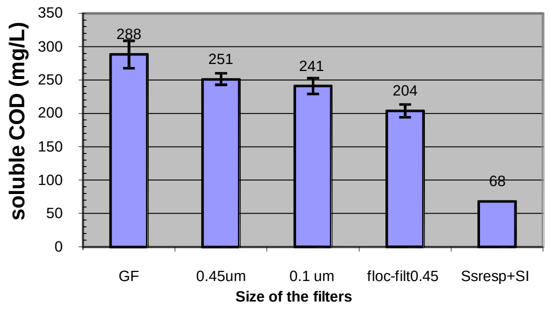


Table 2: Estimates of S_S by different protocols

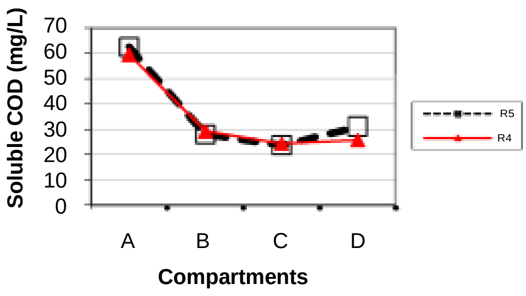
Protocols	**STOWA**	**Influent advisor**	**WERF (2003)**	**Respiro-metry**
Filter-size used	0.1 μm	0.45 μm	ff-.45μm	-
S_S (mg/L) ± StdDev	207 ±12	217 ±9	170 ±9	34 ±4
S_S (%)	42 %	44 %	34 %	7 %

The difference between the 0.45 and 0.1 μm filters was minimal. Also, not any of the “soluble CODs” was matching the sum S_I + S_S, where S_S is by respirometry. The inert soluble COD concentration was estimated from the effluent, being $S_I = 34$ mg/L. Table 2 exhibits the S_S concentrations in the settled influent, as estimated from different procedures ($S_S = COD_{sol} - S_I$). The rbCOD fraction accounted for 7%, 34% or 42-44 % of the total COD, depending on the protocol that is followed. The S_S fractions from the physicochemical methods (S_S-phys) were 5 to 6 times higher than from the biological test (S_S-respiro). Also, a real difference existed within the different physicochemical protocols, which is a direct consequence of the effect of the filters. In the past, it happened that the physico-chemically defined rbCOD (S_S-phys) and the respirometric-S_S (S_S-respiro) gave different values (Gokcay and Sin, 2004; WERF, 2003; Petersen et al., 2002). However, the differences never were as high as it happened in the present study (D-N WWTP). Apparently, the main factors were the quantity and nature of the industrial WWs. Colloidal or emulsified fats and oil & grease can pass a filter, but are not rapidly biodegradable.

Fate of the organic carbon and nature of Ss-phys: Figure 2 represents the average soluble-COD profiles in R4 and R5. In the first compartment there is still a significant amount of soluble COD measurable. In the 2-4th compartment the soluble COD is equal to the effluent value. This was in accordance with the trends shown by the OUR and D.O. profiles in the tanks (data not shown), which allowed also to discriminate between the oxygen dynamics associated with the organic carbon and ammonia oxidation. ASM1 does not include any process to explain the fast removal of the balance between S_S-phys and S_S-respiro. The difference is though to be formed by colloids (fats and oil & grease), immediately removed by enmeshment and/or by adsorption on the biomass (Petersen et al. 2002, WERF 2003, Lagarde et al. 2005, EnviroSim 2006). Alternatively, the residual COD may be soluble starch-like components, also known to accumulate fast in the sludge flocs (Karahan et al., 2006).

Modeling aspects: When S_S-phys is too high compared with S_S-respiro, and when both are subject to a fast removal process, the current practice of replacing S_S-respiro by S_S-phys in the simulators may have some limitations and consequences: a) the OUR measured in cell A must not be used for calibration, otherwise it might result a wrongly calibrated model and parameters; b) the sense and the default values given to many parameters like µHmax, as well as their principles of determination (failed high-F/M respirometric tests) need to be reevaluated; c) the assessment of the relationship between S_S-phys and S_S-respiro is not only a characterization issue, it is also a relevant task with respect to the fundaments of the models and some of the calibration strategies.

Figure 2: COD profiles along the reators



Conclusion

-The research shows that a marked difference may exist, still in municipal wastewaters, between the estimates of the rbCOD fractions measured by respirometry and by physico-chemical methods.-The evaluated WW showed a rather large fraction of COD that is not filtered off (soluble) and which is quickly removed from the bulk liquid, by enmeshment or adsorption in the sludge, without respiration. -Instead of the tropical context, the behavior shown by this WW, very representative of big cities of Mexico, was attributed to the industrial environment. Standardization of the ASM1 calibration procedures will need fundamental insight in the differences between the characterization procedures and the kinds of municipal WWs.

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The study of zinc elimination with dehpa-tbp in mediums sulphated and chlorinated by liquid-liquid extraction

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Abstract

In the aim to contributing to the control of pollution by heavy metals, we proposed to apply the process of extraction liquid-liquid to elimination zinc in mediums sulphated and chlorinated by the DEHPA (acid di (2-éthylhexyl) phosphoric), then by the TBP (tributhyl phosphorus), and in end the synergy of both extractants was studied, n-heptan is used like thinner.

The research of the optimum conditions for extraction of zinc was studied, it acts of the type of extractant, pH, medium and concentration of the extractants.

The results show that for the two mediums, the extraction is better when one uses the DEHPA with more than 5% and one aqueous solution of neutral pH. The outputs of elimination exceed 90%. The synergy effect of both extractants on the output of elimination is without notable effect.

Finally for a proposal for a diagram of process, the desextraction was carried out. The yield obtained is encouraging, it exceeds 90% some is the medium.

CMTDE_154

Electrochemical degradation of some herbicides in aqueous solution on boron doped diamond anodes

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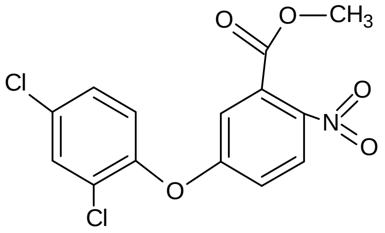
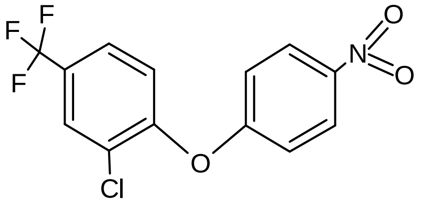
Abstract

Bifenox(a) and acifluorfen(b), respectively (Methyl 5-(2,4-dichlorophenoxy)-2-nitrobenzoate and 5-(2-Chloro-4-trifluoromethylphenoxy)-2-nitrobenzoic acid, are two highly toxic herbicides of the diphenyl ether class. They are widely used in agriculture.

Their electrochemical oxidation behaviour is studied by cyclic voltammetry in various media with different electrodes. When galvanostatic electrolysis is realized on Boron Doped Diamond electrode (BDD) we observe that the studied contaminants undergo an almost complete degradation due to hydroxy radical action as commonly suggested. The rate of the mineralization is followed by spectrophotometric analysis and COD measurements. The optimization of this advanced oxidation process is studied as a function of the current density. It shows that the best results are obtained with low current densities. The obtained COD abatement values are superior to 90 %.



Bifenox (a)



Acifluorfen (b)

Keywords *: Electrochemical oxidation, herbicides, boron-doped diamond, current density.*

Study of a solar desalination unit using humidification and condensation process

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Abstract

Water will be during the next decades a rare commodity, according to the last statistics and foresight of UNO, five billion people will need access to healthy water, why, a solution will be more and more adopted which is the desalination of sea water.

Other share it became clear that fissile energies are not infinites and that their combustion with forced marches generates more insurmountable problems and increasingly serious. For that desalination via the traditional modes poses more problems than they have solved.

This is why nowadays we use and we exploit more and more the renewable energies, in particular the solar energy, for the processes of desalination.

Our solar desalination plant of sea water use the H-D mode (humidification-dehumidification) has the peculiarity of connecting two different circuits of desalination which have only one common element, the condenser.

A first circuit is composed of a water solar collector's battery, a pump, a ventilator and a humidifier.

A second circuit is composed of a water solar collector's battery, two stages of air solar collectors, two humidifiers, two pumps and a ventilator.

Our installation contains in particular measuring and regulation instruments, like valves and flow and speed regulators, as well as probe of measurements

Keywords: *desalination, solar energy, humidification, dehumidification, condenser.*

Synthesis of a composite material and its application for the treatment of effluents charged by copper and lead

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Abstract

The intensive use of chemicals and accidental spills of those pollutants is detrimental to environment. Toxic metals are generally difficult to be eliminated by natural processes. They are very mobile in the diverse compartments of the environment and easily adsorbed by organisms.

Several techniques are currently used for the treatment of contaminated wastewater. Among those methods: precipitation, electrochemistry, filtration and adsorption.

In this study we demonstrate the feasibility of treatment of synthetic contaminated water using a composite material taking advantage from the combination of the large specific surface of activated carbon with the adsorption properties of a natural polymer, sodium alginate, a non toxic, biodegradable and biocompatible powder. Alginate is extracted from brown seaweed named *Laminaria digitata*. It's formed by the association of linear anionic copolymers forming long molecule.

The use of natural supports like sodium alginate associated to activated carbon, to improve the mechanical properties of the polymer, for the adsorption of toxic metals (copper and lead) has been successfully studied in the treatment of an artificially contaminated aqueous solution.

Activated carbon is known to be an efficient adsorbent and is largely used to eliminate organic species. Its use is, however, limited for inorganic contaminant treatment. One elegant way to substantially improve retentive properties of the latter is its encapsulation in alginate matrix.

In this work, the influence of several parameters such as ionic strength, pH, were explored and optimized in order to improve removal power of the composite.

CMTDE_157

Electroextraction of heavy metals by electrodialysis: a case study of Co and Cd

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Abstract

The subject of this study is to find the efficient heavy metals recovery from industrial effluents in synthetic solutions of a soluble cadmium and copper in presence of EDTA as a complexing agent. This work is achieved by the electrodialysis technique under several and various conditions such as: current density, concentrations of solutions, flow rates, pH solutions, etc. Under the optimal conditions, the demineralisation by the ED with this complexant agent is achieved with high performance. In all cases the recovered metals can be, in some cases, recycled and directly reused by manufacturers.

Keywords: *effluent, EDTA, heavy metals, recovery, cadmium, copper, demineralisation, electrodialysis, recycling.*

CMTDE_158

Numerical study of the evaporation of a film falling on the internal wall from a vertical annular space

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Abstract

The processes of desalination seem to be the best solution of the shortage pronounced out of drinking water. Having recourse to the exploitation of solar energy to evaporate salt water, the evaporation of thin films aroused the interest of several researchers.

Within this context, our work concerns the numerical study of evaporation, in forced convection, of a liquid film falling on internal surface from a vertical annular space. This wall is subjected to a heat flux density (r=R1) whereas the second tube is considered adiabatic and dry (r=R2). Space has as a height L. the water film is in direct contact with a flow of ascending air.

The discretization of the equations governing the phenomenon of evaporation is made with the finite volume method.

To highlight the efficiency of this evaporator, a parametric study is undertaken. In fact, the results treating the influence of various operational parameters on the efficiency of evaporation was studied like the heat flux density, the velocity and the temperature of the flow of air at the entry and the report of the rays.

Use of organomineral complex (OMC) for bioremediation of pentachlorophenol (PCP) in forest soil

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Abstract

Adsorption/desorption characteristics for the organic pollutant pentachlorophenol (PCP) were determined for the organomineral complex (OMC) prepared in the laboratory with clay mineral (zeolite) and organic matter (humic acids), both natural products with excellent sorption properties.Experiments were carried out in two characterized soil samples, Calcarosol and Fluvisol. The results of this study indicate that OMC has better retention abilities than the clay minerals alone. Higher amounts of humic acids (HAs), bound to zeolite, enhance its potential to adsorb and retain PCP.

Keywords: *Bioremediation ; Humic acids ; Organomineral complex ; Pentachlorophenol ; PCP ; Sorption.*

CMTDE_160

Caractérisation de la variabilité de la décantation dans les stations d'épurations

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Résumé

Les procédés de traitement biologique des eaux usées à boues activées sont des procédés dynamiques complexes difficiles à gérer. L'aptitude des boues à la décantation est un paramètre essentiel pour l'efficacité globale du procédé de dépollution et pour la préservation de la qualité du milieu récepteur. Ainsi pour une meilleure gestion des stations d'épuration, une étude d'interactions entre le couple réacteur décanteur est nécessaire. Une nouvelle technique de gestion doit prévenir l'exploitant aux problèmes liés à la décantabilité de boues essentiellement à la perte du voile de boue qui aura des effets néfastes sur l'environnement.

L'approche largement adoptée est une approche appliquée et le but est de déterminer quels sont les facteurs qui peuvent expliquer les phénomènes observés pour en tirer des stratégies qui pourraient permettre d'améliorer la décantation des boues au stade industriel. L'approche largement utilisée se base sur la mesure d'indice de Mohlman et donne une simple impression sur l'aptitude de boue à la décantation mais ne prévient pas l'exploitant aux anomalies qui aurons lieux au niveau du décanteur. La modélisation en dynamique du décanteur secondaire est un moyen plus sophistiquée qui tient compte des effets des paramètres d'exploitation et la variabilité de la qualité des effluents en dynamique. Des essais de décantation en batch ont été réalisés sur deux stations 'épurations. Les deux stations sont de type chenaux d'oxydations à boues activées et ayant une faible charge. La première station est située en Tunisie et la seconde station est située à Grenoble (France). La différence réside aux niveaux de l'indice de boues. Des tests en batch ont été menés pour l'identification des paramètres de la vitesse de décantation dans les deux STEP. En parallèle des ces essais de décantation en batch, des mesures in situ ont été effectuées afin de diagnostiquer l'état de fonctionnement des stations et par la suite relier la vitesse de décantation à certains paramètres d'exploitations. Les essais de décantation sont menés sur la liqueur mixte extraite des chenaux d'oxydation.

Les résultats ont montrées que les paramètres de la vitesse de décantation sont liés à la qualité de la boue. Les valeurs moyennes de la vitesse initiale de décantation et de la constante de décantation en masse pour la station d'épuration Tunisienne sont respectivement de 10.2 m3/h et 0.3 L/g. Les valeurs moyennes de la vitesse initiale de décantation et de la constante de décantation en masse pour la STEP de Grenoble sont respectivement de 15,03 m3/h et 1,32 L/g. Ces valeurs sont du même ordre de grandeur que celle citées dans la littérature (Sperling et Froes (1997)) pour des stations d'épuration ayant des indices de boues variables.

CMTDE_161

Ametryn removal with nanofiltration membranes

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Abstract

The wide use of herbicides is indispensable in the agriculture sector to control crop losses, at the same time it causes some environmental problem, i.e. pollution of water sources. A study on the application of nanofiltration membrane in the removal of one kind of herbicide, ametryn, in aqueous solution was carried out in order to evaluate the performances of membrane separation. Ametryn was spiked to the different water matrices feed to a cross-flow nanofiltration pilot-plant. The rejection of ametryn was improved with the presents of both inorganic and organic mater in synthetic water compared with spiked in reference distilled water. The rejection of ametryn was higher in tap water than in distilled water, whereas, the water flux was lower. This may be due to that the NOM in tap water enhanced the size exclusion and charge repulsion of NOM-ametryn complex; meanwhile, both the NOM and NOM-ametryn complex fouled the membranes in tap water.

Keywords *: water treatment; nanofiltration; herbicide; ametryn*

CMTDE_162

Solvent Extraction of Phenol from Aqueous Solutions Using Tributyl phosphate as Extractant

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Abstract

In this work, the liquid - liquid extraction was used. This technique standard of the chemical industry which based on the transfer of mass between two not or partially miscible liquids : a contaminated aqueous phase and an organic phase called solvent which is selected according to its affinity and its selectivity for the elements to extract.

In practice, it is difficult to establish a model of knowledge for the prediction of the parameters influencing the output of extraction. To extract the maximum of information from the results obtained, we then propose to model the output of extraction by a new method of the recent models the basic function radial (RBF).

Keyword: *Extraction efficiency, Liquid-liquid extraction, phenol, tributyl phosphate*

CMTDE_163

Membrane Distillation for a solar powered desalination pilot unit

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Abstract

Saline water desalination is a very interesting non-conventional water source both for large use and for small rural communities. In this case attention has been put recently on the development of standalone systems powered by renewable energy. Within this context, the Lympha project, a cooperative Italian-Tunisian project, aims at the construction of a small Membrane Distillation (MD) desalination pilot unit powered by solar energy. In the present work a state of the art of membrane distillation technology adopted for saline water desalination is presented. MD configurations, different module types, efficiency parameters and existing pilot units are described and thoroughly analysed in order to highlight their main features for the use of MD in small solar powered systems. Finally the progresses of Lympha project are presented giving some insight on the project's aims, coupling schemes, MD technology and first test runs already performed in the initial steps of the pilot unit development.

CMTDE_164

Membrane Distillation efficiency increase by enhanced heat transfer

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Abstract

Module geometry optimisation can be a crucial matter in all membrane processes, among which Membrane Distillation (MD); in fact the choice of proper channel shape and dimension can dramatically affect the performance of the process. Looking at the membrane distillation process, temperature polarization phenomena and pressure drops along the channels are fundamental parameters for the control of separation efficiency on one side and pressures distribution, module mechanical resistance and pumping costs on the other.

Several works have been presented so far in the literature on the fluid dynamic characterization of spacers used in Reverse Osmosis modules, but only few works deal with the problem of channel optimization of MD modules.

The present work aims at studying the thermo-fluid dynamic behaviour of different types of spacer geometries of MD modules by using CFD tools. Both commercial and custom geometries have been simulated in order to identify the most important parameters affecting process efficiency. CFX11.0 has been used for performing simulations. A constant heat flux has been assumed at the membrane surface in order to simulate the heat transferred by the vapour passing through the membrane, while the temperature distribution in the direction perpendicular to the membrane was used to characterise heat transfer coefficient dependences on the spacer shape, dimension and orientation.

Results have been used to identify several features that an optimised spacer should have in order to minimise T-polarization keeping low pressure drops along the channel.

Keywords: *Computational Fluid Dynamics, Membrane Distillation, spacer geometry, design optimisation, simulation, temperature polarization*

CMTDE_165

Corrosion and Fouling of Carbon Steel Heat Exchanger Tubes

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Abstract

Several heat exchanger tubes were corroded, plugged and some of them are perforating in a short period of time. Those heat exchangers were made from carbon steel and used for cooling water in massive desalination and petrochemical plant.

Many samples of corrosion product from different heat exchanger tubes were collected for complete chemical and microbiological analysis. This to find out the composition of the corrosion product or sludge which in turn assist in establishing the root cause of corrosion and fouling of heat exchanger tubes.

Two types of chemicals were injected to treat the cooling water include non oxidizing biocide (quaternary ammonium biocide), and oxidizing biocide (hypochlorite).

Two corrosion inhibitors one was injected to combat fouling and corrosion (blend of phosphates and zinc chloride) and the second was multifunction inhibitor which composes of mixed blend of phosphoric acid, zinc chloride. This inhibitor was injected to the system to combat scaling, corrosion and fouling deposition.

Low water velocity within the shell side of the heat exchanger, high skin temperature of tubes surface and bad control of the microorganism's growth cause the heat exchanger tubes to suffering from corrosion attack and fouling.

The corrosion deposit, bacterial slime, mineral scale and any other deposits is expected to act as a good site for under deposit corrosion, including microbiologically influenced corrosion (MIC) such as sulfate reducing bacteria (SRB).

Key words *: fouling, corrosion inhibitor, biocides, scale, sulfate reducing Bactria.*

Fluoride removal from water by nanofiltration

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Abstract

As any oligoelement, fluoride is necessary and beneficial for human health to low concentrations, but an excess amount of fluoride ions in drinking water has been known to cause undesirable effects, especially tooth and bones fluorosis. The maximum acceptable concentration of fluoride in drinking water was fixed by the World Health Organization according to the climate in the range of 1 $mg.L^{-1}$ to 1,2 $mg.L^{-1}$. Many methods have been used to remove fluoride from water such as precipitation, adsorption, electrocoagulation and membrane processes. Technologies using membrane processes are being used in many applications, particularly for brackish water desalination. Nanofiltration seems to be the best process for a good selective defluorination of fluorinated waters.

The main objective of this work was to investigate the retention of fluoride anions by nanofiltration. The first part of this study deals with the characterisation of the NF HL2514TF membrane. The influence of various experimental parameters such as initial fluoride content, feed pressure, permeate flux, ionic strength, type of cation associated to fluoride and pH were studied in the second part. Results show that the retention order for the salts tested was TR(Na_2SO_4) > TR($CaCl_2$) > TR(NaCl), showing a retention sequence inversely proportional to the salt diffusion coefficients in water. It was also shown that charge effects could not be neglected, and a titration experiments confirmed that the NF membrane carry a surplus of negatively charged groups. Fluoride retention exceeds 60%, and increases with increasing concentration, where the rejection mechanism is related to the dielectric effects. Speigler-Kedem model was applied to experimental results in the aim to determine phenomenological parameters σ and P_s respectively, the reflexion coefficient of the membrane and the solute permeability of ions. The convective and diffusive parts of the mass transfer were quantified with predominance of the diffusive contribution.

Keywords *: Defluorination; nanofiltration; Speigler–Kedem model; mass transfer.*

CMTDE_167

Effect of temperature on ion exchange equilibrium between AMX membrane and binary system of , and ions

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Abstract

Ion exchange is one of the most common techniques that have been employed for many years in chemical process industries and effluent treatment. Extensive work was done by previous researchers to study the concentration and temperature effect on ion exchange equilibrium between resin and uni-univalent and uni-bivalent ion systems.

The aim of this study is to investigate the effect of the temperature variation on ion exchange equilibrium between an anion exchange membrane and solutions of electrolytes containing the most anions present in natural water (, and) was studied. All experiments were carried at 0.3 mol.L^{-1}.

AMX membrane experimented in this work is a commercial product provided by TOKUYAMA SODA. It has quaternary ammonium groups. The membrane characteristics were determined by measuring humidity percentage and ion exchange capacity.

Ionic exchange isotherms for the binary / , / and / were established at different temperatures from 283 to 313K.

For temperatures from 283 to 298K, affinity order was: > > . This order is inversed for the system / at 313K. Selectivity coefficients and the thermodynamic equilibrium constants ° calculated for uni-univalent and uni-bivalent ion exchange reaction systems were observed to increase with rise in temperature. These results were compared with those obtained with strongly basic anion exchange resins.

The thermodynamic parameters such as standard free enthalpy change, standard enthalpy change, and standard entropy change were calculated. Ion exchange equilibrium at temperatures 283, 298 and 313K of / , / and / are found to be endothermic processes.

Keyswords : *ion exchange membrane, selectivity coefficient, isotherms, binary system, influence of temperature, thermodynamics.*

Submerged membrane bioreactor for domestic wastewater treatment and reuse

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Abstract

The Mediterranean basin (and particularly North African countries) is one of the poorest regions in the world in terms of water resources. In Tunisia, treated municipal wastewater is becoming one of the main alternative sources of water. Indeed, in 2007, 99 municipal wastewater treatment plants (WWTP) has treated a quantity of 215 millions of m^3 from which more than 30% are reused. The treated volume in 2011 is expected to be 266 millions m^3, whereas the reused wastewaters should reach more than 50%. However, especially in the eastern and northern Mediterranean regions, wastewaters are inefficiently treated and re-used for irrigation or sanitary purposes, serving as a carrier for diseases or causing water pollution when discharged to water bodies. In the last decade, several water treatment technologies have been used in the region with little success in pathogen removal.

Membrane bioreactor (MBR) technology is a very promising alternative to those conventional water treatments as membranes act as a barrier against bacteria and viruses achieving a high degree of water purification. However, most membrane bioreactors currently in use have very high running costs because of the high pressure drop and high air-flushing rate required for their operation. The objective of this PURATREAT FP 6 EU project was to study a new approach to the operation of membrane bioreactors. This study was included a comparison of three leading membrane technologies. The operating procedure to be studied is expected to yield very low energy consumption and reduced maintenance costs.

After the start up period, the MBR3 was operated with a MLSS concentration of 4.5 and 9 g/L, respectively. Different fluxes as 16, 18, 20 and 22 $Lh^{-1}m^{-2}$ were tested. When the flux increase from 16 to 22 $Lh^{-1}m^{-2}$, the treatment energy consumption decreased from 7 to 5 kWh/m^3. However the increases of MLSS concentration from 4.5 and 9 g/L raise the membrane fouling frequency from 1 time every 3 month, to 1 time every 2 weeks. Under those operating conditions the removal efficiency of soluble COD, NTK, SS and turbidity reach 91%, 83%, 100% and 99.8%, respectively. The treated wastewater meets the Tunisian standards for reuse, it is rich source of nitrogen, phosphorus and micronutrients even easily assimilated by plants (NO^{3-}, PO^{4-}, K^+,...). Pathogen-free, the treated water was tested in ferti- irrigation of vegetable crops.

Keywords : *Submerged membrane bioreactor, domestic wastewater treatment, reuse, ferti-irrigation.*

CMTDE_169

Electrochemical study of some insecticides deriving from carbamates in aprotic media

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Abstact

With the rapid growth of the population, there is an increasing demand for agriculture products and a consequent need of pesticides. It is essential to have an analytical methodology to monitoring them in the environment. The present work reports the electrochemical behavior of three carbamate insecticides, methiocarb, bendiocarb and zectran (fig.1). In oxidation, the cyclic voltammetry measurements indicated an irreversible electrode process for each insecticide in organic media. The electron transfer stoichiometry was determined; the effects of the concentration and the scan rate on oxidation of these compounds were investigated. There was evidence of an ECE type reaction. The principal oxidation products of the carbamate insecticides were determined in acetonitrile using mass spectrometry analysis.

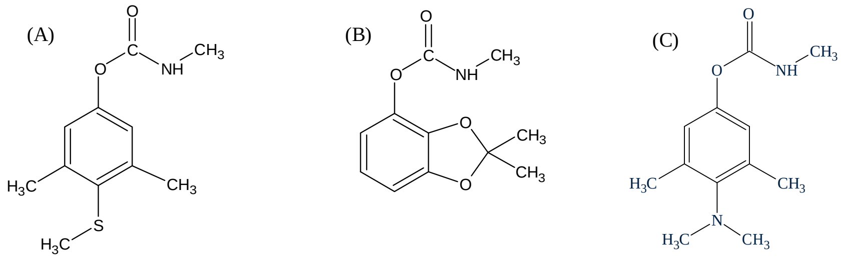

Fig. 1: Chemical structures of methiocarb (A), bendiocarb (B) and zectran (D)

Results of this study will be used to develop an electrochemical method for analyzing these compounds.

Keywords **:** *Cyclic voltammetry, zectran, methiocarb, bendiocarb, pesticide analysis, electrochemical behavior.*

Synthèse de nouvelles membranes utilisables dans les piles à combustible type PEMFC a base de polyéthersulfone sulfonée octylsulfonamide

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Abstract

Parmi les objectifs de nos travaux de recherche, la synthèse et la caractérisation de nouvelles membranes à base de polyéthersulfone sulfonée (SPES) utilisées dans les piles à combustible à membrane échangeuse de proton (PEMFC) ont été effectuées. Pour ce faire, de nouvelles membranes échangeuses de proton, polyéthersulfone sulfonée octylsulfonamide (SPES/Octylamine), ont été préparées avec différents taux de greffage d'octylamine. Cinq membranes ont été synthétisées à partir du SPES (1.3 $H^+.mol^{-1}$). Le taux de sulfonation final a été estimé en RMN ^1H par la quantité d'octylamine greffée.

Le SPES avec un taux de sulfonation de 1.3 $H^+.mol^{-1}$ ne possède pas toutes les propriétés requises pour les membranes échangeuses de proton car son taux de gonflement en eau est élevé, sa solubilité dans l'eau à 80 °C est totale et la membrane devient trop fragile après séchage. Afin de limiter ce caractère hydrophile et cet aspect cassant, nous nous sommes intéressés à augmenter la flexibilité et à diminuer la solubilisation dans l'eau des membranes SPES (1.3 $H^+.mol^{-1}$) en diminuant la température de transition vitreuse. Pour ce faire, des groupes pendants de type sulfonamide ont été introduits par réaction du SPES avec l'octylamine.

La structure et certaines propriétés des échantillons préparés ont été caractérisées en termes de propriétés mécaniques, teneur en eau, nombre de transport, conductivité ionique, RMN^{1}H et DSC.

Mot clés : *électrolyte solide polymère, taux de sulfonation, température de transition vitreuse, pile à combustible à membrane échangeuse de proton.*

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