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Authors List

Experimental study of l elimination of present phenol in industrial waste water by adsorption on cereal by-products

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Abstarct

The rejections of industrial waste water contain significant amounts and very diverse chemical compounds, like phenol and heavy metals, which return them the potential source of the pollution of subterranean water. The phenol makes party of the family of made up aromatic. It is used for the manufacture of medicinal products, dyes, the resins synthetic, the pesticides, the tanning matters, the perfumes, the lubricants, essential oils and solvents. Because of their strong toxicity in water, the phenols appear in the category of position risk of 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 the pH, the initial concentration .

The results show high retention of the phenol; exceeding 70% for an initial concentration of 20mg/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 : industrial waste water, phenol, organic pollutant, adsorption, elimination, natural adsorbent.

Experimental study of the elimination of certain dyes in wastewater by adsorption on natural by products

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Abstarct

The industrial wastewater contains large amounts and diverse of chemical compounds such as dyes. In this work we propose a study on the adsorption of some colors like as: red and blue Methler methylene (RM and BM) 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 dyes led to determine the kinetics where equilibrium is obtained at the end of 120 minutes, the isotherm adsorption of RM was also examined. It is a freundlich isotherm. This study we have also examinated the effect of some parameter such as: pH, the initial concentration .contact time and desiccation time.

The results show high retention of the RM 90% for an initial concentration of 10 mg/l, at 20°C, a mean size diameter of 0.375 mm, a mixing velocity of 600 rpm, an adsorbent concentration of 10g/l, a pH=2 and contact time of two hours

Keywords: industrial waste water, dyes, organic pollutant, adsorption, elimination, natural adsorbent.

Solvent extraction and separation Of Ni (II) AND Co(II) from chloride solutions using Tri-N-Octylamine

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Abstract

Many industrial wastewater streams contain metal cations, one can quote primarily : nickel, cobalt, ...etc. contained in the galvanic rejections they have an impact on the plants and the products for current human consumption, even with low contents.The conventiel process to treat this kind of wastewater such as solvent extraction. In this work , a technique applied to the metals: Ni(II) and Co(II) and a possibility separation Ni(II)-Co(II) by Tri-n-octylamine (TOA) from chloride solutions. The separation of cobalt from nickel in aqueous solution has always been a problem in hydrometallurgy.

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 chemical parameters have allowed us to obtain the variables giving the optimum extraction efficiency for diluted solutions of Ni(II) and Co(II). The mechanisms of extraction of Ni(II) and Co(II) from chlorhydric acid solutions with the tri-n-octylamine (TOA) dissolved in kerosene were investigated. Studies on the separation of nickel/cobalt from chloride solutions by TOA indicated as the best extractant.

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 extracta nts. This also allows an effective protection of the environment while being profitable.

Keywords: nickel, cobalt, solvent extraction, separation, wastewater

Modelling bubble column reactor for future energy production

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Abstract

Bubble column reactors are mainly used in different industries such as: chemistry, petrochemistry, food, biochemistry, bioenergy, metallurgy, and biological waste water treatment processes, because of their simple construction, excellent heat and mass transfer properties, better handling of solids, low operating costs and easier to operate. Often these contactors are filled with the liquid-phase in which a gas-phase or a mixture of gases is distributed by a sparger, and moves upwards in the form of bubbles leading to intense mixing inside the reactor. Many studies have been investigated the gas holdup and bubble diameter in bubble column reactors and empirical correlations have been given for gas holdup, however the flow inside the bubble column reactors remains complex.

The hydrodynamic characteristics have been investigated in air-water and (air-sodium sulfite in water) systems bubble column. Experiments in a 0.04m diameter, 2.4m height were carried out to determine : gas holdup, bubble diameter. In such case the effect of superficial gas velocity, type of spargers, mixing were studied. The latter was studied using conductimetric metohod. The gas holdup was obtained by liquid height measurements. It was found that the gas holdup, increased with increasing superficial gas velocity. Empirical correlations have been proposed to predict the systems studied in the bubble column. The diameter of the bubbles formed using porous spargers varies from 2.5 mm to 8.5 mm, the results are in agreement with the simulation. This study presents also the results of numerical simulations of the fluid flow in bubble column reactor. For modelling the continous phase in gas-liquid bubble column reactor three models have been tested : The standard k-ε model, The RNG k-ε model, the Reynolds Stress Model (RSM). It was found that the RSM model gives a good result.

Keywords: Bubble column reactor; hydrodynamic; gas hlodup, RSM model.

Utilisation des extractants organo-phosphorés dans la dépollution d'eau contaminée par le Ni (II)

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Resumé

Le traitement des effluents aqueux contenant des métaux lourds et l'extraction de métaux polluants contenus dans divers minerais, offrent un large champ d'applications à l'environnement.

Les composés organophosphorés comme les esters alkyl phosphonates, les acides phosphoriques et les acides phosphoniques sont d'excellents agents complexant des ions métalliques et sont fréquemment employés dans les procédés de purification.

Bien que de nombreux extractants soient déjà expérimentés, la recherche de nouveaux extractants pouvant former des complexes stable avec les espèces métalliques reste à l'ordre du jour afin d'améliorer les procédés existants.

Notre travail consiste à synthétiser dans un four à micro-ondes deux extractants de type acide aminodiphosphonique :

L'hexadécylamine bisméthylènediphosphonique «HABMP»

Le décylamine diméthylènediphosphonique «DADMP»

L'utilisation des techniques micro-ondes se traduit par des réactions efficaces, propres, performantes et fortes séduisantes en matière de coût et de protection de l'environnement.

Plusieurs tests d'extraction liquide – liquide par les produits des synthèses ont été réalisés sur des eaux contaminées par le Nickel.

Les meilleures conditions d'extraction du Nickel (II) par le «HABMP » sont obtenues pour : $[Ni^{+2}] = 10^{-3}$ M, [HABMP] = 8.9g/L, Vaq/Vorg = 4 et T = 20°C ; Le rendement obtenu est de 96% pour une extraction à un seul plateau.

Les meilleures conditions d'extraction du Nickel (II) par le «DADMP» sont obtenues pour : $[Ni^{+2}] = 10^{-3}$ M, [DADMP] = 8.9 g / L, Vaq / Vorg = 4 et T = 20°C ; Le rendement obtenu est de 84% pour une extraction à un seul plateau. Le «HABMP» extrait mieux le Nickel que le «DADMP», l'extraction du Nickel(II) par les acides aminodiphosphoniques est d'autant plus efficace que la chaîne R est plus longue.

Theoretical correlation for estimating a hybrid solar still yield

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Abstract

Production of potable water by desalination of brackish water using a solar powered system is a promising technology that it has been considered by many researchers. In remote and arid areas, especially in the almost Maghreb regions, the abundant solar radiation intensity along the year and the available brackish water resources are two favorable conditions for using solar desalination technology to produce fresh water. Many authors studied the optimisation of operating parameters of the considered stills based on experimental data obtained by these systems. In the present paper, a theoretical correlation named a 'Lewis number' correlation is developed and used for the calculation of a hybrid solar still (that it uses a heat pump) yield. The correlation was derived by taking into account heat and mass transfer expressed by Nusselt and Sherwood numbers, respectively. Obtained results are compared with those obtained experimentally. It was found that the calculated productivity is in good agreement with that obtained experimentally.

Surface modification of microfiltration ceramic membrane by fluoroalkylsilane

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Abstract

The membrane separation performances regarding to selectivity and permeate flux depend on the membrane textural and also on the chemical composition of the materiel used to prepare the membrane. The surface properties of composite microfiltration (MF) membrane zirconium/mud of hydrocyclone laundries of phosphates with average pore diameters of 0.2 µm was chemically modified to change its hydrophilic feature into hydrophobic by grafting 1H,1H,2H,2H—perfluorodecyltriethoxysilane molecule (C_8) which formula is $C_8F_{17}(C_2H_4)Si(OC_2H_5)_3$ in the goal to improve the selectivity of the membrane. Analysis of modified surface was accomplished by using different techniques such as thermogravimetric analysis (TGA). The determination of the contact angle on the grafted membrane surface proves the hydrophobic character. So it is shown that the value of contact angles increases from 40° before grafting to a value that exceeds 148° after grafting. The membrane permeability using distilled water of the grafted membranes was also measured. It is decreased from 703 $l\ h^{-1}\ m^{-2}\ bar^{-1}$ before grafting to 72 $l\ h^{-1}\ m^{-2}\ bar^{-1}$.

Keywords: Ceramic membrane; Grafting; Fluoroalkylsilanes; Hydrophobicity

Statistical analysis of microalgae growth

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Abstarct

To prevent environmental problems as an increasing concentration of carbon dioxide in the air and the waste water pollution, the use of renewable energy is necessary.

Microalgae are a natural source of high-value compounds for the pharmaceutical and food industry as:bioactive compounds, vitamins, pigments and fatty acids.

Recently, microalgae are widely used for hydrogen production and for waste water treatment.

The present paper deals about Algerian green alage Chlorella sp cultivation under 25°C and luminous intensity at 120 μmol.m^{2}.s^{-1}photon, for such case three mediums were tested : tris-acetate-phosphate, minimal, Suoka mediums. It was found that the Cholrella sp growth better in the Suoka medium, the concentration reached was about 27 10^{6} cells/ml.

Two methods have been tested to extract pigments using acetone or methanol. It was found that the chlorophyll content was about 6 mg/l using the methanol while using acetone it was only about 4,9mg/l.

Note that during growth experiments, the average microalge size distribbution was carried out by laser granulometry. In this work, we develop a statistical methodology for treating microlage size distribution.

Keywords: Microalgae size distribution, statistical analysis, medium, pigments, Chlorella sp.

Comparative study of degradation of methyl red by gliding arc and dielectric berrier discharge

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Abstract

Plasma process is considered a new alternative of decontamination and wastewater treatment.

The plasma active specie's, which have a high oxidation potential, confer to the plasma the ability to degrade organic compounds. The aims of this work, is the study of the degradation of an azo dye, the methyl red, by two kinds of plasma technique: the gliding arc (Glidarc) and the dielectric barrier discharge (DBD).

The degradation rate and the energetic consumption of each technique were evaluated in order to compare the efficiency of the glidarc and the DBD. Results show that the gliding arc plasma and the DBD plasma are both efficient to degrade methyl red in aqueous solutions. Experiments show also that in spite of the easy to build device and his efficiency, glidarc can be considered a bigger consumer of energy than the DBD which is more efficient and less consumer of energy.

Keywords: Plasma, Gliding arc, DBD, Methyl red

Ceramic membranes with selective ultrafiltration layers based on SiO_2 , TiO_2 and ZrO_2

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Abstract

Ceramic membranes as a class of inorganic membranes are gaining popularity because of their properties which give them an advantage over polymer membranes in separation processes.These include resistance to compaction under high pressure , chemical stability at high temperature , insensitivity to bacterial action and a long operational life.

Membranes techniques have had extensive applications in water treatment and gas separation.

Sol-gel method was called most valuable and practical one for ceramic membranes. There are advantages such as lower synthetic temperature , low-cost manufacture and uniform pore size distribution by sol-gel method.

This work shows the results obtained in the synthesis of selective ultrafiltration layers based on SiO_2, ZrO_2 and TiO_2 using the sol-gel method.

The main component of the mixture is a highly disperse metal oxide (in particular, metal oxide sols are used to obtain ultrafiltration selective layers).

The main properties of membranes are determined, the most significant of which are the composition of the mixture used, the size of highly dispersed oxide particles, and the drying and calcination conditions.

The ZrO_2 sol was obtained by hydrolysis and condensation of zirconium tetrapropoxide used as precursor under acidic conditions.The water necessary to the hydrolysis is produced in situ by an esterification reaction

The SiO_2 sol was synthetized by hydrolysis and condensation of tetraethoxysilane as precursor and the TiO_2 sol was obtained in the same way , with titanium isopropoxide as precursor.

Selective layers were deposited on the inner surface of a tubular support with subsequent drying and calcination.

The structural characterization was studied by differential thermal analysis, infrared spectroscopy and X-ray diffraction. The size of the pores and the porosity of selective layers were identified by the mercury porometry method. Scanning electron microscopy is used to characterize membrane morphology , that is the thickness and its homogeneity along the support .

A technology for producing ultrafiltration ceramic membranes using sol-gel method has been developped.The selective layers based on SiO_2 , TiO_2 and ZrO_2 are obtained and their characteristics are investigated.

Keywords : Membrane, Inorganic, Sol-gel

Solar desalination based on multiple effect humidification process : design and thermal performance

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Abstract

In view of the growing global demand for energy and water, both for potable use and for irrigation, the coupling of renewable energy sources, such as solar energy, with desalination units would generate a sustainable source of fresh water as well as energy. This coupling is highly valued as it limits and reduces the consumption of fossil fuel and the production of CO_2 emissions. A new generation of water desalination installation by solar energy using a multiple effect humidification process and called SMCEC technique (Solar Multiple Condensation Evaporation Cycle) is presented in this paper. The good quality of distilled water obtained by this new concept favours its use for producing water for drinking and irrigation. The purpose of this work is to present the design, the operation principle, the modelling, and the thermal performance of this kind of installation exposed to a variation of the control parameters. The paper also presents the environmental impact of the desalination procedures.

Keywords : Solar energy, water desalination, steady state, modeling, GOR

Optimization and modeling of a solar still with heat storage

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Abstract

Taking into account the obtained results issued from theoretical and experimental studies, carried out on a simple solar still with a greenhouse effect, where there is an evidence of a low efficiency of this type of the system, and when comparing the daily production with that recorded during the night, the difference is remarkable. This can be explained by the absence of the energy needed to ensure a continuous operation of the system.

In order to improve the production of distillate, our work has an objective to enrich the data already available through the simulation of the performance related to a prototype of solar still coupled a flat solar collector and a storage tank, simultaneously.

The installation consists of a solar still, a flat water collector and a water storage tank.

The solar still includes a basin inside which there is brackish water, a tube of exchanged heat, a metallic cover representing the condensation surface and having a back insulation.

The solar still is a flat water collector, where our choice tends towards an existing solar collector (commercial one), in order to be coupled with the distiller.

The storage tank is used for the daily storage and is adapted to sunny areas and characterized by high diurnal temperature changes, where a high capacity of storage leads to an improvement of the solar system efficiency. The storage by significant heat represents, actually, the most running system; it acts as a volume isolated with a material, which we put in thermal contact with the collectors. The choice of the medium storage is generally conditioned by the system, thus, water is used in the systems with carried-heat liquid. For all these reasons, we selected a storage water balloon which, at the beginning, is not stratified and where the quantity of the existing water is considered as a unique homogeneous layer and our balloon becomes then stratified with different temperature layers.

The modeling of the solar still is the most important, where we selected a solar still with a simple effect, having a metallic cover which performs as a condenser and a simple heat exchanger is set up inside the basin in order to heat the brine to be distilled. The aim of our study of simulation is the optimization and the effect of the physical, geometrical and operating parameters on the system efficiency (distillate production).

Keywords: thermal storage, solar energy, brackish water, solar distillation

Version française

Optimisation et modélisation d'un distillateur solaire avec stockage de chaleur

Smakdji Nafila, Kaabi Abdennacer

Tenant compte des résultats obtenus lors des études théoriques et expérimentales du distillateur solaire simple à effet de serre, où on reconnaît le faible rendement de ce type de système, et comparant la production journalière avec celle nocturne, la différence semble remarquable, et qui peut être expliquée par l'absence d'énergie nécessaire pour assurer le fonctionnement continue du système.

En vue d'améliorer la production du distillat, notre travail a pour objectif d'enrichir les données déjà disponibles par l'étude de simulation de fonctionnement d'un prototype de distillateur couplé à un capteur plan et à un réservoir de stockage.

L'installation consiste en un distillateur solaire, un capteur plan à eau et un réservoir de stockage liquide à eau.

Le distillateur solaire comporte un bassin dans le quel se trouve l'eau saumâtre et un tube d'échange de la chaleur et un couvercle métallique qui représente la surface de condensation et ayant une isolation se trouvant au niveau arrière

Le capteur solaire est un capteur plan à eau dont notre choix se penche sur un capteur solaire existant sur le marché, où le but est de le coupler avec le distillateur

Le réservoir de stockage est destiné pour le stockage journalier et est adapté aux régions bien ensoleillées ayant des écarts de température diurne élevée, où une capacité du stockage élevée conduit à une amélioration du rendement des systèmes solaires. Le stockage par chaleur sensible est le système le plus courant à l'heure actuelle ; il s'agit d'un volume isolé d'un matériau que l'on met en contact thermique avec les capteurs. Le choix du milieu du stockage est généralement conditionné par le système, c'est ainsi que l'eau est utilisée dans les systèmes à caloporteur liquide. Pour toutes ces raisons, on a choisi un ballon de stockage à eau qui, au départ, n'est pas stratifié, et où la quantité d'eau existante est considérée comme une seule couche homogène, puis notre ballon devient stratifié, où l'eau existe sous forme de couches de températures différentes.

La modélisation du distillateur est la plus importante, où nous avons choisi un distillateur solaire à simple effet avec une couverture métallique qui joue le rôle de condenseur et un simple échangeur de chaleur est installé à l'intérieur du bassin afin de chauffer la saumure à distiller.

L'objectif de notre étude numérique est l'optimisation des paramètres physiques, géométriques et de fonctionnement sur le rendement du système (production du distillat).

Mots clés: stockage thermique, énergie solaire, eau saumâtre, distillation solaire

CMTDE_17

Adsorption and desorption of Thioanisole on activated carbon supported ß-Cyclodextrin

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Abstract

The possibility of the application of cyclodextrins for reducing the polluants in water has long been recognized. Cyclodextrins are cyclic oligosaccharides formed from the degradation of starch by bacteria and have hydrophobic interior cavity and hydropholic periphery face. Cyclodextrins have excellent ability in the preconcentration of organic pollutants from aqueous solutions by forming inclusion complexes. Carbon nanotubes possess high adsorption capacity in the removal of organic pollutants through the formation of conjugated complexes. In this study, ß -cyclodextrin (ß CD) was grafted on the surface of activated carbon (AC) by using esterification reaction.

In this study the adsorption isotherms were correlated with the Langmuir and Freundlich models and the results permit to conclude that the sorption process depends on many factors such as the chemical structure and the concentration of the pollutant. This study shows that adsorption mechanism on activated carbon supported ß CD is more selective than that on the non grafted AC. The maximum adsorption capacity of thioanisole onto the new adsorbent is 57 mg/g. Desorption studies to recover the adsorbed thioanisole from activated carbon. supported ß-cyclodextrin were performed with HCl solution.

The new adsorbent material was also characterized by different techniques: the BET method to measure its specific surface area and pore size distribution, elemental analysis (CHN), X-ray diffraction (XRD) analysis and chemical composition (FTIR).

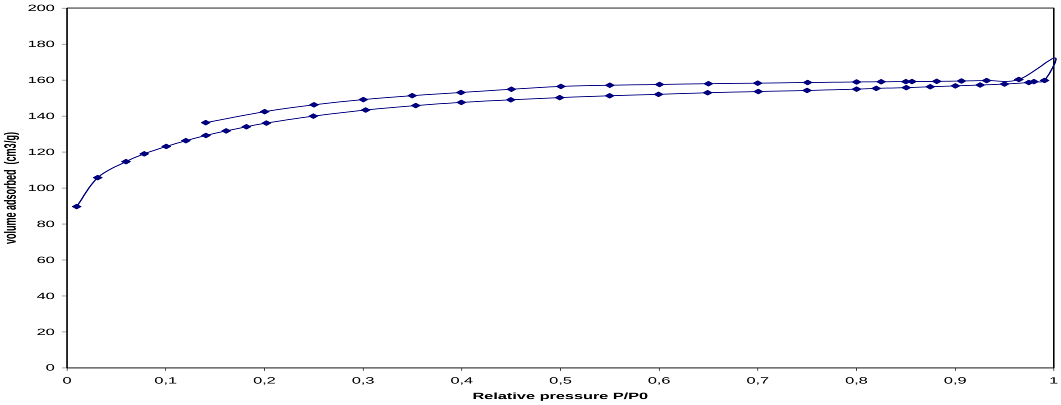

Fig . Adsorption isotherm of N_2 on AC supported ß CD at 77 K.

Keywords: Activated carbon, Adsorption, desorption, ß -cyclodextrin, Kinetics, Isotherms.

Removal of dyes from aqueous solutions by waste Tunisian palm tree dates

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Abstract

Wastewater from food colouring, cosmetics, paper and textile industries are polluted by dyes. When these coloured effluents enter rivers or any other surface water system they upset biological activity. Ground-water systems are also affected by these pollutants because of leaching from the soil. Dyes can cause allergic dermatitis, skin irritation, cancer and mutation. The conventional methods for treating dye-containing wastewaters are coagulation and flocculation, reverse osmosis and activated carbon adsorption. These technologies do not show significant effective-ness or economic advantage. Low-cost treatment methods have, therefore, been investigated for a long time.

A number of non-conventional, low-cost adsorbents have been tried for dye removal… These include peat, wood, clay… The present investigation is undertaken to test the use of a cellulosic waste, Tunisian palm tree dates, for the removal of different types of dyes: méthylen blue and Congo red, from water. The parameters which affect wastewater treatment, such as dye concentration, agitation time, adsorbent dosage, temperature and ph were investigated in batch-mode adsorption studies.

The result shows the waste palm is an effective adsorbent for the removal of dyes from aqueous solution. Adsorption followed both Langmuir and Freundlich isotherms. The adsorption capacity was 200mg/g and 80mg/g for the dyes méthylen blue and Congo red, respectively.

Le dessalement et les perspectives des énergies renouvelables en Mauritanie

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Résumé

La Mauritanie, plus que partout ailleurs, est cet immense pays austère, intensément irradié, venté et désolé, ce pays où l'eau est plus que primordiale ! C'est aussi un des pays les moins arrosés de la planète. Semi-désertique à désertique dans sa grande majorité, il se caractérise par l'absence d'eaux superficielles, par la difficulté d'accès à des eaux souterraines maigres et de surcroît de qualité souvent médiocre, saumâtre à salée, et par la disponibilité d'une côte marine de plus 700 km.

Dans un tel contexte où en plus prévalent une faiblesse notoire à une indisponibilité aigue et persistante des énergies conventionnelles et des pénuries criantes d'eau d'alimentation, l'intégration des énergies renouvelables aux procédés de dessalement est un enjeu de survie et un atout majeur de développement durable. Cette intégration aura pour effet d'assurer l'adéquation et la péréquation de l'énergie au dessalement et d'abaisser substantiellement le coût de l'eau.

Le présent article examine les procédés de dessalement dans le contexte mauritanien et l'opportunité que représente l'association des énergies renouvelables comme source énergique à ces procédés. De ce fait, pour apprécier cet enjeu, outre un aperçu sommaire du dessalement, l'historique des techniques de désalinisation utilisées en Mauritanie et la définition des contours des potentialités des énergies solaires et éoliennes et leurs utilisations, sont faits afin de cerner la nécessité de la synergie commune.

Characterization and evaluation of the factors affecting the geochemistry of surface water of Koudiat Medouar Basin, Algeria

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Abstract

Hydrochemistry of surface water in Koudiat Medouar Basin, Algeria was used to assess the quality of surface water for determining its suitability for drinking and agricultural purposes. In the three stations, there is a good correlation between the electrical conductivity and elements Ca, Mg, K, Cl, SO_4 and HCO_3. In order to determine the geochemical nature of water, the data was interpreted using the Piper diagram where in the results show the predominance of Ca-Mg-HCO_3 or Ca-Mg-HCO_3-Cl water type in the Oued Reboa, Ca-Mg-HCO_3 or Ca-Mg-Cl-HCO_3 water type in the Oued Timgad and Ca-Mg-Cl-HCO_3 water type in the Reservoir dam. Principal components analysis results revealed that surface water quality was mainly controlled by geology, agricultural uses and domestic discharges. All the surface water samples in Oued Timgad fall in the field of C3S1, indicating high salinity and low sodium. Most of the surface water samples in Oued Reboa and in the reservoir dam fall in the field of C2S1, indicating medium salinity and low sodium. Based on RSC values, all the samples of the three stations had values less than 1.25 and were safe for irrigation.

Keywords: Surface water, principal component analysis, drinking and irrigation water quality, Koudiat Medouar Basin, Algeria.

Effect of operational thermophysical parameters on the performance of a double slope type solar still

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Abstract

Algeria is one of the Maghreb countries that is interested in using many types of solar stills for a sufficient potable water supply from brackish water, since it is situated in a region where the solar radiation intensity is considerably high, especially in the summer season. In this study, a computer program has been developed to simulate the effect of some operational thermophysical parameters on the performance of a double slope solar still in order to obtain the optimum design parameters, under climatic conditions of Constantine (Eastern Algeria) and by using meteorological data at a step by step hour of the highest daily temperature recorded during the last decade. The shallow water depths, 10m/s wind velocity and 10° cover tilt angle are found to be the optimum design parameters that give maximum daily and hourly water production. In addition we found that the larger the temperature difference between the collector and the water surface, the more the daily production is important. Finally, we find that local materials such as aluminium and polystyrene give the highest solar still yield.

Keywords: solar still; thermophysical parameters; performance; solar radiation; Constantine.

Hexavalent chromium removal from water by HL nanofiltration membrane: effects of Cr(VI) concentration, pH, and co-existing ions

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Abstract

Nanofiltration is investigated as a possible alternative to the conventional methods of Cr (VI) removal from aqueous synthetic solutions and industrial effluents. The influence of transmembrane pressure and feed concentration on permeate flux, water recovery, ionic strength, presence of co-existing anions and pH was studied. The results have shown a chromium retention which varies from 30 to 99% relating to the composition of the solution and operating conditions. A better retention was obtained in basic medium and for high permeate fluxes. The retention of the Cr(VI) ions was not affected by the feed concentration. The influence of the salt addition on the retention has revealed the effect of the interactions of the membrane/solute and solute/solute on the selectivity of the membrane. The influence of the ionic strength makes the phenomenon of repulsion less significant and consequently the ions were less and less retained. The rejection rate of Cr(VI) was found to increase with the increase of feed solution pH.

Spiegler-Kedem model was applied to experimental results in the aim to determine phenomenological parameters σ and Ps respectively, the reflection coefficient of the membrane and the solute permeability coefficient of ions. The convective and diffusive parts of the mass transfer were quantified with predominance of the diffusive contribution.

Keywords: *Nanofiltration; Spiegler–Kedem model; Mass transfer*

Elimination du 2,4,5-trichlorophénol par des argiles activées à l'acide sulfurique et organophiles

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Résumé

La synthèse et la caractérisation d'argiles activées à l'acide sulfurique, puis rendues organophiles par insertion dans leur espace interfoliaire d'un tensioactif, l'héxadécyltriméthylammonium bromide (C16), ont été testées dans l'élimination d'un polluant très présent dans les eaux, très toxique, très dangereux et classé par l'EPA en 2002, comme étant un des polluants prioritaires pour son élimination des eaux : le 2,4,5-trichlorophénol. L'activation de la bentonite par une attaque à l'acide sulfurique à haute température augmente considérablement sa surface. Ceci a été confirmé l'analyse BET, la surface spécifique de la bentonite passe de 80 m^2/g à 296 m^2/g. L'étude infrarouge confirme l'insertion du tensioactif utilisé dans la deuxième étape d'activation. L'analyse thermogravimétrique a montré que les matériaux sont stables jusqu'aux hautes températures et peuvent être utilisés sans danger pour la purification des eaux. L'étude de l'élimination du 2,4,5-trichlorophénol par les échantillons préparés a été étudiée en fonction de facteurs dont dépend fortement l'adsorption (la masse de l'adsorbant, la concentration initiale du polluant, le pH de la solution et la température). Cette étude a révélé que quelques soient les paramètres étudiés dans l'adsorption, le processus est de pseudo-second-ordre. Les paramètres thermodynamiques ont révélé que le processus de l'adsorption du 2,4,5-trichlorophénol sur les matériaux préparés est spontané, de nature physique et exothermique. Les isothermes d'équilibre ont été étudiées et ont montré une très grande affinité adsorbant-adsorbat dès les faibles concentrations. Les quantités maximums adsorbées à l'équilibre vont jusqu'à 380 mg de polluant par gramme d'adsorbant. Les matériaux que nous avons préparés sont efficaces, peu chers relativement à d'autres adsorbants comme le charbon actif, et surtout propres pour l'environnement. Ils restent très compétitifs et peuvent être utilisés dans l'assainissement des eaux polluées.

Mots clés: Bentonite activée organophile; isothermes d'adsorption ; 2,4,5-trichlorophenol; cinétique.

Elimination du phenol en solution aqueuse par des argiles

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Résumé

L'eau, est un élément indispensable à la vie. Depuis toujours, la qualité de l'eau est un facteur déterminant pour le développement des civilisations, mais aussi, le véhicule le plus commun et le plus important de la transmission des maladies.

La pollution chimique de l'eau devient de nos jours une préoccupation de santé publique, qui prend des formes multiples. Certaines formes de pollutions chimiques échappent souvent aux méthodes ordinaires de traitement de l'eau et posent par conséquent des problèmes complexes de pollution, tant au niveau des eaux de surface (rivières), qu'au niveau des nappes souterraines.

Les produits phénoliques constituent un ensemble de composés hydroxylés du benzène qui ont pour origine une pollution industrielle (usines de pétrochimie, raffineries, papeteries) ou par dégradation des insecticides.

En ce qui concerne, le but principal de ce travail est l'utilisation de deux variétés d'argiles : la bentonite et le kaolin, dans le domaine du traitement des eaux phénolique. Ainsi, nous nous sommes intéressés à l'élimination du phénol, élément très toxique rencontré dans les effluents liquides, en condition statique.

Dans ce travail, nous avons :

- Réaliser les cinétiques d'adsorption du phénol sur la bentonite et le kaolin en fonction de deux paramètres testés (le temps de contact et la masse de l'adsorbant).
- Déterminer les constantes de vitesse d'adsorption du phénol par la bentonite et le kaolin par le modèle mathématique de Lagergreen.
- Effectuer des équilibres d'adsorption pour connaître la capacité maximale des adsorbants vis-à-vis du phénol utilisé à partir de la modélisation de ces isothermes par le modèle de Langmuir et Freundlich.

Nos expériences ont montrés que :

- Les deux adsorbants étudiés possèdent une certaine affinité pour le phénol.
- La bentonite adsorbe plus du phénol que le kaolin.

La capacité d'adsorption du phénol à l'équilibre par la bentonite et le kaolin est influencée par la masse de l'adsorbant.

- Les cinétiques d'adsorption du phénol sont rapides pour les deux adsorbants.
- Les cinétiques d'adsorption du phénol sur les adsorbants utilisés sont de même ordre (1er ordre).

- Les isothermes d’adsorption du phénol par les deux adsorbants, sont décrites de manière satisfaisante par le modèle de Langmuir, alors que la modèle de Freundlich n’arrive pas à décrire nos résultats expérimentaux.

Mots clés: Adsorption, phénol, bentonite, kaolin, Cinétique, Equilibre

A supported liquid membrane system for efficient extraction of vanillin from aqueous solutions

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Abstract

The paper presents an experimental study on the extraction of vanillin from aqueous solutions through a flat-sheet supported liquid membrane (FSSLM) system. Thereby, the best organic solvent and the operating conditions that would yield optimum performance of the developed SLM system have been identified. Tributyl phosphate (TBP) is used as carrier. Among various solvents, tested for the above purpose, kerosene is found to be the best. The effects of operating conditions, viz. TBP concentration, pH of feed and receiving solutions, initial vanillin concentration, feed dose and stability of the membrane are investigated. Under optimum conditions, an initial flux value around 4 x 10^{-6} mol m^{-2} s^{-1} has been determined and more than 60% of the initial vanillin concentration can be extracted. The main feature is that the elaborated FSSLM system retained its stability and initial performance during the 13 days long experiment. After 24 h of extraction, 84.5% and 64.5% of initial vanillin concentration can be removed from vanilla sugar and vanilla liquor real samples, respectively. The present study shows that, the developed SLM system can be auspiciously applied to extract vanillin from aqueous solutions.

Keywords: Vanillin extraction, Tributyl phosphate (TBP), Liquid-liquid extraction, Flat-sheet supported liquid membrane, Stability.

Application of a new cationic exchange membrane for electrodialysis

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Abstract

Electrodialysis is a mature process which is applied for more 50 years on a large industrial scale for the production of potable water from brackish water sources.
In this study, we have used a new cationic membrane SPESOS (sulfonated polyether sulfone sulphonamide) for testing its selectivity to monovalent ions like Li^+, Na^+ and K^+ in the electrodialysis of the synthesised solutions.
These membranes were made by ERAS-Labo [1] from SPES grafted with octylamine.
The permselectivity of membrane can be obtained from the transport number values. It was noticed that the selectivity of the membrane is very high for proton transport in H2SO4 solutions. Ionic exchange capacity (IEC) and water uptake were also found to be satisfactory.
The influence of applied intensity of cation removal was studied in the electrodialysis of the synthesised solutions when the solution contains only a single kind of anion and when the anions are mixed. The membrane presents different selectivities of each cation. The concentration variations of cation values versus the time of electrodialysis was also studied.

[1]: W. Mabrouk, L.Ogier, F.Matoussi, C.Sollogoub, S.Vidal, M.Dachraoui, J.F.Fauvarque. Preparation of new proton exchange membranes using sulfonated poly(ether sulfone) modified by octylamine (SPESOS) Materials Chemistry and Physics (article in press).

Utilisation d'une nouvelle membrane échangeuse de cations (MEC) en électrodialyse.

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L'électrodialyse est un processus qui est appliqué à une grande échelle industrielle depuis plus de 50 ans pour la production d'eau potable à partir d'eau saumâtre.
Dans cette étude nous proposons de tester la sélectivité, en électrodialyse et en solution synthétiques, d'une nouvelle membrane cationique SPESOS (sulfonate polyether sulfone sulfonamide) vis-à-vis des ions monovalents comme Li^+, Na^+ et K^+. Cette membrane a été élaborée à ERAS-Labo à partir de SPES greffé à l'octylamine [1].
La permsélectivité d'une membrane peut être obtenue à partir de la valeur du nombre de transport. Nous avons alors, noté la grande sélectivité de la membrane SPESOS vis à vis des transports des protons en solution H_2SO_4. La capacité d'échange ionique ainsi que le taux de gonflement de la membrane SPESOS ont été également évalués, les résultats se sont avérés satisfaisants.
Nous avons procédé à l'étude de la variation de la concentration de chaque cation pris à part, en fin d'électrodialyse, en fonction de l'intensité du courant imposé, la même étude a été faite pour le mélange des trois ions. La sélectivité ne s'avère pas la même pour tous les ions. La variation des concentrations des cations en fonction du temps d'électrodialyse a été également étudiée.

[1]: W. Mabrouk, L.Ogier, F.Matoussi, C.Sollogoub, S.Vidal, M.Dachraoui, J.F.Fauvarque. Preparation of new proton exchange membranes using sulfonated poly(ether sulfone) modified by octylamine (SPESOS) Materials Chemistry and Physics (article in press).

Removal of Cadmium and Zinc from aqueous solution by Polyelectrolyte enhanced ultrafiltration

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Abstract

Nowadays, water treatment is one of the main important fields of studies, due to the increase of the world population and industrial activities. Efforts are devoted to optimise the techniques for the prevention and control of pollutions through purification and recycling of wastewaters.Ions metal such as cadmium and zinc are classified as highly toxic elements and serious environmentalcontaminants.Therefore, its removal, separation and enrichmentin aqueous solutionsplay an important role for the environmentalremediation of wastewater

Cadmium and zinc removal from aqueous solution by polyelectrolyte enhanced ultrafiltration (PEUF) process was investigated using poly(acrylic acid) (PAA) with average molecular weight 100.000 Da. The ultrafiltration studies were carried out using a tangentiel cell system equipped with 10.000 MWCO regenerated cellulose. Several parameters such as: transmembrane pressure, PAA concentration, pH and ionic strength have been optimizedto improve the retention of these metal ions.The removal of Cd^{2+} and Zn^{2+}exceeds 96% and 94% respectively, when each ion was studied separately.The study of pH effect on the cadmium and zinc recovery reveals retentions almost around 85% and 78% respectively at pH 5.Selectivity was studied using a solution containing the two metal ions. It was found that zinc retention decreases compared to single metal solutions, which is more significant in the case of cadmium ions.

Keywords: Cadmium; Zinc; Ultrafiltration; Polyelectrolyte Enhanced-Ultrafiltration; poly(acrylic acid).

Application of grafted ceramic Tunisian clay membranes in membrane distillation process for water desalination

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Abstract

In this paper new types of ceramic hydrophobic porous membranes could be used in membrane distillation (MD) to produce drinking water. Membrane distillation differs from other membrane technologies in that the driving force for desalination is the difference in vapour pressure of water across the membrane, rather than total pressure. The membranes for MD are hydrophobic, which allows water vapour (but not liquid water) to pass. Two kinds of hydrophobic membranes were prepared by grafting 1H,1H,2H,2H-perfluorodecyltriethoxysilane (C8 compound) on Tunisian clay ceramic membranes with pore diameters of 0.18µm and 15 nm. Air Gap Membrane Distillation (AGMD) experiments were performed with sodium chloride solution at different concentration of salt. The effect of the mean temperature and pore diameter of the membrane was studied. The water vapor permeability of the proposed membranes was determined. The new membranes seem to be promising in the field of membrane distillation. High salt rejection rates higher than 99% were obtained for both modified MF and UF ceramic clay membranes. This process has been applied to seawater desalination. AGMD is a process very efficient and cost effective to produce fresh water from seawater.

Keywords: Air gap membrane distillation; Seawater; sodium chloride solutions; Desalination; Ceramic clay membrane.

An international overview of economics of nuclear desalination

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Abstract

As a viable option to meet water scarcity and mitigate the adverse environmental impact caused by large-scale desalination plants using other fuel sources, the economics of seawater desalination using nuclear energy is yet to be realized through large commercial plants. Recent research from ten IAEA Member States participated in a 3-year long Coordinated Research Programme (CRP), including techno-economic feasibility studies carried out for specific sites, showed that nuclear desalination is a possible and in some cases the only viable solution to on-going water scarcity. Results of the CRP, to be highlighted on this paper, include various configurations of different reactor sizes and technologies and both thermal and electrical desalination processes.

Results of sensitivity analysis of water cost based on current economic status and trends, and using the newly released desalination economic evaluation program (DEEP 4), demonstrate that nuclear desalination can be an economically attractive option, as compared with conventional fossil fuel-based desalination systems. Crucial parameters affecting water cost have been analysed e.g the effect of capital and fuel costs over the water cost. It was found that nuclear desalination maintained its competence even in economically unstable conditions and it is the one of the best alternatives for long term water production, compared to volatile fossil fuel-based solutions. Finally, an overview of IAEA activities related to seawater desalination using nuclear energy is also presented.

Equilibre isotherme d'adsorption d'une amine aromatique sur un residu agricole

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Résumé

Les propriétés adsorbantes de trois échantillons de charbons ont été étudiées à partir des isothermes d'adsorption d'une amine aromatique à 12 ; 28 et 45°C. Nous avons considéré la fixation du 4-bromoaniline sur des charbons préparés à base de noyaux d'abricot, préalablement traités aux acides minéraux sulfurique, chlorhydrique et phosphorique. L'étude cinétique a montré que le processus d'élimination du 4-bromoaniline est rapide et que les meilleurs rendements d'élimination de la molécule considérée sont obtenus avec les charbons traités aux acides phosphorique et chlorhydrique. L'application aux systèmes étudiés des modèles mathématiques décrivant les équilibres isothermes d'adsorption a montré que le modèle de Langmuir décrit convenablement la fixation du 4-bromoaniline par les charbons activés aux acides minéraux, avec des capacités maximales d'adsorption variant entre 109 et 333 mg g^{-1}.

Mots clés : Adsorption; 4-bromoaniline; Charbon actif; Noyaux d'abricot.

Optimizing adsorption of dye on high-surface-area activated carbon using experimental design methodology

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Abstract

Activated carbon was prepared from Algerian date pits using physicochemical activation method consisted of zinc chloride ($ZnCl_2$) treatment and carbon dioxide (CO_2) gasification. The activated carbons produced were characterized by carbon yield (%), BET surface area, porosity development (total pore volume and micropore fraction).Adsorption of Orange G dye (OG) from water was studied using the prepared activated carbon. A tree-factor central composite design (CCD) combined with response surface modeling (RSM) was employed for maximizing OG removal from aqueous solution by the activated carbon based on 20 different experimental data obtained in a batch study the effects of various parameters such us agitation time, initial dye concentration and adsorbent dosage were studied. The significant factors on each experimental design response were identified from the analysis of variance (ANOVA), the significant factors on each experimental design response were identified.

Keywords: activated carbon, optimization, central composite design, response surface modeling.

Etude du développement de la texture poreuse d'une houille activée chimiquement: Application à l'adsorption de polluants en milieu aqueux

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Résumé

Des charbons actifs ont été préparés par activation chimique successivement à l'hydroxyde de rubidium, à l'hydroxyde de césium et à l'acide phosphorique, d'une houille algérienne. On note que les pertes de masse au cours de la pyrolyse de la houille sont parfaitement corrélées aux chaleurs d'immersion des matériaux obtenus dans le benzène; en effet, plus la perte de masse est grande, autrement dit l'activation plus efficace, plus la porosité est développée et donc le mouillage par le benzène plus facile. Par ailleurs, les résultats obtenus montrent que l'hydroxyde de césium est l'agent activant le plus efficace. L'efficacité de ce dernier est confirmée par les isothermes d'adsorption du phénol, du bleu de méthylène et du cristal violet qui montrent une plus grande capacité d'adsorption. Enfin, les capacités d'adsorption des charbons actifs obtenus, vis-à-vis de ces polluants, sont nettement plus importantes que celles des charbons obtenus sans traitement activant.

Mots clés: Activation, porosité, adsorption.

Removal of basic Yellow dye from aqueous solution by sorption on chemically modified date stones

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Abstract

The adsorption of basic yellow dye onto chemically modified agricultural waste materials was studied. Adsorbent was prepared by treatment of date stones with concentration sulfuric acid at 25° C followed up by a subsequent neutralization with NaOH aqueous solutions. The effect of contact time, adsorbent dosage, initial pH and initial dye concentration were investigated for this adsorbent. Adsorption isotherms were interpreted from various isotherm models like Langmuir and Freundlich. The best fitting isotherm was found to be the Langmuir isotherm. The adsorption kinetics was analyzed using series of rate equation like first-order rate equation and second-order rate equation. The rate of dye removal better follows pseudo-second-order rate kinetic model, corroborating high correlation coefficient for calculated parameters with the experimental data.

This study indicates that sorption onto this adsorbent is an effective, cheaper alternative for dye removal.

Application of membrane process technology in concentration of polyphenols from *Rosmarinus Officinalis* L. plant extracts

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Abstract

Rosemary (*Rosmarinus Officinalis* L.) (RO) leaves extracts show a very high antioxidant activity and increasingly used as food additives and proposed as important human dietary factor. Rosemary oils were assessed for their antimicrobial and antioxidant activity. The oils' antioxidant potential was determined by ($DPPH^{\cdot}$) assay and Trolox equivalent antioxidant capacity (TEAC) assay. Aqueous and Methanolic extracts were obtained and concentrated by membrane nanofiltration and ultrafiltration by three kind of membrane in the aim to have a retentate or a permeate rich in rosmarinic or carnosic acids .The essential oil analyzed by GC-MS technique showed the following fractions : 1,8-Cineole (44.86 %) , Camphre (14.39 %), and α-pinène (12.62 %).The antioxidant effects, the levels of total phenol and the total phenol contents of volatile oils and plant extracts were determined in various *RO* plant. Antioxidant activities and the total phenol contents were measured by spectophotometric method as well as the volatile oil content of the fresh plants with gas chromatograph. Our results clearly indicate that the antioxidant capacity of volatile oils and plant extracts closely related to the total phenol contents. *R officinalis L.* essential oil and aqueous or methanolic extract and their permeate and retentate obtained using membrane technology showed interesting results, being one of the best performing on in terms of ability to neutralize free radicals.

Keywords: Rosmarinus Officinalis L., antioxidant activity, total phenolic compounds, DPPH, UV-vis,. nanofiltration, membrane process, permeability, rosmarinic acid, carnosic acid.

Application of reverse osmosis for removal of boron from natural water

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Abstract

Boron is a vital element for organism growth, but excess of boron in water poses a problem due to adverse effects to plants, animals and possibly humans. Due to its detrimental effects on the reproducibility of living organisms, the World Health Organization stipulates the maximum admissible value for the concentration of boron at 0.5 ppm and the European Union at 1 ppm as the non-observed effect level for drinking water. However, it has been challenging to remove boron from water. It is not significantly removed by reverse osmosis membrane in the ambient operating parameters. The aim of this work is to characterize an AG 2514 TF RO membrane and to investigate the effect of pH, operating pressure, conversion rates, concentration of the feed water, ionic strength and temperature on the removal of boron from water. The experimental results indicated that retention rate of boron was over 93% at feed solution pH of around 11, while it doesn't exceed 35% at neutral pH. This retention was not remarkably affected by pressure conversion rates and concentration.

The effect of ionic strength reduces boron retention since the electrostatic effects of the membrane become weaker. The retention rate of boron increases with temperature which is due to the increases because of water and solutes diffusivity.

Finally an application was made on natural sample (Oued Bouthebbane) containing 3mg/L of boron. Results showed that RO could remove efficiently boron reaching 91.5%.

Keywords: Boron; RO membrane type AG; operating parameters

Geochemical evolution of groundwater in an alluvial aquifer: Case of El Eulma aquifer, East Algeria

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Abstract

Hydrochemical, multivariate statistical and inverse hydrogeochemical modeling techniques were used to determine the main factors and mechanisms controlling the chemistry of groundwaters in the El Eulma Mio-Plio-Quaternary aquifer, East Algeria. Cluster analysis based on major ion contents defined three main chemical water types, reflecting different hydrochemical processes. The first, group 1, has low salinity (mean EC = 937 µS/cm) and abundance orders $Ca^{2+} > Na^{+} \approx Mg^{2+} > K^{+}$ and $HCO^{-}_{3} > Cl^{-} > SO^{2-}_{4} > NO^{-}_{3}$. With increased water-rock interaction, waters in groups 2 and 3 become more saline, changing composition towards Cl-HCO_3-Ca and Cl-Ca-Na types. The PHREEQC geochemical modeling demonstrated that relatively few phases are required to derive water chemistry in the area. In a broad sense, the reactions responsible for the hydrochemical evolution in the area fall into three categories: (1) dissolution of evaporite minerals; (2) precipitation of carbonate minerals, quartz, kaolinite and Ca-smectite; (3) ion exchange.

Keywords: Groundwater; Cluster analysis; Geochemical modeling; PHREEQC; El Eulma Mio-Plio-Quaternary aquifer; Algeria.

Study of electrochemical scale deposition on stainless steel substrate

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Abstract

The corrosion and scaling are undesired situations in energy installations. Indeed the uniform corrosion consumes the material and induces a reduction of the lifetime of the facilities. The localized corrosion is more damaging and unpredictable because its initiation and its propagation are very fast, so it can, cause failures in cooling loops and result serious incidents.

The scaling is also apprehended phenomenon particularly in the nuclear or the desalination of seawater installations. The scale deposition in heat exchangers must be strictly avoided the risk of altering the thermalhydraulic parameters.

The fight against these phenomena is based primarily on prevention. But prevention can be effective without a good knowledge of specific processes brought into play at the solid / liquid interface. These mechanisms depend on the material fact of his environment and his dependence conditions.

In this study we present the results on the scale deposits electrochemically on stainless steel substrate. Our study parameters are: rotation speed, concentration of carbonates, the cathodic potential polarization and the temperature. The technical methods used are: potentiodynamic, the Chronoamperometry and the characterization was carried by X-ray diffraction and the scanning electron microscope techniques.

Keywords: ORR, scale, Cathodic potential, scaling deposition, Chronoamperometry, XRD, SEM.

Removal of phenolic compounds from synthetic wastewater using cross-flow micellar enhanced ultrafiltration

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Abstract

The recovery of natural phenolic compounds from residual resources (e.g. olive mill wastewaters) gain increasing interests. Several techniques were proposed for the treatment and recovery of phenolic compounds from phenolic wastewaters including membrane processes. In this work, the cross-flow micellar enhanced ultrafiltration (MEUF) of some natural occurring phenolic compounds in synthetic wastewater using a flat sheet polyethersulfone membrane of 10kDa molecular weight cut-off (MWCO) and cetylpyridinium chloride (CPC) as cationic surfactant was studied. The effect of surfactant concentration on the permeate flux and phenolic compounds (vanillic acid, p-coumaric acid and tyrosol) rejection was investigated. The CPC was found to contribute significantly to the fouling phenomenon, since the initial permeate flux was reduced by 60% when processing 0.3 g/l of phenolic compounds (0.1 g/l each) and 4.6 mM CPC against 2.6% of reduction when processing phenolic compounds without surfactant. The rejections of vanillic acid (75-88%) and p-coumaric acid (73-86%) were much higher than the rejection of tyrosol (39-46%). The addition of sodium carbonate (Na_2CO_3) to the feed increased the rejection of tyrosol and decreased significantly the permeate concentrations of the three phenolic compounds and CPC.

Keywords: Micellar enhanced ultrafiltration; Phenolic compounds; CPC; Sodium carbonate; Rejection.

Simulation of a solar thermal membrane distillation: Comparison between linear and helical fiber

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Abstract

In arid coastal regions, the lack of potable water coincides often with high solar insolation. In this case, the coupling of the desalination systems with the solar energy is of great importance. Among the desalination systems, the membrane distillation technique holds important advantages. This work focuses on the vacuum membrane distillation coupled with solar energy. The aim of the work was to simulate a novel membrane in order to enhance the permeate product. This novel membrane is composed of hollow fiber wound in helically coiled shape. Two dimensional Navier-Stokes equations are written and were solved with the finite element method. For the pitch of 32.2 mm and the coil radius of 95.7 mm, the simulation results of the permeate product are 0.2685 kg/h and 7.688 10^{-3} kg/sm^2 for the permeate flux. These values present an enhancement when we compared them to the linear hollow fiber configuration and in the same conditions.

Keywords: Vacuum membrane desalination; Solar energy; Helical fiber; Linear fiber; Simulation

A preliminary study on boron removal from seawaters by electrocoagulation

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Abstract

Naturally occurring, boron is present in groundwater primarily as a result of leaching from rocks and soils containing borates and borosilicates. Concentrations of boron vary widely and depend on the surrounding geology and wastewater discharges. For most of the world, the concentration of boron in drinking-water is judged to be below 0.5 mg L^{-1} and it exceeds the concentration in seawater, estimated to be 5 mg L^{-1}. According to the WHO (2011), the boron concentration should be reduced to less than 2.4 mg L^{-1} for drinking water. Electrochemical technology contributes in many ways to a cleaner environment and covers a very broad range of technology. Electrocoagulation (EC) is an efficient method used for treating various process effluents and investigated as a new technology for boron removal.

In this study, EC process using two aluminum electrodes was selected as a treatment process for boron removal from seawaters. Several working parameters, such as pH, current density, EC time, energy consumption and conductivity were studied in order to assess optimal operating conditions.

Boron removal by EC was found to be pH dependent. Results obtained showed that the most effective removal capacity was achieved at pH 8. It was noted that the removal efficiency of boron increased with the current density, leading consequently to energy consumption increase. Experimental results displayed that an increase of current density notably reduces the treatment duration. The effect of supporting electrolyte (NaCl) on boron removal was also studied. It is mainly found that higher conductivity accelerated the EC process and reduced energy consumption.

Important operating parameters were optimized to access higher boron removal efficiency as follows: pH: 8, current density: 86 mA cm^{-2}, optimal EC time: 60 min and initial conductivity: 39,2 mS cm^{-1}. An amount of 47% of boron removal from synthetic aqueous solution containing initial boron concentrations of 5 mg L^{-1} was reached and energy consumption was evaluated of 7 kWh m^{-3}.

Electrocoagulation tests were performed to treat Tunisian seawaters containing 4.86 mg L^{-1}. Removal efficiencies did not exceed 18 %.

Keywords: Boron removal, Electrocoagulation, Aluminum electrode, pH, Current density, conductivity, energy consumption, Boron seawater.

Influence of Biological treatment and Ultraviolet disinfection system on the diversity of Pseudomonas SPP. in wastewater as assessed by DGGE

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Abstract

The genus Pseudomonas is a heterogeneous group of bacteria due to the elevated metabolic versatility capable of utilizing a wide range of simple and complex organic compounds. Consequently, they are found ubiquitously in water, soil and plants. Pseudomonas “sensu stricto” group I includes, firstly, the type species of the group, Pseudomonas aeruginosa. This bacterium is an opportunistic human pathogen responsible for frequently lethal hospital infections. Secondly, plant deleterious pseudomonads, like Pseudomonas syringae, produce toxins that affect the plant growth and is primarily foliar pathogen producing diverse types of disease symptoms. Finally, Pseudomonas fluorescens and Pseudomonas putida considered among saprophytic bacteria can exerts a toxic activity against various deleterious microorganisms. Consequently this prominent property makes these bacteria attractive candidates for use in bioremediation and biocontrol activities.

In this work, the diversity of Pseudomonas spp. in untreated and treated wastewater (Bio-discs and ultraviolet disinfection system as, respectively, secondary and tertiary water treatment method) was studied by means of culture-independent approaches. A PCR-DGGE strategy was used to evaluate the effect of wastewater treatment processes on the diversity of Pseudomonas populations in wastewater of pilot station d’El-MenzehI.

Direct DNA extraction of wastewater samples was performed. Primers specific for the genus Pseudomonas were used to amplify 16S rRNA genes and then a semi-nested PCR reaction was applied to obtain smaller fragments for comparing the PCR products by DGGE. An internal Mix composed of a mixture of PCR fragments of seven identified Pseudomonas strains (P. aeruginosa, P. otitidis, P. syringae subs savastanoi, P. fluorescens, P. vancouverensis, P. putida and P. mosseli), allows comparison with the different bands obtained from tested samples. In order to verify the hypothesis obtained, we identified representative’s bands by 16S rDNA sequencing.

The method allowed the detection of diversity of bands obtained from bio-disc biofilm corresponding to saprophytic and pathogenic bacteria. Treated Waste water collected after biological treatment and UV disinfection, showed some persistent bands that do not disappear with the different treatment.

The combination of semi-nested PCR and DGGE was found to be rapid and sensitive technique to achieve the detection of multiple Pseudomonas strains in wastewater community by a simple comparison with internal Mix.

Keywords: Pseudomonas, Wastewater, DGGE

Study of the inhibiting effect of the HEDP on hard waters by impedancemetrie

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Abstract

The precipitation of calcium carbonate of hard waters on metal surfaces always caused significant problems in the factory constructions, agronomic and the domestic equipment (valves, taps and boilers).

Water of the two natural sources Hamma and Negrine are known like hard waters. They have a hardness of 59°F for Hamma and 56°F for Negrine.

According to the chronoamperometric study of raw waters of Hamma and Negrine, the water of Hamma is classified like a water extremely furring with an index of scaling of 103.09min^{-1} and the water of Negrine is classified like a water very furring, it presents an index of scaling of 74.07min^{-1}.

In this study one used the electrochemical method which consists of the measurement of the impedance. It is a powerful method of characterization of the layers of sediment on an electrode of platinum. These precipitates are formed with increasing time intervals what corresponds to also increasing quantities of tartar deposited.

The application of the measure of the impedances is used:

-To study the shape of the curve of the impedance of raw waters of Hamma and Negrine.

-To evaluate the inhibiting effect of the HEDP on two waters Hamma and Negrine.

-To determine the limiting and effective concentration of HEDP necessary to the inhibition of the scaling of water of Hamma and Negrine.

Keywords: Calcium carbonate, Inhibition, HEDP, Chronoamperometrie, Impedancemetrie.

Adsorption of cadmium onto natural and activated clay

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Abstract

The removal of heavy metals from industrial waste streams has become one of the most important applications in wastewater treatment in terms of protecting public health and environment. The recovery of metals present in the industrial effluents by adsorption onto natural materials constitutes a technological option increasingly studied throughout the world. However, the implementation of such process on an industrial scale requires the use of adsorbents easily available and inexpensive. Clay in these two forms natural and activated answers very well to these two requirements. The present research aimed the study of the capacity of fixing of cadmium present in aqueous solution, by two types of clay: natural and activated. The effect of the principal parameters such as: (i) clay mass concentration, temperature, and (ii) pH of solution. The effect on the capacity of fixing of cadmium was undertaken within the framework of this research.

Keywords: Adsorption, natural Clay, activated Clay, Cadmium, Isotherm, Modeling.

Molecular typing of V. alginolyticus strains isolated from Tunisian marine biotopes by two PCR-based methods (ERIC and REP) and study of their antibiotic susceptibility

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Abstract

The members of genus Vibrio have acquired a great importance because several are associated with human disease. These members are autochthonous to aquatic environments including estuarine, coastal waters and sediments worldwide, and some species are well-known pathogens of marine organisms including fish, crustaceans, corals and mollusks.

The aim of the present study was to analyze the intraspecific genetic variability within V. alginolyticus strains isolated from different Tunisian aquatic biotopes by the use of two PCR–based techniques.

Seventy eight strains including 9 Vibrio type strains and sixty nine V. alginolyticus strains isolated from seawater, sediment, Sparus aurata; Dicentrachus labrax and from mollusks (C. gigas, M. edulis) were analyzed by repetitive extragenic palindromic PCR (REP- PCR) and enterobacterial repetitive intergenic consensus sequence PCR (ERIC-PCR).

In this study, 62 genotypes by ERIC-PCR and 58 genotypes by REP-PCR were found, indicating the higher discriminatory power of ERIC-PCR.

For the resistance to antibiotics, 20 drugs were used in this study, all the isolates were multi-resistants, defined as resistance to at least three antibiotics with multiple resistance index ranging from 0.3 to 0.7 for the isolates of Khenis, 0.5 to 0.8 (Menzel Jmil), 0.5 to 0.75 (Hergla) and from 0.3 to 0.7 for the isolates of Oued Soltane.

In this study, we can say that REP-PCR and ERIC-PCR techniques are useful typing methods for V. alginolyticus strains; whereas the multiple resistance can cause an important risk to human health since the sea products are consumed by humans.

Keywords: Vibrio alginolyticus, genetic diversity, REP-PCR, ERIC-PCR, antibiotic susceptibility.

Autopsy of an old Reverse Osmosis (RO) membrane from the PNBA in Mauritania: case study of Rgueiba

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Abstract

The overall objective of the present work was to estimate by membrane autopsy the level of performances degradation of old reverse osmosis (RO) membranes/modules in order to envisage their reuse. A mechanistic approach using the Spiegler–Kedem–Katchalsky model helps us to observe that the old RO membrane acquired a convective mass transfer. We defined a novel Peclet number (denoted Pe′) usable to distinguish between diffusional and convective mass transfer. We observed that for the old membrane Pe′ numbers are always higher than 1. Furthermore, SEM/AFM and EDX experiments show crystals and bacteria particles as fouling agents, roughness increase for the old membrane (from 73 to 220 nm) due to foulants deposition.

EDX experiments demonstrated that FexOy crystals are dominant. SP measurements help us to observe a displacement of the isoelectric point (IEP) for the virgin membrane from 2.3±0.2 to 3.5±0.2 in comparison to the old one showing chemical modifications of the inner active layer suspected due to biofouling residuals. In the last part and for the first time, module materials reuse occurred in the place of their incineration as geotextile in proper home garden.

Keywords: Membrane, reverse osmosis, seawater, ageing, autopsy, nanofiltration.

Kinetics of degradation of 17β-estradiol by Electro-Fenton process

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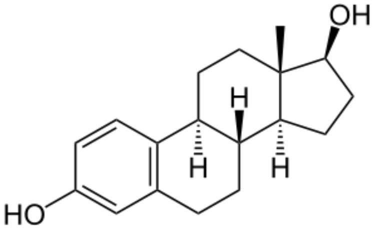
Abstract

Advanced oxidation processes (AOPs) constitute a promising technology for the treatment of wastewaters containing pharmaceuticals and endocrine disrupting chemicals. The electrochemical advanced oxidation method “Electro-Fenton process” has been observed to be very efficient in eliminating estrogens present in water. In this system, the degradation of organic pollutants occurs by attack of hydroxyl radicals ($OH^•$) which are produced from the reaction of added metallic catalyst (Fe^{2+}, Mg^{2+}, Co^{2+}…) and hydrogen peroxide (H_2O_2) electrogenerated by oxygen reduction at carbon felt cathode.

In the present work, we have applied the electro-Fenton process to degrade, in aqueous–acetonitrile mixture, the 17β-estradiol which is a steroid hormone, releases from humans, animals and residual pharmaceuticals into the environmental water and usually causes suspected undesirable effects in aquatic organisms.



<u>Chemical structure of 17β-estradiol</u>

Degradation kinetics and chemical oxygen demand (COD) have been determinated. The evolution of the concentration during treatment was followed up by high performance liquid chromatography (HPLC). Kinetic analysis showed that the oxidation of 17β-estradiol by hydroxyl radicals follows a reaction kinetic of pseudo-first order. The results confirm the efficient of the Electro-fenton process to degrade organic pollutant in aqueous-acetonitrile mixture.

Catalytic ozonation of phenolic compound over Nickel supported on activated carbon

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Abstract

Advanced oxidation processes (AOPs) were frequently selected as a treatment option to oxidize refractory and toxic organic compounds present in water. Because of their high cost in treatment, traditional AOPs, such as photocatalysis or catalytic wet oxidation, can hardly affect the efficacies of the process. Heterogeneous catalytic ozonation, a novel alternative to traditional AOPs, has received wide interest as a promising technology for removing refractory organic pollutants in water. It combines ozone with the adsorptive and oxidative properties of solid phase metal oxide catalysts to mineralize refractory organic compound. The mineral matter present in the activated carbon positively contributes to its activity to enhance the ozonation process

Nickel supported on activated carbon (Ni/AC) was prepared by wetness impregnation of the precursor salts $Ni(NO_3)_2$ $6H_2O$ at 30°C for 2 h followed by calcination at 450°C and reduced in N_2 flow (400ml/min). The obtained catalyst was used to degrade a phenolic compound in water. A higher dipping $Ni(NO_3)_2$ concentration and calcinations process increases its microporous volume and surface area. The catalytic activity reaches optimal when 5% (w/w) of Nickel is deposited on activated carbon. Ni/AC catalyst was characterised by BET and XRD. Semi batch experiments in a liquid_gas reactor were conducted to investigate the effects of the amount and the type of catalyst, temperature of oxidation, pH, initial phenolic compound concentration on catalytic ozonation of organics in water. The results of the toatal organic carbon TOC show that the presence of either activated carbon or Ni/AC catalyst considerably improves the degradation of the phenolic compound when compared to simple ozonation. The best performance is observed for the combine use of O3/CH-Ni which makes it possible to reach an abatement of TOC 59% at the end of 30 min .It was found that Ni/AC is a promising catalyst for ozonizing organic polluants in the aqueous solution.

Sorption de traces micropolluants émergents (médicaments, pesticides et hormones) sur des argiles modifiées

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Abstract

La pollution des eaux, accidentellement ou volontairement par certains produits chimiques d'origine naturelle comme les hormones stéroïdiennes ou les produits pharmaceutiques (anti-inflammatoires, antibiotiques, agents d´anti-anxiété, antibacté-riens, stéroïdes…) ou encore les contaminants agricoles (engrais, pesticides : herbicides, insecticides…) constitue une source de dégradation de l'environnement et suscite un intérêt particulier à l'échelle internationale.

La détection de plus en plus de contaminants émergents dans l'environnement présente une grande préoccupation chez les scientifiques. Les progrès majeurs réalisés en matière d´analyse environnementale ont permis de mettre en évidence leur présence à l´état de traces (ng.L^{-1}). Bien que ces micropolluants soient parfois présents à de très faibles concentrations, ils peuvent causer des impacts et des effets nocifs sur la santé humaine et les écosystèmes. De nombreuses recherches scientifiques de différents horizons se sont intéressées à la recherche de nouveaux adsorbants à base de matériaux naturels et surtout à base d'argiles qui sont largement disponibles dans la nature. Les argiles peuvent jouer un rôle important dans la dépollution grâce à leur capacité d´adsorption directement liée à leur nature physicochimique: large surface développée par ces matériaux, présence des charges négatives sur sa surface et possibilité d´échange des cations. La modification de la surface de ces minéraux argileux a retenu l'attention, car ces modifications permettent la création de nouveaux matériaux comme adsorbants.

Dans le but de contribuer à la mise en valeur des argiles et de leur utilisation comme adsorbant de différents contaminants émergents dans l'eau, le présent travail s´intéresse en première étape à la modification de la structure d'une montmorillonite tunisienne pour la synthèse des organo-argiles. Pour ce faire on intercale un sel d'ammoniun quaternaire dans le volume interlamellaire afin d'espacer les feuillets du minéral argileux et ainsi donner un caractère hydrophobe et organophile au matériau en fixant ce tensioactif cationique à longues chaînes (19carbones-le bromure hexadécyl-N,N,N-trimethylammo-nium, noté HDTMA$^+$, Br$^-$). Pour une telle étude, la connaissance des caractéristiques physicochimiques et de la morphologie de l'argile utilisée est primordiale et font aussi partie intégrante du projet.

La deuxième étape est consacrée à la présentation de la capacité d'adsorption d´une montmorillonite purifiée sodique et des organo-argiles synthétisées à l´adsorption des différents contaminants et micropolluants les plus répandues et émergents dans l'eau à savoir quatre pesticides (atrazine, DEA, carbendazime, linuron), un estrogène (17α-ethinylestradiol), deux progestogènes (progestérone, medroxyprogestérone), quatre antibiotiques (sulfamonomethox-ne, sulfamethoxazole, triméthoprime et ciprofloxacin), deux anti-inflamatoires (phenylbuta-zone, sulfadimidine), un analgésique (codéine), un bétabloquant (aténolol), un insectiside répulsif (DEET), un agent antibactérien (trichlorocarban), et un agent traceur de tabac (nicotine). L'examen de la fixation de tous ces contaminants ainsi que la comparaison et la quantification de la capacité d´adsorption de ces micropolluants depuis les argiles étudiées sont été réalisées par le biais d´une méthode analytique de temps d'analyse très court, basée sur l´extraction sur la phase solide (SPE) associée à la chromatographie en phase liquide à ultra haute performance –spectrométrie de masse en tandem via une source d´électronébulisation (SPE-UPLC-ESI-MS/MS). Une tel étude peut donner une valeur environnementale supplémentaire aux argiles et une amélioration de la qualité des eaux.

Mots Clés: Montmorillonite, Argiles organophiles, HDTMA, micropolluants, produits pharmaceutiques, hormones, pesticides, SPE, LCMS-MS en tandem.

ACV: Un outil d'aide à la décision

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Abstract

Le développement durable repose sur une nouvelle forme de gouvernance, axée sur un triple objectif : social, économique et écologique; son succès repose sur le partenariat et la coopération entre acteurs de disciplines différentes (économique, sociologique, écologique…etc.), de secteurs différents (transport, eau, déchets, milieu naturels, …etc.), de milieux différents (associatif, institutionnel, administratif, commercial et syndical); agissant à des échelons territoriaux différents, du niveau international au niveau local.

Le défi de la mise en œuvre du développement durable consiste donc à faire en sorte que dans nos comportements, nos actions, nos politiques, nos programmes, nos lois et nos règlements, dans l'ensemble de nos interventions comme citoyens, groupe d'intérêt, entreprise, gouvernement, nous visions l'atteinte simultanée et équilibrée des trois objectifs du développement durable.

La finalité de ce travail est de pouvoir mettre à la disposition de toute personne respectueuse de l'environnement et surtout à la disposition de l'industriel une méthode d'éco conception, qui lui permettra d'intégrer la dimension écologique en amont des processus de fabrication.

« Prévenir plutôt que guérir », « éviter une pollution plutôt que tenter de la capter ou d'en réparer les dommages » : si ces principes de bon sens ne peuvent susciter qu'une large adhésion, leur mise en œuvre pratique reste encore bien fragmentaire. Parmi les voies à explorer, une des plus prometteuses est sans conteste celle qui s'axe autour de la conception des produits. En effet, où mieux que durant la phase de conception, peut-on réduire à la source de futurs impacts sur l'environnement ? Quels choix, sinon ceux de conception, influent-ils le plus sur les caractéristiques environnementales des produits ?

Approche volontaire et positive de l'environnement, source d'innovation et de compétitivité, la prise en compte de l'environnement dès la phase de conception des biens – l'éco conception – peut représenter un facteur de valorisation pour l'entreprise dans son ensemble, comme pour chacun de ses acteurs ou partenaires.

L'éco conception, peut être une nouvelle approche dans la stratégie de l'entreprise, qui lui permettra d'intégrer le principe du développement durable.

Mots clés: éco conception, Analyse de cycle de vie, Simapro.

Study of the oxidation of the green of bromocresol by the processes like Fenton and like photo-Fenton in aqueous medium

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Abstract

This study aims at testing the efficiency of the advanced oxidation technics on the process of discoloration of anionique dye (green of bromocresol) in aqueous medium.

It is about systems like: Like Fenton (Fe^{3+}/H_2O_2) and like photo-Fenton (Fe^{3+}/H_2O_2/UV in 254nm and 365 nm).

For Like Fenton, the obtained results showed that the fastest discoloration was obtained for the ratio $[H2O2]_0/[Fe^{2+}]_0 = 30$, at pH =3 and for has concentration of 6 10^{-5} M of the dye. It corresponds to a reaction time of 180 minutes .This efficiency was increased by coupling the process like Fenton with the UV radiation (254 nm). In these conditions, this process was reached witham 60 minutes. This is due on one hand to the radicals $OH^{\cdot}$ generated by the reaction between Fe^{3+} and H_2O_2 and on the other hand to the photolysis of H_2O_2 at the same wavelength. We noticed that the green of bromocresol (6 10^{-5} M) was not sensitive as well with the peroxide of hydrogen as with the Fe^{3+} (no reaction of complexation in absence of UV radiation).

It is noted that the disappearance of the green of brmocresol is faster by the process H_2O_2/Fe^{+3}/UV (254nm) that by the process H_2O_2/Fe^{+3}/UV (365nm) because with 365nm, the production of radicals OH° can come only from one source: the photoreduction of the monomers Fe $(OH)^{+2}$ in Fe^{+2}.

From these works, we can thus conclude that the process Like Photo-Fenton more effective that those of like Fenton.

Keywords: Like Fenton, like photo Fenton, VBC, oxidation, H_2O_2.

Use of synthetic NaP-1 zeolite in removal of Cd^{2+} ions

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Abstract

Zeolites have been proven ion exchange materials as Na^{+} cations are not tightly fixed to the hydrated aluminosilicate structure and can be easily exchanged with other cations in solutions. These ion exchange properties are used to remove cations from chemical effluents. Many toxic heavy metals like Fe^{3+}, Cu^{2+}, Pb^{2+}, Cd^{2+}, Zn^{2+} and Ni^{2+} have been discharged into the environment as industrial wastes, causing serious soil damage and water pollution.

This research paper describes the investigation of Cd^{2+} ions adsorption on the synthetic zeolite NaP-1. The adsorbent was synthesized according to a hydrothermal crystallization process. It was characterized by several techniques as X-ray powder diffraction, Infrared spectroscopy, Scanning electronic microscopy, and Differential thermal and gravimetric analysis and Nitrogen adsorption.

The effects of the initial cadmium concentration, pH solution, solid-liquid ratio and temperature were studied. The adsorption equilibrium isotherms of cadmium ions were tested using the Dubinin-Radushkevich (D-R), the Freundlich and the Langmuir models. The sorption kinetics was fitted to the pseudo first order, pseudo second order reaction and intraparticle diffusion equations. In this study, a quantitative treatment of the data based on the modified models obtained from Fick's differential equations was applied. The thermodynamic parameters namely the enthalpy $\Delta H°$, entropy $\Delta S°$ and free energy $\Delta G°$ of adsorption of Cd^{2+} ions on NaP-1 zeolite were determined.

Key-words: Cadmium; NaP-1 zeolite; synthesis and characterization; Removal.

Removal of chromium (VI) ions onto algerian clay. characterization, equilibrium and kinetic studies

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Abstract

The removal of chromium (VI) ions from aqueous solutions onto Algerian clay was investigated in batch. The clay samples were characterized by X-ray powder diffraction, Infrared spectroscopy, Scanning electronic microscopy, Differential thermal and gravimetric analysis and Nitrogen adsorption technique for specific area surface and porous volume. The effects of parameters as initial concentration, pH, solid-liquid ratio (S/L) and temperature were studied. The Freundlich and the Langmuir models have been applied and the adsorption equilibrium has been found to follow the Langmuir model. Kinetic studies showed that the second-order sorption model was the most prevalent for the adsorption of chromium (VI) ions. The rate constant of the exchanged ions appears to be controlled by chemical sorption process. Thermodynamic parameters were calculated and showed that adsorption enthalpy was endothermic nature and the reaction was spontaneous.

Key-words: Chromium; Algerian clay; Characterization; Removal; Environment.

Fixing of heavy metals by smectic clays

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Abstract

The structure and chemical composition, exchangeable ion type and small crystal size of smectite are responsible for several properties, including a large chemically active surface area, a high cation exchange capacity and inter-lamellar surface having unusual hydration characteristics. Smectic clays are usually considered as natural barrier which limit toxicity and pollutants propagation, especially in zones where polluted water is directly discharged without treatment in natural environment. The aim of the current study is to highlight the role of Tunisian clay layers (Souar formation) in the field of water treatment. For this reason, a mineralogical and physicochemical characterization of some inflated clays was undertaken in order to assess their role in heavy metals retention. The adsorption of heavy metals by smectic clay minerals has been reported by several investigations. The purpose of this investigation was to remove some heavy metals from aqueous solution by raw and purified smectic clay. The influence of several parameters, such as the factors controlling the adsorption (time of contact, variable heavy metals concentration, pH, temperature) and those related to the adsorbent (granulometry, impurities), were studied in order to optimize the operating conditions of adsorptions and consequently the heavy metals removal effectiveness from non treated water by Souar formation clays. Langmuir and Freundlich models were employed to examine the equilibrium adsorption data.

Keywords: Smectic clay, Heavy metals, Adsorption, Souar formation, Tunisia.

Adsorption of antibiotic by dried biomass

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Abstract

Recently, the attention of many researchers working in the environmental field was focused on the presence in the environment (and more specifically in waters) of pharmaceuticals as a new class of pollutants. Antibiotics are potential pollutants being responsible for disturbing the wastewater treatment processes and the microbial ecology of surface waters. In the present work, the attention is focused on amoxicillin, a broad-spectrum antibiotic, widely used in human and veterinary medicine. Adsorption is a well established and powerful technique for treating domestic and industrial effluents. Activated carbon is the most widely, effectively and cost used adsorbent. The potential use of dried Pleurotus mutilis: waste of a drug produced by fermentation as a substitute for powdered activated carbon for removal of amoxicillin one of the most widely used antibiotics in Algeria, from aqueous solution was examined. Some pre-treatment of dried Pleurotus mutilis, such as washing by distilled water or rinsing with HCL solution, has been done. We examined the static kinetic of adsorption of the amoxicillin /dried biomass system using amoxicillin as a pollution model. UV/Visible spectrophotometry is used as a method of analysis. The influence of some essential parameters, namely, initial amoxicillin concentration, contact time and temperature on the static adsorption of the amoxicillin/ biomass system has been investigated.

The adsorption studies of amoxicillin from aqueous solution on dried Pleurotus mutilis biomass have been studied in the range of 05–50 mg/L initial amoxicillin concentrations and at the temperatures of 25, 30 and 45°C. The maximum amoxicillin adsorption yields was obtained as 80% at the temperature of 30°C at pH=6,5, the equilibrium uptake increased with increasing initial amoxicillin concentration.

Langmuir and Freundlich isotherms were used to analyze the equilibrium data at different temperatures. The results show that experimental data fit perfectly the Langmuir model. Batch adsorption models, based on the assumption of the pseudo-first order and pseudo-second order mechanism, were applied to examine the kinetics of the adsorption.

Keywords: Adsorption; Amoxicilline; Pleurotus mutilis; Equilibrium

Bacterial Community Diversity Assessment during Wastewater Biological Treatment Process Using DGGE

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Abstract

The rotating biological contactor (RBC) is a treatment process used in the treatment of wastewater following primary treatment. The RBC process involves allowing the wastewater to come in contact with a biological medium in order to remove pollutants in the wastewater before discharge of the treated wastewater to the environment. Microorganisms grow on the surface of the discs where biological degradation of the wastewater pollutants takes place.

Denaturing gradient gel electrophoresis (DGGE) method using 16S rDNA was commonly used for a direct comparison of structural diversity among different microbial communities.

In our study, we aimed to assess bacterial community structure and diversity in wastewater and biofilm during the RBC treatment using DGGE, and to follow the evolution of Salmonella community using sdiA primers. Samples were collected weekly, from different point of the RBC process, during two seasons (summer and winter). Total DNA was extracted and PCR amplification targeting 16S rDNA genes was performed. The analysis of the DGGE profiles and the sequence of the dominant DGGE bands showed a variability of the bacterial community with season, and revealed the effectiveness of the treatment process. The majority of the bacterial species was eliminated during the treatment process. The use of sdiA gene was efficient for the detection of Salmonella during the treatment process.

In this study, we demonstrate that DGGE method coupled with specific detection of pathogenic bacteria provides precise information for wastewater bacterial treatment.

Electrochemical mineralization of rotenone and paraquat pesticides using boron-doped diamond anode. Elucidation of the key role of dissolved oxygen

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Abstract

The degradation of the two pesticides rotenone and paraquat by anodic oxidation using a boron doped diamond (BDD) anode and a carbon felt cathode was studied.

The effects of various operating parameters (dissolved oxygen, nature of electrolyte and applied current) on the degradation rate and the mineralization efficiency have been investigated and the key-role of dissolved oxygen elucidated. A very high mineralization rates were obtained for both pesticides (yielding 98% and 97% COD and TOC decay, respectively). The decay kinetics followed pseudo-first order reactions. Reversed-phase chromatographic analysis revealed the appearance of various aromatic intermediates. Among them, hydroquinone and 12aβ-hydroxyrotenone were identified by LC-MS-MS as oxidative degradation by-products of rotenone.

The effective mineralization of both pesticides was further evidenced by following the concentration profiles of generated short-chain aliphatic carboxylic acids (such as formic, oxalic, acetic and succinic acids) using ion-exclusion chromatography. The mineralization process of paraquat leads to a complete release of nitrate ions and a total disappearance of chloride ions at the end of treatment.

Keywords: Anodic oxidation, BDD anode, dissolved oxygen, mineralization, rotenone, paraquat.

Optimization of influential parameter to biodegrade the phenol in batch by microbial consortium

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Abstract

Phenol is a very toxic compound present at different concentrations caused by the development of industrialization, more and more industrial wastewater containing phenolic compounds are discharged from industrial processes such as oil refineries, chemical plants and coke ovens. A variety of techniques have been used for the remediation of phenol. Conventional methods of treatment are largely chemical or physical, but these processes lead to secondary effluent problems. Besides, biological treatment is an effective method which shows an increasing number of industrial applications, since a wide range of microorganisms can assimilate phenol as the sole source of carbon. In this purpose, phenol biodegradation was carried out in a batch reactor containing mixed bacteria; the temperature (30°C), the stirring velocity (200 r /min), initial concentration of NaH_2PO_4 (3 g/L), initial concentration of $MgSO_4$ (0,1 g/L) and the phenol concentration (100 mg/L) were kept constants. The initial pH was varied in the range 5 – 9 and the concentrations of other mineral components were tested in the following concentration ranges: 0 – 2 g/L for KNO_3, 0 – 4 g/L for KH_2PO_4.

Their effects on phenol biodegradation and specific growth rate were examined. All experiments were carried out at a given initial bacterial concentration of 0.08 g/L. The shorter biodegradation time of phenol was 18.58 h. Maximum specific growth rate (0.389 h^{-1}) and total phenol removal (99.99 %) were recorded for an optimal pH value equal 7 with optimal concentrations KNO_3 and KH_2PO_4 equal to 0.5 g/L.

Key words: Biodegradation, Phenol, Microbial consortium.

Experimental design methodology applied to optimize the defluoridation by adsorption on activated alumina

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Abstract

This paper aims to examine the adsorption of fluoride on activated alumina (AA) from aqueous solutions using a two-level full factorial design.

For this sake, four operating parameters which are supposed to affect the removal efficiency were chosen: initial fluoride concentration, pH of solution, adsorbent dose and temperature.

The statistical analysis allowed to verify that the four studied parameters have an influence on the fluoride elimination. Indeed the adsorbent dose and the temperature have a positive effect unlike pH and initial fluoride concentration. The greatest effect on fluoride removal was supplied by adsorbent dose.

Besides the adsorption isotherms were correlated with the Langmuir and Freundlich adsorption equations and the kinetic study was carried out using first and second-order models.

The thermodynamic study showed that the adsorption of fluoride by AA is an exothermic and spontaneous process.

Practically batch studies were performed to evaluate the viability of the studied adsorbent in a real field application by using two groundwater samples of high fluoride concentration.

The results suggest that AA can be used as effective adsorbent for the removal of fluoride ions.

Keywords: fluoride, activated alumina, factorial design, adsorption kinetic, thermodynamic, adsorption isotherms.

Removal of lead from aqueous solutions by Agar beads with EPS produced from Paenibacillus polymyxa

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Abstract

Lead adsorption from aqueous solution onto agar beads with an extracellular polysaccharide (EPS) produced by the bacterium Paenibacillus polymyxa was studied. The ability of beads to adsorb lead has been studied at different optimized conditions of pH, Pb(II) concentration, contact time, biomass dosage and temperature. In order to determine the adsorption characteristics, Langmuir, Freundlich and Dubinin –Radushkevich adsorption isotherms were applied to the adsorption data. The thermodynamic parameters such as variations of enthalpy ΔH, entropy ΔS and variation of Gibbs free energy ΔG were calculated. The involvement of the functional groups on the surface of beads in biosorption process was also evaluated by FTIR spectral analysis. The results suggested that Agar + EPS beads could be suitable as a sorbent material for removal of lead ions from aqueous solutions.

Keywords: Paenibacillus polymyxa, biosorption, heavy metals, lead, EPS, Agar

Degradation of Trimethoprime by electro-Fenton process: Application of Doehlert matrix

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Abstract

In the last two decades, pharmaceuticals such as antibiotics and analgesics, have been found in the effluent sewage treatment plants. Some of these compounds were not readily biodegradable and were also detectable in surface water and groundwater. Because they are produced in important quantities and used excessively, these substances accumulate continuously in the environment. Hence, there is an urgent need to develop an economical treatment system for the removal of these substances. The most recent advances in the treatment of wastewaters concern advanced Oxidation Processes such as electro-Fenton. This process has been proved to be efficient in the treatment of toxic organic pollutants mostly bio-recalcitrant. The production of hydroxyl radicals, highly reactive species, promote oxidation of persistent organic compounds until mineralization. The main purpose of our study is to examine the influence of some experimental parameters, such as the electrolysis time, the current intensity and the initial (Fe^{2+}) concentration, on the degradation of Trimethoprime by electro-Fenton step. The optimal experimental parameters for Trimethoprime degradation have been investigated by the use of Doehlert matrix. It has been demonstrated that under the optimal conditions determined by this method, electro-Fenton process can lead to a complete degradation of the pharmaceutical solution after 25 min. The total organic carbon measurements indicate an efficient mineralization of 80% after 10 h of treatment. Consequently, electro-Fenton process seems to be efficient technique for the degradation of pharmaceuticals in water.

Keywords: Electro-Fenton, Trimethoprime, degradation, hydroxyl radicals.

Application of membrane process technology in concentration of polyphenols from Thymus capitatus Hoffm. & Link. plant extracts

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Abstract

Thyme, Thymus capitatus Hoffm. and Link is a Mediterranean plant very known in Tunisia, which is characterized by its antioxidant polyphenols of which most known are the carnosic and rosmarinic acids. The chemical composition of essential oils isolated by hydrodistillation from the aerial parts of Tunisian Thymus capitatus Hoff. and Link was analyzed by gas chromatography/mass spectrometry (GC/MS).The main components of the essential oils were carvacrol (71.58 %), p-cymene (8.00 %), α-terpinene (4.41 %), Linalyl acetate (1.65 %), 1,8-Cineole (1.52 %), β-myrcene (1.36 %),terpinen-4-ol (1.32 %) and α-Terpinene (1.08 %). This work constitutes a contribution to the chromatographic and biological study of the Thyme with an aim of concentrating the carnosic and rosmarinic acids by the membrane process. In addition, self made of nano and ultra filtration membranes were used to concentrate aqueous and methanolic extracts. All prepared products (permeates and retentates) of the various extracts using three types of membrane (NF-DK, NF-labo, UF-labo) and UV-visible analysis for all samples was applied. This analysis enabled us to get more informations about the content of the various products to seek the trace of rosmarinic and carnosic acids compared to the different filtrations.

The study of the antioxidant activity was carried out with three methods, the DPPH., the ABTS+., and total phenol contents. Indeed for certain concentrated extracts by membrane process, notable antioxidant effects appear and were identified. The recent development of various membrane-based techniques for the purification of valuable natural products is reviewed and based on the important research that has been conducted on the utilization of microfiltration, ultrafiltration and nanofiltration techniques in order to achieve concentration and purification of natural products from Thymus plant as a biological source.

There is also a special focus on the research that has been undertaken to overcome the choice of the membrane and its properties to have the high product yield which able as to have the most antioxidant extract (retentate and permeate) according to the specific used membrane

Keywords: Thymus capitatus; Essential oils; membrane, Antioxidant activity, DPPH, ABTS, phenol content

Impact of hydrodynamic regime on the capacity of oxygen transfer in a stirred electroflotation column

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Electroflotation appears as a new technology for industrial wastewater treatment, it is characterized by the electrochemical version of the traditional flotation, but it is distinguished by the mechanism of bubbles formation, which is usually generated by electrolyzing the treated effluent.

In this context we studied oxygen transfer in an agitated electroflotation column for various configurations of agitator blades.

The capacity of oxygen transfer is controlled by the volumetric mass transfer coefficient (K_La) experimentally evaluated for different hydrodynamic regimes, they are associated to the variation of Reynolds number relative to the agitation movement and relative to the ascensional movement of the gas bubble in the liquid phase.

Modeling the volumetric mass transfer coefficient (K_La) by the method of nonlinear regression allows the prediction of optimal treatment regime an industrial effluent.

Keywords: Electroflotation, Coefficient of oxygen transfer, Agitation, Reynolds number.

Impact du régime hydrodynamique sur la capacité de transfert de l’oxygène dans une colonne d’électroflottation agitée

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Version française

L’electroflottation se présente comme une nouvelle technologie de traitement des eaux usées industrielles, elle est caractérisée par la version électrochimique de la flottation traditionnelle, mais elle se distingue par le mécanisme de formation des bulles, qui sont générées en électrolysant habituellement l’effluent à traiter.

Dans ce cadre on a étudié le transfert de l’oxygène au sein d’une colonne d’électroflottation agitée pour diverses configurations de mobiles d'agitation.

La capacité de transfert de l’oxygène est contrôlé par le coefficient volumique de transfert de l’oxygène (K_La) évalué expérimentalement pour différents régimes hydrodynamiques, ces derniers sont liés a la variation du nombre de Reynolds relatif au mouvement d’agitation et celui relatif au mouvement ascensionnel de la bulle de gaz dans la phase liquide.

La modélisation du coefficient volumique du transfert le l’oxygène K_La par la méthode de régression non linéaire permet la prédiction du régime optimale de traitement d’un effluent industriel.

Mots clés : Electroflottation, Coefficient de transfert de l’oxygène, Agitation, Nombre de Reynolds.

Modeling breakthrough curves of nitrates sorption onto Amberlite IRA 410 resin

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Abstract

Adsorption in a liquid phase is a subject which is thoroughly studied experimentally, increasingly in modeling field. Attempts of describing breakthrough curves or leaks of filters, which show the saturation of adsorbing material, go back to Bohart's and Adams' works in 1920. Other equations with other assumptions were lately proposed (Thomas 1944, Hutchins 1973, Clark 1987 and Wolborska 1989).These models attempt to model the breakthrough curves without taking into account the system hydrodynamics that can be a significant factor of the performance. Most of these models are defined by one or two empirical parameters which allow the acquisition of the adsorption maximum capacity, the sorption kinetic constant and/or the evolution velocity of the sorption front. In spite of the importance of these key parameters in the design of an integral adsorber, they remain limited to the explored field because of the approximations assumed by authors to facilitate their use. Recently, another approach, more sophisticated, has been developed on the basis of physical mechanisms. This approach includes a group of equations integrating mass assessments, external and internal transfers as well as equations describing the water flow into the adsorbor.

The analytical solution of the equations system, presented by (1) to (5) was applied to our breakthrough curves for three parameters: the flow rate, the bed height and the initial concentration. The sorption of nitrates onto Amberlite IRA 410 resin is selected like a sorption system to validate the simulation method. The calculation program that we used showed the excellent agreement between the experimental and the calculated breakthrough curves. This agreement shows the predominance of the surface diffusion in the total process of nitrates sorption with plug flow.

$$\frac{C}{C_0}=\frac{1}{2}+\frac{2}{\pi}\int_0^\infty \exp\left[-\xi \mathrm{H}_1(\lambda)/5\right]\sin\left[2\lambda^2\tau/15-\xi \mathrm{H}_2(\lambda)/5\right]\frac{d\lambda}{\lambda} \qquad (1)$$

with H_1 and H_2 are complicated hyperbolic functions of λ and υ given by the following equations:

$$\mathrm{H}_1(\lambda)=\lambda[\sinh(2\lambda)+\sin(2\lambda)]/[\cosh(2\lambda)-\cos(2\lambda)]-1 \qquad (2)$$

$$\mathrm{H}_2(\lambda)=\lambda[\sinh(2\lambda)-\sin(2\lambda)]/[\cosh(2\lambda)-\cos(2\lambda)] \qquad (3)$$

and ξ,τ are dimensionless parameters defined as:

$$\xi=\frac{15D_S}{R_p^2}\,\frac{K_eZ}{U}\,\frac{(1-\varepsilon)}{\varepsilon} \qquad (4)$$

$$\tau=\left(\frac{15D_S}{R_p^2}\right)(t-Z/U) \qquad (5)$$

Removal of oxytetracycline by adsorption onto Activated carbon

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Abstract

Activated carbon is a highly effective adsorbent for water treatment. The adsorption of oxytetracycline (OTC) onto Activated carbon was studied. The effects of initial concentration and adsorbent dosage on the sorption capacity have been investigated.

The kinetics of adsorption was analyzed, using an agitated batch adsorber and closed loop fixed bed adsorber and to propose an adsorption mechanism. The results showed that the type of adsorber influences over the equilibrium time and the equilibrium capacity. The experimental results were fitted to equilibrium isotherm models, Langmuir and Freundlich. The equilibrium capacity based on the Langmuir analysis was 177.06 mg.g^{-1}.

The adsorption rate based on an intraparticle diffusion rate parameter derived from the plots of OTC adsorbed versus the square root of time indicated that the adsorption mechanism was predominantly intraparticle diffusion.

Key words: activated carbon, oxytetracycline, adsorption, kinetic, modeling

Removal of oxytetracycline by electrocoagualtion: adsorption and kinetics studies

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Abstract

Pharmaceuticals have attracted an increasing attention in recent years as emerging contaminants. Several kinds of drugs, such as antibiotics, hormones, preservatives and anesthetics have been identified in surface water, groundwater, sewage water, and drinking water. The most frequently detected kind in various environments is antibiotics. Antibiotics from the oxytetracycline family have been extensively used in human and veterinary medicine to treat bacterial infections. It has been established that their excessive accumulation can produce arthropathy, nephropathy, central nervous system alterations, spermatogenesis anomalies, possible mutagenecity and photosensitivity in human beings [1].The present study provides an electrocoagualtion process for the removal of oxytetracycline that was selected because of its wide application, high solubility in water and non-biodegradation. Experiments were carried out in a batch electrochemical reactor using aluminum electrodes. The study was carried out as a function of initial concentration. The results showed that the maximum removal efficiency of 98% was achieved for all concentrations studies. The mechanism of electrocoagulation has been modeled using adsorption kinetics models. The results showed that the adsorption process follows pseudo-second order model.

[1] K. Kummerer, A. Al-Ahmad, V. Mersch-Sundermann, Biodegradability of some antibiotics, elimination of the genotoxicity and affection of wastewater bacteria in a simple test Chemosphere 40 (2000) 701.

Key words: Antibiotic, oxytetracycline, electrcoagulation, kinetics models

Synthesis and characterization of new cross linked membranes based polyethersulfone for proton exchange membrane fuel cells applications

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Abstract

Proton Exchange Membranes can be used in various industrial applications : electrodialysis, fuel cells, … One of the most classic membrane is currently Nafion®, a polymer with a perfluorinated backbone, that presents excellent long term stability in both oxidative and reductive environments and high proton conductivity when fully hydrated. However, such membrane exhibits some drawbacks such as high cost and hydratation instability above 80°C.

The purpose of this work is the synthesis and the characterization of a new exchange membrane made of sulfochlorated polyethersulfone (Sulfochlorated PES) cross linked by the aminated polyethersulfone (PES-NH_2) or hexamethylenediamine. The Sulfochlorated PES and the PES-NH_2 have similar chemical structures that allow the compatibility between them. Sulfonated polyethersulfone S-PES membrane, with initially an ionic exchange capacity (IEC) of 2.38 meq/g (1.3 H^+ per monomer unit) exhibits a high degree of swelling in water and a similar ionic conductivity than that of Nafion® membrane (0.1 mS/cm), in the same measurement conditions. Chemical crosslinking of sulfochlorated polyethersulfone (1.3 Cl^- per monomer unit) was performed to obtain three news proton exchange membranes: Sulfonated Polyethersulfone Sulfonamide Polyethersulfone called $ClNH_2$, Sulfonated Polyethersulfone Hexadisulfonamide Polyethersulfone called HEXCl and Sulfonated Polyethersulfone Octylsulfonamide Polyethersulfone called UDNHO. These membranes were proposed for Proton Exchange Membrane Fuel Cell application (PEMFC) and were synthesized in Eras Labo enterprise. They were characterized by TGA, DMA, DSC, ionic conductivity, transport numbers, water swelling. PEMFC experiments have been conducted using Paxitech electrodes (0.5 mg/cm^2) for assembly membranes and electrodes (AME) (25 cm^2 moncell). The performances in PEMFC with the synthesized membranes at room temperature have been evaluated.

Reference : Mabrouk W., Ogier L., Vidal S., Sollogoub C., Matoussi F., Dachraoui M. & Fauvarque J. F.
Preparation of new proton exchange membranes using sulfonated poly(ether sulfone) modified by octylamine (SPESOS), accepted 19 mach 2011,
10.1016/j.matchemphys.2011.03.031

Keywords : sulfonated polyethersulfone, ionic conductivity, proton exchange membrane fuel cell.

Caracterisation physico-chimique des eaux de pluie. Traitement et reutilisation

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Résumé

L'eau joue un rôle considérable dans la vie sur terre, c'est un élément indispensable à toute forme de vie, c'est le composant le plus important de la matière vivante. L'eau de pluie est une ressource d'eau naturelle inépuisable. Dans le cadre de notre travail, une attention particulière est donnée aux eaux de pluie et surtout à leur réutilisation. Le présent travail se propose de contribuer à l'estimation de la qualité physico-chimique des eaux de pluie météorite et eau pluviale. Avant d'arriver sur le sol, les eaux de pluie subissent la pollution atmosphérique et peuvent ainsi dégrader le milieu naturel si elles ne sont pas traitées. Les eaux de pluie ont été récupérés sur plusieurs sites du bassin hydrographique Algérois –Hodna-Soummam. Les paramètres physico-chimiques analysés sont le pH, la T, la CE, les MES, la DBO et la DCO et les ions Ca^{2+}, Mg^{2+}, Na^{+} , K^{+}, SO_4^{2-}, Cl^{-}, NH_4^{+} , NO_3^{-} NO_2^{-} et PO_4^{3}. Une plante a été utilisée pour traiter ces eaux de pluie. Les eaux de pluie ont été analysées avant et après l'utilisation de la plante. Les différents paramètres ont été analysés par volumétrie, DCO- métrie, spectrophotométrie UV- Visible et spectrophotométrie de flamme.

Mots clés : Eaux pluviales, eaux de ruissellement, analyses physico-chimiques, valorisation.

Étude de l'effet de substances pharmaceutiques sur les microorganismes épurateurs dans une station d'épuration

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Résumé

Depuis quelques années, la présence de substances pharmaceutiques a été observée dans l'environnement notamment dans les milieux aquatiques y compris dans l'eau potable. Les principales sources de dispersion de ces composés dans l'environnement sont les stations d'épuration des eaux usées (STEP). Ces molécules se retrouvent dans les eaux usées. Elles peuvent avoir des effets sur la biomasse des stations d'épuration car elles sont, par définition, destinées à avoir un impact su l'organisme vivant.

Dans le procédé de traitement des eaux usées par boues activées de nombreux microorganismes épurateurs (Vorticelle, Coleps, Episttlis…) sont associés aux colloïdes organiques et organométalliques présents dans l'eau usée.

Le but de ce travail est d'examiner le comportement bactérien via l'analyse microscopique en présence de molécules médicales tout en estimant la capacité d'épuration bactérienne et l'effet de présence de ces molécules, selon la méthode des plans d'expériences, sur les paramètres de pollution (pH, MO, NO_2^-, HCO_3^{--}, SO_4^{2-}, DCO, DBO… etc.).

Nous avons étudié trois types de médicaments sous trois formes galéniques différentes, Antibiotique (doxycycline 100 mg « Gélules »), Antifongique (kétoconazole 2% « Crème dermique ») et un Antihistamique (loratadine 10 mg « Comprimés»).

Mots clés: station d'épuration, micro-organismes, médicaments, paramètres de pollution

Caractérisation et valorisation d'un effluent agro-alimentaire. Traitement anaérobie pour réduire la matière organique et les substances nutritives

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Abstract

Les eaux résiduaires de la laiterie comme toutes les industries agro-alimentaires, utilisent énormément d'eau pour la fabrication de produits de consommation. Ces eaux sont fortement polluées par une charge essentiellement organique. Enormément de directives insistent sur le traitement de ces eaux. Beaucoup d'études proposent le traitement biologique qui est fortement contraignant dans beaucoup de cas.

Dans cette étude nous avons opté pour un traitement biologique par voie anaérobie d'une eau usée issue d'une industrie agro-alimentaire. La digestion anaérobie est la dégradation de la matière organique par des bactéries et production d'un biogaz composé essentiellement de méthane et de dioxyde de carbone.

Nous, nous sommes intéressés dans une première étape à caractériser et analyser les paramètres physico-chimiques de pollution d'un effluent provenant d'une laiterie qui est directement déversé dans un oued. Les résultats des analyses ont montré que la teneur des paramètres physico-chimiques de pollution dépassait largement les normes de rejet. Dans la deuxième étape nous avons appliqué à cet effluent un traitement biologique par voie anaérobie. Le suivi de l'évolution des ions NO_3^- , PO_4^{3-}, SO_4^{2-} , Ca^{2+} et Mg^{2+}, de la DCO et de la DBO avec l'optimisation des conditions physico-chimiques (pH, température, agitation) durant le traitement a montré que les meilleurs rendements ont été obtenus avec agitation à la température de 20°C et un pH égal à 6.5 et la dégradation des paramètres DCO et NO_3^- a atteint des rendements d'élimination de l'ordre de 70 et 66% respectivement.

Mots clés : Eau usée, pollution, valorisation, effluent agro-alimentaire, traitement anaérobie.

Treatability and COD fractionation of high salinity industrial wastewater

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Abstract

This study was carried out at a centralized activated-sludge (AS) wastewater treatment plant (WWTP) that receives the discharges of nearly 140 factories from an industrial park. The work was done in the context of a future project for improving the quality of the WWTP effluent, to make possible its reuse. The objective of this research phase was to evaluate the limits of the currently applied treatment process (conventional AS), and identify the most promising options of tertiary treatment, based on the specific characteristics of the wastewater. The COD fractionation pattern (based on ASM1, activated sludge model N°1) was determined, and some physico-chemical analyses, respirometric and biodegradation batch tests were ran. The wastewater was particularly characterized by a relatively high salt content (5459 μS/cm conductivity) and COD concentration (2503 mg/L), associated with a low BOD_5 (568 mg/L) and normal ranges of pH (8.0), nitrogen (48 mg/L NH_4-N and 87 mg/L TKN), and phosphorus (10 mg/L P). The BOD_5/COD and BOD_5/N/P ratios were 0.24 and 100/15/2, respectively, which were sustainable for the AS process. However, the degradability of the organics in the WW was shown to be limited by the high content of inert soluble COD (S_I), as revealed by the COD fractionation pattern: 0.6% of S_S (readily biodegradable), 39.4% of S_I, 37% of X_S (slowly biodegradable) and 23% of X_I (particulate inert COD). The degradable COD fractions ($S_S + X_S$) were practically removed at 100% in the batch tests, but the effluent quality left by the treatment still was highly colored and organically charged (40 to 50 % of the initial COD, mostly in inert form). As expected, the salinity was not lowered by the treatment; furthermore, it was the main cause of the erratic operation of the oxygen sensors at the plant and of the filamentous nature of the biomass. To meet the WW reuse objectives, the plant requires some additional processes; tertiary membrane treatment (reverse osmosis) and/or membrane bioreactors (MBR) were recommended.

Key Words: Activated sludge; salinity, COD fractionation, ASM1, reuse, membranes.

Etude numérique de l'effet de l'hétérogénéité chimique d'un milieu poreux sur la dispersion réactif

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Résumé

La théorie de transport de soluté en milieux physiquement homogène prévoit que lorsque l'interaction consiste en un équilibre d'adsorption, la variance temporelle réduite de la percée du réactif est égale à celle de la percée du traceur de l'eau. Ce constat signifie que les molécules du traceur interactif suivent les mêmes chemins que celles de l'eau, mais que leur panache est seulement plus étalé dans le temps en raison de la rétention.

Cependant, des expériences réalisées au sein de l'équipe "séparation par les milieux poreux de Nancy (France)" sur des colonnes de milieux poreux naturels, montrent des percées du réactif plus étalées que les percées du traceur de l'eau [1]. Ces écarts peuvent engendrer de sérieux problèmes dans le domaine du traitement de l'eau à travers des lits de milieux poreux naturels, comme dans l'étude du transport des polluants dans les aquifères.

Parmi les différentes origines de cet écart disponible dans la littérature, l'hétérogénéité chimique du milieu nous parait la plus plausible, en particulier lorsque les temps caractéristiques d'éventuel transfert de matière ou de cinétique d'adsorption sont faibles. Ainsi l'objectif principal de ce travail est de montrer l'existence d'un lien direct entre l'échelle de l'hétérogénéité chimique d'un milieu physiquement homogène et la dispersion d'un soluté interactif.

Cette étude portera sur la modélisation numérique du transport de soluté à travers un lit en introduisant l'hétérogénéité chimique du milieu poreux comme un nouveau paramètre dans l'équation du transport (EADF). Le milieu est considéré réparti en bandes transversales actives et non actives. La distribution de l'hétérogénéité est alors unidimensionnelle et sa longueur est calculée selon l'équation1.

$$\lambda = n \cdot d_p \qquad \text{éq.1}$$

On définit la fonction d'hétérogénéité chimique en fonction de la position par Γ(x), la probabilité de rencontrer un grain actif dans la direction de l'écoulement :

$\Gamma(x) = 1$: si on est dans la zone active ;

$\Gamma(x) = 0$: si on est dans la zone non active.

L'équation du transport advection dispersion Fikienne devient alors :

$$U\frac{\partial C}{\partial x}+\left[1+\rho k_{d}\left(\frac{1-\varepsilon}{\varepsilon}\right)\Gamma(x)\right]\frac{\partial C}{\partial t}=D_{L}\frac{\partial^{2}C}{\partial x^{2}} \qquad \text{éq.2}$$

La distribution de l’hétérogénéité chimique Γ(x) dépend de la distance λ.

La résolution de cette équation est faite par la méthode des volumes finis suivant l'algorithme de BASHFORT.

Les résultats issus de cette étude ont montré que lorsque l'échelle de l'hétérogénéité augmente, les percées sont de plus en plus dispersées par rapport à la DTS et deviennent de plus en plus asymétriques. Par ailleurs la comparaison des DTR et des DTS à la même hétérogénéité en fonction de la longueur a montré que l'influence de la longueur sur les DTS est importante comme le prévois la théorie, cependant une très faible dispersion de la DTR obtenue sur les milieux courts par rapport au milieu long.

Mots clés: transport réactif, modélisation, hétérogénéité chimique, milieu poreux.

1. *Semra.S., 2003, Dispersion de soluté réactif en milieu poreux chimiquement hétérogène Thèse de doctorat INPL, Nancy, France.*

Study of a veterinary antibiotic degradation by TiO2 /UV photocatalysis

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Abstract

Currently, water polluted by pharmaceuticals effluent, namely traces of antibiotics, anticancer drugs, analgesics, antidepressants, anti-inflammatory drugs, hormones or beta-blockers is a major concern for researchers in the environment field, particularly in water treatment.

However, it is important to develop techniques for water treatment in order to meet the needs of pharmaceuticals degradation present with a threatening manner in wastewater.

Among Advanced oxydation processes, heterogeneous photocatalysis has proved to be of real interest as efficient tool for degrading aquatic organic contaminants. Heterogeneous photocatalysis involve the acceleration of photoreaction in presence of semiconductor photocatalyst.

The objective of this work is to validate the effectiveness of pharmaceutical effluent treatment by the TiO_2/UV photocatalysis process. The interest of this study is not only on the degradation of the effluent, but also on a better control and understanding of the process by studying the reaction kinetics.

Thus, degradation experiments of antibiotic tylosin were made by varying the initial concentration of pollutant in the presence of titanium dioxide powder in aqueous suspension. The initial pollutant concentration are in the range of 15 to 80 mg.L^{-1}. The photocatalytic degradation rate of tylosin is between 82% and 87% for the selected concentrations, a maximum degradation is observed for low concentrations (15 and 30 mg.L^{-1}). The application of Langmuir-Hinshelwood model has led to the determination of the rate constant of tylosin photodegradation.

The obtained results are satisfactory and encouraging for advanced applications in the field of pharmaceutical micropollutants treatment.

Keywords: Photodegradation ; pharmaceuticals ; photocatalysis ; titanium dioxide ; kinetics

Synthesis of MgAl Layered Double Hydroxides
Application to the treatment of water

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Abstract

The present paper focuses on the direct synthesis of MgAl LDH by concomitant addition of Mg and Al chloride in solution with NaOH solution, at a constant pH value of 10. Various Mg/Al ratios (Mg/Al = 2, Mg/Al = 3) were investigated and samples were collected after successive additions. Each sample was then analyzed by Small Angle X-ray and infrared spectroscopy.

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

The adsorption of the phthalate and triton X100 neutral molecule by hydrogen bonding or Van der Waals interactions on [Mg_2AlCl] and [Mg_3AlCl], is lower than the adsorption or exchange of $K_2Cr_2O_7$ charged molecule.

Keyword : LDH, adsorption, inorganic molecules, organic molecules,

Study On An Activated Sludge Stirred Reactor Application : Wastewater Treatment

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Abstract

Bioreactors are commonly used in environmental industry. These reactors have proven to be effective for soil remediation, and in some cases for water, polluted with fuel hydrocarbons (oil, gasoline and diesel) and organics.

In order to identify which parameters control mass transfer efficiencies in bioreactors, hydrodynamic and mass transfer parameters have been investigated for gas-liquid and gas-liquid-solid systems in a mechanically agitated tank. For this purpose, experiments were performed in a cylindrical glass column (D= 0.25m and H=0.25m) at laboratory temperature and atmospheric pressure. The following parameters have been investigated under different operating conditions of gas (air), liquid (tap water) and solid (soil) :

- Gas hold-up was determined by the difference height method,
- Bubble size was determined by image acquisition and data treatment systems,
- Volumetric mass transfer coefficient was determined by the 'gasing out' method.

The different techniques applied on the bioreactor allowed a complete characterization of hydrodynamic and mass transfer phenomena. This experimental study was conducted to evaluate the influence of solid concentration on the bioreactor performances and to initiate a mass transfer model.

Keywords: Stirred tank, Gas hold-up, Bubble diameter, Oxygen mass transfer, bioreactor.

Removal of linuron from water suspension by heterogeneous photocatalysis at 365nm

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Abstract

The advanced oxidation processes (AOPs) represent a promising alternative technology for pollutant destruction contained in wastewater. The most important of these AOPs is the photocatalysis in presence of TiO_2 particles. It is based on the formation of electrons and wholes due to the excitation of the semi-conductor particles by UV irradiation. These charge carriers either recombine or move to its surface where they react with adsorbed molecules.

In the present work, the degradation of linuron in aqueous solution by UV radiations is performed using a double-helical photochemical reactor. The herbicide kinetic photodecomposition, the effects of initial pollutant and TiO_2 concentration, pH value (3 to 11), solution flowrate have been studied in order to evaluate the performances of this reactor. Different types of catalysts (DT51, EL10, PC105, P25, T42 and PC500) have been also studied. The UV lamp (HPA 18W/S with a monochromatic radiation at 365 nm and a nominal power of 18 W), is set in axial position in the open space of the sheath.

The effect of different processes on the linuron photodegradation has been studied. As such, the experimental results showed that the disappearance rate of linuron increased significantly during photocatalysis compared to adsorption and photolysis. Furthermore, during photolysis, adsorption and photocatalysis, respectively 40%, 65% and 96% of linuron have been eliminated after an irradiation time of 3 hours.

The parametric study of the pollutant oxidation showed that the degradation depended on the solution pH, the initial concentration of linuron, the TiO_2 concentration and on the flowrate of the reactional mixture. Furthermore, we noted that an increase in the initial concentration of linuron disadvantaged the reaction; an adjustment of the pH at 3 with H_3PO_4 gave a better degradation for the pollutant. The variation of pH value in the system also indicates the formation of inorganic and organic acids which caused the pH of the solution to drop. We observed that a low flowrate through the reactor removed a significant quantity of linuron.

Even though linuron was slightly adsorbed on P25, the best degradation was observed with this photocatalyst. Photodegradation of linuron process accords well with Langmuir-Hinshelwood pseudo-first order kinetics.

Keywords: herbicide, linuron, AOPs, titanium dioxide, TiO_2, suspension, UV radiation.

Photooxidation of an herbicide (linuron) on Immobilized Titanium Dioxide Catalyst

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Abstract

Nowadays, organic micropollutants like linuron are known as a distinct characteristic of water pollution. A number of toxic and dangerous organic micropollutants have been found not only in source water or effluent, but also in drinking water, therefore, the removal of organic pollutants from water has become an important objective in water treatment. The directives from the world health organization about the quality of drinking water are so severe that the conventional water treatment methods, such as chlorination or adsorption on porous solids does not permit a complete removal of the toxic components, which are, in addition of this bio-refractory can damage the central nervous system, liver, kidney and blood of humans and animals.

In the present work, the study of linuron herbicide photodegradation has been released in a photoreactor containing immobilized layers of TiO_2 catalyst. The advantage of this type of photoreactor comparing to the slurries, is that neither separation nor filtration are needed. For immobilization of TiO_2 particles, we used glass sheet as support and four layers have been deposited and calcined at 475 °C. Photocatalytic degradation of linuron in aqueous thin film flowing over illuminated particulate layers of titanium dioxide in batch-mode plate photoreactor was investigated using titanium dioxide P25 (Degussa) under 18W high pressure mercury lamp irradiation. The effect of the distance of UV irradiation tube from glass plate, the initial concentration of linuron, the flowrate, UV light irradiation time and pH solution were studied and optimized values were obtained. Results showed that this process with optimal operational parameters may lead to complete degradation of linuron. Thus, the photocatalytic degradation efficiency of linuron was increased by the decreasing amount of pollutant, flowrate and distance, the oxidation was equal to 90% after 7 hours of illumination, best results for linuron degradation were obtained at acidic pH, and at pH = 1 and pH = 2 the linuron was degraded to 80% after 7 hours of irradiation time. The effect of UV-light irradiation time on the photocatalytic degradation of the linuron showed that it was degraded at irradiation time of 7 hours and it is also evident that the percentage of photodegradation increases with increasing irradiation time. The position of 5 cm is the best one to obtain more than 90% of degradation. The rate constants for the different parameters were evaluated. The kinetics were described by the Langmuir-Hinshelwood kinetic model. An overall pseudo-first order kinetic constant has been calculated for linuron conversion. In this work, we remarked that we used the prepared catalyst during 600 hours without obvious decrease in catalytic activity.

Keywords: linuron, advanced oxidation process, titanium dioxide, immobilized layers, UV radiation.

Application d’un procédé d’oxydation avancé à l’élimination d’un antibiotique en présence du dioxyde de titane en suspension

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Résumé

Les progrès de la science permettant de manipuler la matière, qu’elle soit minérale, organique ou vivante, font que l’homme est confronté à des situations qu’il n’avait jamais éprouvées auparavant. Les rejets industriels présentent des propriétés physico-chimiques, biologiques et écologiques très variables ce qui empêche la prédiction de leur action néfaste sur l’environnement car le facteur temps modifie les contraintes. Devant l’échec des méthodes traditionnelles telles que l’oxydation par le chlore ou par l’ozone, l’adsorption sur charbon actif et les traitements biologiques, de nouveaux procédés de traitement ont été proposés: ce sont les techniques d’oxydation avancées (H_2O_2/O_3, O_3/UV, H_2O_2/UV, TiO_2/UV,...), très efficaces pour la dégradation des polluants de l’eau. Dans le présent travail, nous nous sommes intéressés à la dégradation photocatalytique de la tylosine dans un photoréacteur à double spirale dans lequel circule une suspension aqueuse contenant du dioxyde de titane de type Dégussa P 25. L’étude a été réalisée en présence d’une irradiation d’une puissance de 18 watts émettant à 254 nm. Plusieurs paramètres ont été étudiés et optimisés: le débit de recirculation, le temps d’exposition aux radiations UV, la concentration en polluant et en catalyseur, la nature de l’acide et de la base permettant de donner la meilleure élimination du polluant, le pH de la solution (3 à11 ajusté et non ajusté) ainsi que l’effet de l’oxydant H_2O_2. Les performances de différents catalyseurs (DT51, EL10, PC105, P25, PC 500 ainsi que T42) ont été étudiées.

Les résultats ont montré que ce procédé avec l’utilisation des paramètres opératoires optimisés peut conduire à une dégradation totale de la tylosine. Ainsi, la photodégradation est favorisée pour une concentration faible en polluant et en catalyseur ainsi qu’un fort débit de recirculation du mélange réactionnel. Notons qu’au bout de 3 heures d’irradiations, l’élimination de l’antibiotique est totale en présence de H_2O_2 à une concentration de 1g/L, de plus la meilleure dégradation a été obtenue par utilisation de H_3PO_4 à un pH 3 non ajusté et à un pH 5 ajusté, l’oxydation a été totale au bout d’une heure. La photolyse de la tylosine a permis d’atteindre un taux d’élimination ne dépassant pas 60%, la photocatalyse 90 %, le procédé UV/ H_2O_2/TiO_2, quant à lui a conduit à une oxydation totale du polluant. La dégradation de la tylosine sur les différents catalyseurs a montré qu’une forte adsorption sur un adsorbant ne mène pas nécessairement à un meilleur taux d’élimination.

Les constantes de vitesses de pseudo-premier ordre ont été déterminées pour les différents paramètres étudiés, ainsi les valeurs obtenues aux pH acides sont plus élevées que celles obtenues aux pH basiques, l’étude cinétique a démontré la grande activité et efficacité du dioxyde de titane Degussa P25, ainsi, nous avons observé une dégradation de 100 % en tylosine au bout de 3 heures d’irradiations UV dans les conditions optimales. Les cinétiques ont été convenablement décrites par le modèle de Langmuir-Hinshelwood (L-H), permettant la détermination des constantes cinétique et d’adsorption.

Mots clés: POAs, photocatalyse, polluant, tylosine, suspension, TiO_2.

Biosorption of lead from aqueous solution by biological activated dates' pedicels : Batch and column study

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Abstract

The biosorption of lead by biological activated dates' pedicels (ADP) using a batch system and a continuous up-flow fixed-bed column was studied. Batch experiments were conducted to determine the biosorption capacity, equilibrium time and optimal pH. The maximum biosorption capacity of lead was 11.5 mgg^{-1} at optimal pH of 5.2. The Langmuir and Freundlich models were used to explain the equilibrium data. The Langmuir model showed

better fit of data with correlation coefficient of 0.98. The kinetics of biosorption followed pseudo second order model. For continuous biosorption experiments, breakthrough curves were analyzed at different flow rates and bed depth. Bed depth service time (BDST) and the Thomas models were used to describe the experimental data. A solution of 4 g/L $CaCl_2$ did well to elute lead from biomass. The release of Ca, Mg and Na ions during lead biosorption revealed that ion exchange was the major removal mechanism.

Keywords: Lead, Biosorption, Kinetic study, Equilibrium isotherm, fixed bed.

Physicochemical and microbial caracteristics performency in wastewater treated under nitrification reactor

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Abstract

The current work study the hydraulic and biogeochemical mechanisms brought into treatment process on a filter bed (gravel) which could be used in small agglomerations. Experiments were conducted on a gravel filled PVC column fed with primary wastewater at a pulsed rhythm of 2 sequences per day (54 per day) separated by anoxia-aerobic phase. PVC column is 315 mm in diameter and 200 cm in height; it is filled with gravel with not homogeneous particle size (8-10 mm in diameter) at 168 cm of height. The column is equipped with sampling at 85 cm of depth. For performances study process, physicochemical and bacterial analyses (with MPN method) effluent at inlet and outlet of column were realized. The results showed that through filter mass a significant removal of suspended solids by filtration (94%), organic matter degradation, oxidation of nitrogen compounds in the form of nitrate by bacteria that grow attached within massif. Orhophosphates removal is not important. The microbial abatement results is <1.1 Log units of indicators fecal contamination (fecal coliforms, fecal streptococci and E. coli). The microbial water quality is slightly higher than Tunisian standard.

Keywords: Aerobic nitrification reactor, pulsed rhythm, bacterial analyses, physicochemical parameters, Chemical Oxygen Demand (COD), Suspended Solids (SS), Biological Oxygen Demand (BOD_5).

Biosorption of phenol by dried biomass

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Abstract

Removal of hazardous compounds from industrial effluents is one of the growing needs of the present time. Phenols are considered as priority pollutants since they are harmful to organisms at low concentrations and many of them have been classified as hazardous pollutants because of their potential to harm human health. Chronic toxic effects due to phenols reported in humans include vomiting, difficulty in swallowing, anorexia, liver and kidney damage, headache, fainting and other mental disturbances. The maximum concentration of total phenols in drinking water is given as 0.5 μg dm^{-3} by the European Union [1–3]. Adsorption is a well established and powerful technique for treating domestic and industrial effluents. Activated carbon is the most widely and effectively used adsorbent. However, its high initial cost and the need for a costly regeneration system makes it less economically viable as an adsorbent. The potential use of dried Pleurotus mutilis: waste of a drug produced by fermentation as a substitute for powdered activated carbon for removal of phenol from aqueous solution was examined. Some pre-treatment of dried Pleurotus mutilis, such as washing by distilled water or rinsing with HCL solution, has been done.

We examined the static kinetic of adsorption of the Phenol /dried biomass system using phenol as a pollution model. UV/Visible spectrophotometry is used as a method of analysis. The influence of some essentials parameters, namely, initial phenol concentration, contact time, temperature and particle size on the static adsorption of the phenol/biomass system has been investigated.

The adsorption studies of phenol from aqueous solution on dried Pleurotus mutilis biomass have been studied in the range of 25–70 mg/L initial phenol concentrations and at the temperatures of 25, 30 and 45°C. The maximum phenol adsorption yields was obtained at the temperature of 30°C at pH=6.5, the equilibrium uptake increased with increasing initial phenol concentration and the best adsorbed amounts were obtained for particle sizes between 0,05 and 0,4 mm for biomass Pleurotus Mutilus.

Langmuir and Freundlich isotherms were used to analyze the equilibrium data at differents temperatures. The results show that experimental data fit perfectly the Langmuir model.

Keywords: Adsorption; phenol; dried biomass; Pleurotus mutilis

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Numerical study of evaporation by mixed convection of a binary liquid film flowing down the wall of two vertical plates

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Abstract

This paper deals with a numerical analysis of the evaporation of binary liquid film flowing on one of two parallel vertical plates under mixed convection channel. The first plate is externally submitted to a uniform heated flux q_1 and wetted by a film while the second one (y = d) is dry and isothermal. The liquid mixture consists of water (the more volatile component) and ethylene glycol while the gas mixture has three components: dry air, water vapour and ethylene-glycol vapour. The set of non linear and coupled equations expressing the conservation of mass, momentum, energy and species in the liquid and gas mixtures is solved numerically using a finite difference method. The results concern the effects of the inlet parameters in the gas and in the liquid mixtures on the water evaporation rate. As was found in some former work, this study shows that it is possible to evaporate in the same conditions more water than if the film at the entry was pure water only. The main objective of this study is to clarify the existence and the physical origin of this unexpected phenomenon.

Key words: Binary mixture, Binary liquid film, Evaporation, Combined heat and mass transfer, Mixed convection, Laminar flow.

Photocatalyic Degradation Of Tylosin
In An Aqueous Suspension Using UV/ZnO In Helical Reactor

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Abstract

In the setting of the waters purification, some molecules appear recalcitrant to the traditional treatments. The exploitation of the properties of some catalysts permits to amplify the oxidization performances with ultraviolet radiance and to damage this pollution by a non biological way. This study was conducted to investigate the effect of a photocatalysis oxidation system for organic pollutants treatment. Oxidative degradation of Tylosin by hydroxyl radicals (OH°) was studied in aqueous medium using suspended forms of ZnO and UV light.

The results improve that the treatment was affected by many factors such as flow of solution, initial pollutant concentration and catalyst concentration. The rate equation for the Tylosin degradation followed first order kinetics and the rate-constants were determined.The reaction rate fitted well with Langmuir– Hinshelwood model and the removed ratio of Tylosin was 97 % in less than 60 minutes.

To adopt this technique in industrial scale, the reactor design is very important. The experimental device was constituted of a helical glass reactor with double streamer (double helical pipe) of 2 m and volume of 0,8 L, that is also placed in a fluid buckle recirculation system composed by a perfectly agitated reservoir of 2 litters. The solution flow containing the Tylosin is assured by a peristaltic pump. The UV irradiation is done by UV lamp (Phillips ATLD 24W) which was centred on the length of the reactor.

To determine the optimum catalyst coating, a series of experiments were carried out by varying the amount of catalyst from 0.05 to 0.5 g/L. The results demonstrate that the rate of photodegradation is optimum with catalyst coating of 0.1 g/L. The optimum reaction flow rate is 3.787 mL/S.

One of the most important parameter in heterogeneous photocatalysis is the pH of the reaction mixture, since it influences the surface charge properties of the photocatalyst and adsorption behavior of the compound. Therefore, the photocatalytic degradation of both compounds was investigated at different pH values. Employing ZnO as photocatalyst, the degradation of Tylosin was studied at different pH values (Free pH and pH=6 ,9, 12) . Highest efficiency was observed at free pH.
The effect of substrate concentration on the degradation of Tylosin was studied at different initial concentrations. The degradation rate for the decomposition of pollutant was a function of substrate concentration employing ZnO as photocatalyst. The rate was found to increase with the Decrease in substrate concentration from 30 to 5 mg/L.
Therefore, this simple photoreactor design for the removal of organic pollutants has the potential to use in wastewater treatment from pharmaceutical production and other industries.

Keywords: TOA (Advanced Technique oxidization), oxidization, photocatalysis, ZnO, UV, Tylosin

Study of a new desalination unit using humidification – dehumidification process

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Abstract

Worldwide water, especially in the developing world, indicates a pressing need to develop inexpensive and simple desalination technologies which use solar energy. Simple basin solar still is one of the simplest and most promising of these technologies. However, the productivity is very low. The purpose of this study is to combine the simple solar distillation with humidification – dehumidification process. This manner of operating is made to increase the condensate output from the system. The process consists of air passing through seawater situated on simple basin solar still. Then, the humid air follows a condensation step in order to provide potable water as a condensate. The operation principle of this unit will be presented. Using this new equipment, a small pilot plant could be constructed and run to test the new process under different operating conditions. The results of these tests will be presented and interpreted.

Key words: Solar desalination, solar still, humidification – dehumidification, operating conditions.

Marble powder wastes reuse as a low cost material for phosphorus removal and recovery from aqueous solutions under dynamic conditions

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Abstract

In this study, Marble powder wastes (MPW) generated from marble industries, were used as a cost-effective adsorbent to investigate the phosphorus removal from synthetic and urban secondary treated wastewater solutions. Dynamic experiments using continuous stirring reactors (CSTR) were carried out to study the effect of phosphate influent concentration, MPW dosage and feed flow rate on phosphate removal. The experimental results show that the phosphates removal efficiency is essentially dependent on the influent feeding flow rate. The influent phosphates concentrations and the MPW are also key parameters. For an influent phosphates concentration of 100 mg/L, the best removal efficiency (more than 90%) was observed for two CSTR disposed in serial, a feeding flow rate lower than 4.5 mL/min and a MPW of 12 g/L. The application of this system to the removal of phosphates from an urban wastewater proved that it has similar efficiency to the synthetic solutions and confirmed that the competition effect with the other anions such as chlorides, sulphates and nitrates is negligible.

In comparison with other natural adsorbents, MPW could be considered as one of the most efficient natural materials for the removal and recovery of phosphorus with the possibility of agronomic reuse as fertilizer.

Key-words: phosphorus; adsorption; marble wastes; CSTR.

Phosphates removal from aqueous solutions by marble wastes under static conditions

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Abstract

Marble wastes generated by marble industry with abundant amounts were used in this study as a low cost adsorbent to investigate the phosphate anions removal from synthetic solutions under static conditions. Batch assays were carried out to study the effect of some key parameters such as phosphate influent concentration, contact time, marble dosage and pH on phosphate removal. The batch experiments results showed that marble wastes have relatively high phosphates adsorption capacity compared to several natural materials. Indeed the adsorption capacity determined from Langmuir isotherm exceeds 35 mg/g. Furthermore, the adsorption process is favored for acidic pH values, when increasing initial aqueous concentrations and marble wastes dosage. The phosphates removal efficiency from the aqueous solutions exceeds 90% for adsorbent dosage higher than 2 g/L. On the other hand, the adsorption modeling studies showed that phosphates adsorption is well described by second order model and was essentially controlled by the boundary layer diffusion process.

The FTIR and EDS analyses confirm that the phosphorus adsorption by marble wastes is essentially controlled by chemisorption processes including both ion exchange and complexation. The cost-effective and high adsorptive capability of marble wastes make them attractive materials for phosphate anions removal and recovery from secondary treated wastewaters with the possibility of agronomic reuse as fertilizer.

Key-words: wastewater; marble wastes; Batch; phosphorus; Removal.

Catalytic ozonation of oxalic acid over Cobalt supported on activated carbon

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Abstract

Advanced oxidation processes (AOPs) were frequently selected as a treatment option to oxidize refractory and toxic organic compounds present in water. Because of their high cost in treatment, traditional AOPs, such as photocatalysis or catalytic wet oxidation, can hardly affect the efficacies of the process. Heterogeneous catalytic ozonation, a novel alternative to traditional AOPs, has received wide interest as a promising technology for removing refractory organic pollutants in water. The mineral matter present in the activated carbon positively contributes to its activity to enhance the ozonation process.

The aim of this study is to investigate catalytic activity of Cobalt supported catalyst on activated carbon on ozone oxidation of oxalic acid.

The heterogeneous Cobalt catalyst was prepared by wetness impregnation of the precursor salts $Co(NO_3)_2$ $6H_2O$ at 50°C for 24 h followed by calcination at 750°C and reduced in N_2 flow (400ml/min). the Co/AC catalyst was characterised by BET . Semi batch experiments in a liquid_gas reactor were conducted to investigate the effects of the amount and the type of catalyst, temperature of oxidation, pH, and initial oxalic acid concentration on catalytic ozonation of organics in water. The results show that the presence of either activated carbon or Co/AC catalyst considerably improves the degradation of the acid compound and the TOC removal when compared to simple ozonation. It was found that Co/AC is a promising catalyst for ozonizing organic pollutants in the aqueous solution.

Investment and production costs of desalination plants by semi-empirical method

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Abstract

Energy consumptions and costs of desalting systems are among the main parameters affecting the choice of certain desalting system and desalted water final cost. The paper describes a semi-empirical method for determining production and investment costs taking into account plant capacity, availability, energy price and consumption, plant capital cost, membrane service life and other process variables. This study concerns the different desalting processes of seawater, namely distillation multi-stage multi-flash, distillation multi-effect, vapour compression and the reverse osmosis. Results show that this method can give a good estimation of the investment and production costs for the concerned processes. Surely, this method can be useful especially in the maturation and the feasibility of any project in the field of desalination. So that most decisions of realization of any project can be taken in a relatively short time and therefore, costs of engineering can be reduced considerably.

Keywords : Desalination, Process, Economical, Plant

Sorption Efficiency of a New Sorbent Towards cadmium(II): MethylPhosphonic Acid Grafted Polystyrene Resin

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Abstract

A new chelating polymeric sorbent has been developed using polystyrene resin grafted with amino methylene phosphonic acid. After characterization by FTIR and elementary analysis, the new resin has been investigated in liquid–solid extraction of cadmium(II). The results indicated that phosphonic resin could adsorb Eu(III) ion effectively from dilute aqueous solution. The adsorption was strongly dependent on pH of the medium with enhanced adsorption as the pH value of 6.5. The influence of other analytical parameters including contact time, amount of resin, metal ion concentration, and ionic strength were investigated. The maximum uptake capacity of Cd(II) ions was 122.6 mg/g grafted resin at 25 ± 2 °C, at an initial pH value of 6.50. The overall adsorption process was best described by Lagergren-first-order kinetics. When Freundlich and Langmuir isotherms were tested, the latter had a better fit with the experimental data. Furthermore, Eu(III) could be eluted by using 0.5 mol/L HCl solution and the grafted resin could be regenerated and reused.

Kinetics of cadmium adsorption by the smectite Oued Tfal (GAFSA BASIN)

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Abstract

In Tunisia, the clays are abundant substances and are among the valuable materials whose valorization is very important to the economy. These materials constitute the raw material for manufacturing products as varied as construction materials (cement, bricks, tiles, pottery ...) molds for foundries, drilling muds the bleaching earth. They are also used in the composition of certain industrial fine chemicals (pharmaceuticals, cosmetics, catalysts…). Clays owe their industrial applications to their physicochemical properties such as plasticity, swelling power and adsorption, rheological properties and cation exchange capacity.

The metal adsorption by clays is widely studied: the classical method consisted to mix a volume of metal solution with a mass of clay and then made series of agitation- centrifugation, the supernatant was analyzed by atomic absorption method to determine the concentration adsorbed by clay, but this method presents several disadvantages.

This work aims to studying the influence of a new method that using membrane filtration to determine the maximum amount of metal adsorbed by clay.

To confirm the effectiveness of such method, several identification techniques was used such as chemical analysis, XRD, IR, CEC, BET.

The results of adsorption show a huge value Qe_{max} , so the effectiveness of this method.

Keywords: Smectite, adsorption, membrane, metal

Effect of physico-chemical treatments on the biodegradation of the liquid effluents of paper industry

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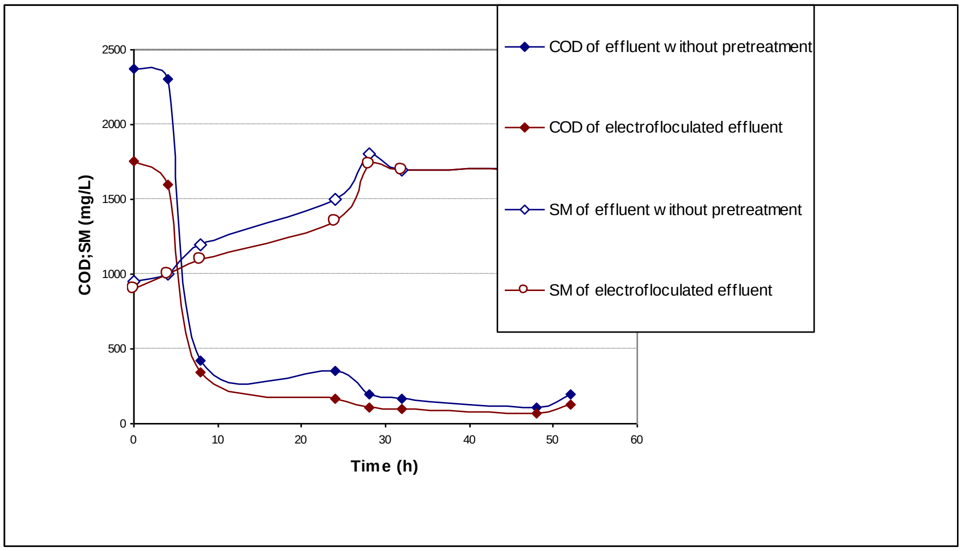
Abstract

The pulp and paper industry was always characterized by important impacts that are related by the technical, economic or social aspect. Indeed, the paper industry which uses Alfa as raw material that is a big consumer of water which involves a great quantity of hydrous effluents. Thus, the treatment of these liquid effluents is now a challenge for the industry increasingly difficult to maintain. Because the regulation and the standards to track down the pollutant thresholds lower and lower in the effluent treatment admitted in station of communal purification or rejected in the natural environment in order to protect the environment. This work aims to study of the effect of the physico-chemical treatments on the biodegradability of liquid effluents of paper industry. Treatment by electrofloculation can achieve a percentage reduction of COD abatement around 60%. Furthermore, the rate of COD abatement is 91% by biological treatment by activated sludge in batch for 24 hours of culture. However, the kinetic studies of the biological degradation in batch of the untreated, filtered and electrofloculated effluent show that the pre-treatment of the rejection allows a reduction in the polluting load and facilitates the biological treatment.



Evolution of the SM and the COD of various biodegraded effluents over time.

Geochemical evolution of groundwater in an alluvial aquifer : case of el eulma aquifer, east algeria

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Abstract

Hydrochemical, multivariate statistical and inverse hydrogeochemical modeling techniques were used to determine the main factors and mechanisms controlling the chemistry of groundwaters in the El Eulma Mio-Plio-Quaternary aquifer, East Algeria. Cluster analysis based on major ion contents defined three main chemical water types, reflecting different hydrochemical processes. The first, group 1, has low salinity (mean EC = 937 µS/cm) and abundance orders $Ca^{2+} > Na^{+} \approx Mg^{2+} > K^{+}$ and $HCO^{-}_{3} > Cl^{-} > SO^{2-}_{4} > NO^{-}_{3}$. With increased water-rock interaction, waters in groups 2 and 3 become more saline, changing composition towards Cl-HCO_3-Ca and Cl-Ca-Na types. The PHREEQC geochemical modeling demonstrated that relatively few phases are required to derive water chemistry in the area. In a broad sense, the reactions responsible for the hydrochemical evolution in the area fall into three categories: (1) dissolution of evaporite minerals; (2) precipitation of carbonate minerals, quartz, kaolinite and Ca-smectite; (3) ion exchange.

Keywords: Groundwater; Cluster analysis; Geochemical modeling; PHREEQC; El Eulma Mio-Plio-Quaternary aquifer; Algeria.

Optimisation des paramètres physico-chimiques et hydrodynamique par utilisation d'une membrane pour la photoélectroposition du métal dans un réacteur agité à double paroi

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Abstract

La protection de l'environnement des différentes pollutions dû notamment aux rejets des métaux toxiques exige l'utilisation de nouvelles technologies sites propres. La plupart des procédés conventionnels de séparation et de concentration utilisés en hydrométallurgie comme la précipitation, l'échange d'ions sur résines, lixiviation des minerais ou l'extraction liquide - liquide sont aujourd'hui reconsidérés du point de vue de la possibilité de leur substitution par des procédés utilisant des membranes synthétiques. Parmi les procédés membranaires mis au point ces dernières décennies, les membranes choisis dans notre travail supportées paraissent particulièrement intéressantes pour le traitement de solutions hydrométallurgiques diluées, elles permettent de combiner à la fois les avantages de l'extraction liquide- liquide et ceux des autres procédés membranaires (dialyse de Donnan, ultrafiltration, électrodialyse, l'osmose inverse, etc.). Elles opèrent en même temps une séparation et une concentration avec une consommation faible d'énergie et de faibles coûts de réalisation. L'objectif de ce travail est l'élimination du métal à partir d'un effluent industriel en utilisant une combinaison entre les membranes synthétiques et le semi-conducteur. L'oxyde doit avoir les propriétés semi conductrices avec une bande interdite proche de 1,5 eV (Valeur idéale pour la conversion solaire). Une optimisation des paramètres hydrodynamiques (vitesse d'agitation, choix des mobiles d'agitation, débit d'agitation, position du mobile d'agitation etc.…) par utilisation d'une membrane pour la photoélectroposition du métal dans un réacteur agité.

Chromium reduction and photoproduction of hydrogen by photocatalysis on an oxide semiconductor in a stirred reactor

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Abstract

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.

Keywords: Photocatalysis, semiconductor, heterojunction, Chromium (VI).

Chloromethylation of Metaxylene by Phase Transfer Catalysis. Application to Water treatment

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Abstract

The petrochemical industry widely used liquid hydrocarbons. Among the C_8 congeners is widely used in liquid hydrocarbons, only the para and ortho xylenes are employed in spite of the abundance of the metaxylene. Large amounts of liquid xylene are either isomerized or used as additive in fuels. The chloromethylation of metaxylene has been improved by introducing the phase transfer catalysis. The innovation consists in the use of metaxylene-based quaternary ammonium salts as catalysts, which lowers the reaction time comparatively to the classical method and leads to mono, di and trichloromethyl metaxylenes. The results obtained during the chloromethylation and quaternation highlighted the influence of some operational parameters involved in the reactions, leading to their optimization with the obtention of products having well specified properties. The optimal values ($[CH_2O]/[\text{metaxylene}]$ = 2,120 min, 80°C) gave relatively high yields of mono, di and trichloromethyl metaxylene identified by mass-spectroscopy coupled to gas chromatography. The best catalyst was found to be $C_6H_3(CH_3)_2[CH_2N^+(CH_3)_3]Cl$ with an optimal concentration of 0.07 M. The quaternary ammonium salts are tested for the waste water treatment and has proven to be good extraction agent's of heavy metals. They are positively charged and may fix the anionic complexes. In this work, we determine the formation of associates from quaternary ammonium salts, very soluble in chloroform. As a result, one can extract metals (Cu, Zn, Fe, Ni, Cr, Cd, Hg) which form stable complexes with thiocyanates. The extraction takes place in a wide pH range of (1-10). Zinc gave the better yield with $C_6H_3(CH_3)_2[CH_2N^+(CH_3)_3]_2Cl^-$ (98.93 %) due to the great stability of the complex while the lowest rate is that of mercury

Key words: Chloromethylation, Metaxylene, Phase transfer catalysis, Quaternary ammonium salt, Phase transfer catalysis.

Récuperation du bismuth par membrane liquide emulsionnée

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Résumé

Le bismuth est utilisé dans les produits cosmétiques (préparation des crèmes et colorants de cheveux), pharmaceutiques (traitement de troubles intestinaux) et dans d'autres applications [1]. Aujourd'hui, l'extraction de métaux constitue un défi important tant sur le plan économique (récupération des métaux de valeur marchande) que sur le plan environnemental (traitement des effluents industriels et domestiques).

Les techniques conventionnelles d'extraction d'ions métalliques incluent les procédés suivants : La précipitation, l'extraction par solvant, l'échange ionique, l'adsorption, la récupération électrochimique et la séparation par membrane. Ces derniers, qui sont actuellement les plus employés dans les techniques de traitement, peuvent être inefficaces en vue des contraintes d'ordres législatives, techniques ou économiques [2].

La technique de membrane liquide émulsionnée (MLE) présente une alternative attrayante. Elle est conçue en dispersant en premier lieu une phase interne (phase d'épuration) dans un liquide immiscible (phase membranaire ; diluent organique contenant un extractant et un tensio-actif). Ensuite, disperser l'émulsion formée dans une troisième phase, appelée : phase externe (phase d'alimentation métallique). Les MLE présentent plusieurs avantages tels que : Vitesse de transport élevée à travers la couche organique (membrane) ; grande surface de contact ; flux élevés (grande diffusivité) ; procédé environnemental (recyclage total des différentes composantes) ; aptitude au traitement de différents éléments et composés dans un arrangement industriel à grandes vitesse et efficacité.

L'objectif de notre travail est d'étudier l'élimination du bismuth (III) à partir d'une solution aqueuse nitrée par la technique de MLE en utilisant l'extractant organophosphoré D2EHPA (acide di-(2-éthylhéxyl)phosphorique et le tensioactif TritonX100. Des investigations effectuées sur la cinétique d'extraction ont montré qu'en variant les paramètres expérimentaux tels que : Rapport D2EHPA/TritonX-100 ; nature du diluent, vitesse de formation de l'émulsion ; concentration en acide d'épuration ; temps d'équilibre d'extraction ; concentration du bismuth, l'effluent métallique est régénéré à 93%.

Mots clés : Membrane liquide émulsionnée (MLE), Bismuth - D2EHPA- TritonX100,Cinétique d'extraction

Référence :

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Extractions du Bi(III) et du Cu(II) par la resine XAD-1180 fonctionnalisee par le D2EHPA

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Résumé

L'extraction de métaux constitue un défi important tant sur le plan économique (récupération des métaux de haute valeur marchande) que sur le plan environnemental [1]. Les techniques conventionnelles d'extraction d'ions métalliques à partir des matrices environnementales incluent les processus suivants : La précipitation, l'extraction par solvant, l'échange ionique, l'adsorption, la récupération électrochimique et la séparation par membrane. Ces derniers, qui sont actuellement les plus employés dans les techniques de traitement, peuvent être inefficaces en vue des contraintes d'ordres législatives, techniques, économiques ou environnementales [2].

La technique de Résines Imprégnées par Extractants (RIE) est une alternative attrayante de séparation et de recyclage d'espèces chimiques (organique ou inorganique) à partir des solutions diluées [3]. L'utilisation des supports organiques de polymères macroporeux avec une superficie élevée et bonne stabilité mécanique, contenant des extractants organophosphorés (D2EHPA) offre plusieurs avantages par rapport à l'extraction liquide-liquide largement utilisée à l'échelle industrielle.

La RIE a été préparée en imprégnant physiquement le D2EHPA dans la résine Amberlite XAD-1180. Des investigations effectuées sur la cinétique d'extraction du bismuth (III) et du cuivre (II) à partir des solutions nitrées par RIE ont montré qu'en variant les paramètres expérimentaux le bismuth est extrait à 98,5% et le cuivre à 100%. Les valeurs expérimentales ont servi à déterminer le modèle expérimental qui décrira l'extraction du bismuth en système batch.

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Influence of operating conditions on the retention of phenol in water by reverse osmosis

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Abstract

The presence of organic toxic solutes in industrial wastewater is common environmental problem. Phenol is one of the most common organic water pollutants, because it is toxic even at low concentrations. Against this pollution, very strict standards were imposed for phenol content in water because of their high toxicity. Conventional treatment technologies (chemical oxidation, adsorption, biological treatment) for removal of phenol from aqueous solution are not economical and generate huge quantity of toxic chemical sludge. Technologies using membrane processes are increasingly employed in many industrial sectors as important alternative technologies to classical processes of separation.

The aim of this study is to investigate the retention of phenol from aqueous solutions using a polyamide thin film composite RO membranes denoted as SG 2514TF from Osmonics Company. The first objective of this work is to evaluate the characteristics of the SG membrane used in permeation experiments with aqueous solution of charged organic solutes. The next objective was to study the effect of various key parameters such as feed pressure, initial concentration, pH, recovery and ionic strength. Results show that the retention order for the salts tested was $R(Na_2SO_4) > R(CaCl_2) > R(NaCl)$, showing a retention sequence inversely proportional to the salt diffusion coefficients in water. The retention of phenol depends on the chemical parameters (feed concentration, ionic strength and pH) and applied pressure. The well-known Speigler-Kedem model was applied in order to determine phenomenological parameters б and P_s respectively, the reflection 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: Reverse osmosis, Phenol removal, Speigler-Kedem model, Mass transfer

Traitement des rejets métallifères par le procédé d'électrocoagulation bipolaire

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Résumé

La présente étude est consacrée à l'étude du procédé d'électrocoagulation pour le traitement des rejets métallifères. L'électrocoagulation est un procédé d'électrolyse à anodes solubles. En imposant un courant électrique entre les électrodes, et selon la nature des anodes, qui sont en général soit des plaques de fer ou d'aluminium, des ions de fer (Fe^{3+}) ou d'aluminium (Al^{3+}) sont libérés.

Notre travail consistait à étudier l'influence de différents paramètres sur l'efficacité du procédé d'électrocoagulation appliqué à l'élimination du Cr(VI). Nous avons ainsi préparé dans un premier temps des solutions de concentrations variables en chrome (VI) (5, 50, 200, 300, 500 ppm) et ensuite nous avons fait une application sur un rejet industriel de l'entreprise ENIEM C.A.M Oued Aissi de Tizi Ouzou.

Les paramètres retenus sont : La densité de courant, la salinité, le pH initial de la solution, la concentration de la solution, la distance inter-électrodes et le nombre d'électrodes.

Pour les deux matériaux d'électrodes utilisés à savoir l'aluminium et le fer, nous avons systématiquement étudié l'influence de chacun de ces paramètres sur l'efficacité de l'élimination du chrome (VI).

A l'issu de ce travail, nous avons sélectionné les conditions optimales du procédé d'électrocoagulation.

Nous avons appliqué ce procédé en utilisant les paramètres optimaux sur un rejet de l'ENIEM C.A.M Oued-Aissi et nous avons réussi à ramener la concentration en Cr(VI) à des valeurs au de la de la valeur limite admise et atteindre (~80%) d'abattement de la DCO.

La comparaison entre les deux matériaux d'électrode (Aluminium et fer) a montré que l'efficacité d'élimination du Cr (VI) et d'abattement de la DCO est beaucoup plus meilleure dans le cas des électrodes en Fer et ont été obtenues en un temps relativement très court.

Recovery of potassium from synthetic solutions and urban wastewater by marble wastes under dynamic mode

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Abstract

In this study, we have investigated the retention and recovery of potassium from aqueous solutions under dynamic mode (CSTR) using marble wastes, as a low cost adsorbent material. Several experiments using synthetic solutions, raw and treated wastewater are carried out to study the effect adsorbent dosage, the initial concentration of potassium and the feeding flow rate. The results show that potassium removal efficiency increases with increasing adsorbent dosage and with decreasing feeding flow rate and initial concentration of potassium. The best removal efficiency of potassium ions from synthetic solutions is about 96%. Furthermore, the adsorbent capacity of potassium by marble wastes is about 13.5 mg/g. The removal efficiencies of potassium from raw and treated wastewater are about 76% and 81%, respectively. The use of series of two reactors increases the removal efficiency of potassium to 86% and 91% from raw and treated wastewater, respectively. As well as, the increase of adsorbent dosage to 20 g/L increases the removal efficiency of potassium to 90% and 94% from raw and treated wastewater, respectively. According to these results, the use of such waste in dynamic mode could be a promising technique for the recovery of potassium ions from wastewater as alternative potassium sources.

Keywords: Potassium; Recovery; Marble; CSTR; Wastewater.

Anodization treatment of magnesium alloys

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Abstract

Magnesium has a low corrosion resistance; the presence of impurities such as Fe, Ni, Cu…in its matrix is enough to induce its corrosion. This corrosion leads to the formation of a discontinuous and nonprotective layer. The means to improving the characteristic in corrosion of magnesium is thus to make it passive by addition of elements able to form protective oxides on the surface. A new anodic oxidation produced in a bath containing niobium and zirconium salts, hydrofluoric, phosphoric and boric acids has been designed for improved corrosion resistance of magnesium alloys. The corrosion protection provided by this new coating was evaluated by electrochemical measurements (polarization curves, electrochemical impedance spectroscopy) in Na_2SO_4 electrolyte. X-Ray Photoelectron Spectroscopy (XPS) was used for the characterization of the chemical composition of the coating. The electrochemical results show: i) a significant decrease of the corrosion and anodic currents and ii) higher polarization resistances compared with other treatments. XPS showed that the new coating consists mainly of Nb, Zr and Mg oxides and fluorides, derived from oxidation of the alloy and the chemical/electrochemical reactions of the species present in the treatment bath on the alloy surface. This new coating provides, due to the presence of stable mixed Nb and Zr oxides and fluorides, improved corrosion resistance.

Keywords: Magnesium alloys, AZ91, Anodic oxidation, Zirconium dioxyde, Niobium pentoxyde, Corrosion protection.

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Modélisation discrète du transport hydrique dans un milieu poreux homogène

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Abstract

Le transport réactif d'un soluté dans un milieu poreux saturé est le résultat de nombreux processus, ces processus ont lieu principalement dans la phase liquide, par le réseau poreux rempli d'eau qu'est le vecteur principal du transport de soluté. Il s'agit donc en premier lieu de comprendre le comportement de l'eau dans le milieu poreux.

En raison de la complexité du milieu, il est difficile de mettre en œuvre des expérimentations en vrai grandeur pour comprendre et prévoir ce transport. La modélisation est alors considérée comme une substitution pure et simple des données expérimentales.

Deux modèles ont été étudiés, en se basant sur l'approche discrète, permettant de décrire le comportement d'un traceur inerte. Le premier modèle (MC) établi lorsque l'équilibre thermodynamique local est atteint, cependant le deuxième (MCE) prend en compte l'existence d'une fraction d'eau immobile qui échange de la matière avec la fraction d'eau mobile selon une cinétique d'ordre un. Ces modèles reposent sur l'établissement de bilans de matière effectués sur une série de réacteurs parfaitement agités, les fonctions de transfert globales obtenues dans le domaine de Laplace sont :

$$\mathrm{G_{MC}}(\mathrm{s}) = \frac{\overline{C_J}}{\overline{C_0}} = \left[1 + \frac{t_m}{J} s\right]^{-J} \qquad \text{et} \qquad \mathrm{G_{MCE}}(\mathrm{s}) = \frac{\overline{C_J}}{\overline{C_0}} = \left[1 + \frac{t_m}{J} s\left(1 + \frac{K_{im}}{1+t_M s}\right)\right]^{-J}$$

L'objectif principal de ce travail est la résolution analytique de l'équation de transport de l'eau issue de ces deux modèles. L'utilisation de la transformée inverse de Laplace basée sur la méthode de résidu, donne accès aux fonctions de distribution des temps de séjour, E(t).

La validation des E(t) théoriques est réalisée par l'ajustement aux données expérimentales de SEMRA [SEMRA, 2003]. Pour cela, un code de calcul a été élaboré sous MATLAB selon la méthode des moindres carrés.

Deux milieux poreux expérimentaux ont été utilisés, noté chromo 1 et chromo 2, dont la différence principale réside dans la porosité du lit.

Les résultats obtenus en chromo 1 montrent que le modèle MC est adapté aux faibles débits exploités (1, 2, et 5 ml/min). En revanche ceux du milieu chromo 2 indiquent que l'hypothèse de l'équilibre thermodynamique local n'est pas vérifiée bien que l'on soit dans la même gamme de débit. Dans ce cas le modèle MCE est plus adapté, ce qui explique l'existence d'une phase immobile échangeant de la matière avec la phase mobile.

Le modèle à deux régions d'eau à généralement utilisé pour expliquer ce non équilibre thermodynamique pendant le transport [TEVISSEN, 1993].

Mots - clés : transport hydrique, modélisation discrète, courbes de percée, milieu poreux.

A comparative study on phosphorus adsorption mechanisms by a mineral and an organic waste: SEM, EDS and FTIR analysis

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Abstract

The aim of this study consist to study the adsorption capacities of phosphorus by a mineral waste (phosphates mine slimes) and an organic sea-waste in batch mode and to determine and to compare the involved adsorption mechanisms. During this study batch assays were undertaken to assess the effect of initial phosphorus concentration, contact time, pH, temperature, adsorbent dosage and competition effect. The results showed that the two adsorbents presented relatively the same equilibrium time (40 min), however, the adsorption capacity is more important in the case of the mineral adsorbent than the organic one. For pH and temperature variations, the two adsorbents showed the same behaviour. However for the competition effect, the adsorption capacity of phosphorus decreased in the presence of high concentration of chlorides in the case of mineral adsorbent, and for high concentration of sulphates in the case of the organic adsorbent. The physicochemical characterization using SEM, EDAX and FTIR analysis were investigated before and after adsorption. The results showed that for the two adsorbents the adsorption of phosphorus occurred essentially by ion exchange between chlorides and sulphates at the adsorbents surface and phosphorus in solution, complexation with carboxylic acids and precipitation process between calcium and phosphorus.

Key-words: Adsorption, phosphorus, mineral waste, organic waste, ion exchange, complexation.

Modeling of a simple solar distiller for water desalination using solar energy

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Abstract

Distillation by solar energy becomes in these last years a concern for the majority of the scientists and a hope awaited for the whole world since if this solution proves its efficiency, a heap of problems of energy and thirst will be solved. It is what occurs in the world to our days and it is what brings the idea of our present study which treats a simple unit of distillation by solar energy that one aimed to make to it an optimization by the means of a numerical modeling.

Keywords: distillation -energy - solar-modeling-optimization-efficiency

Removal of Cd(II) from aqueous solutions by adsorption onto natural and acid-activated clay

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Abstract

The removal of heavy metals from industrial waste streams has become one of the most important applications in wastewater treatment in terms of protecting public health and environment. The recovery of metals present in the industrial effluents by adsorption onto natural materials constitutes a technological option increasingly studied throughout the world. However, the implementation of such process on an industrial scale requires the use of adsorbents easily available and inexpensive. Clay in these two forms natural and activated answers very well to these two requirements. The present research aimed the study of the capacity of fixing of cadmium present in aqueous solution, by two types of clay: natural and activated. The effect of the principal parameters such as: (i) clay mass concentration, temperature, and (ii) pH of solution. The effect on the capacity of fixing of cadmium was undertaken within the framework of this research.

Keywords: Adsorption, natural Clay, activated Clay, Cadmium, Isotherm, Modeling.

Application des supports synthétiques à la dépollution des eaux contaminées par le plomb

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Résumé

La présence des métaux lourds dans un grand nombre de rejets, particulièrement liquides en qualités très variables, constitue un souci majeur pour les pouvoirs publics de par les conséquences néfastes pouvant avoir lieu sur l'environnement.

Par conséquent un grand nombre de travaux ont été accomplis concernant les méthodes d'élimination et de récupération de ces espèces métalliques présentés dans les déchets issus de traitement des effluents.

Le but de ce travail est la synthèse de nouveaux supports à base de silice enrobé de polymère, ensuite nous avons appliqué ces supports à l'élimination des eaux contaminées.

Et enfin nous avons évalué leurs capacités d'élimination du plomb contenu dans les eaux usées industrielles, la fixation ou la rétention de ces métaux conduit à déterminer les isothermes d'adsorption

Mots clés: Adsorption-support synthétique-plomb-eau usée-rétention

Biofilm formation of staphylococcus aureus strains after their exposition to UVc rays

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Abstract

The use of ultra-violet c rays as an advanced method of disinfection is well recognized. It has a number of advantages which makes it especially suitable in several fields because it presents a dry process of decontamination without chemical effluent nor release toxicity. The UVc radiation is electromagnetic radiation from portion of the spectrum encompassing wavelengths from 100 to 280nm. UVc irradiation is most effective for germicidal purposes at a wavelength of 253.7 nm

The aim of our study is, at first, to isolate Staphylococcus aureus stain from various origins (clinical, food, environmental...), to identify them by using the following criteria: Gram staining result, the presence of catalase-positive, coagulase and DNase production. All the isolates were checked by PCR for the presence of the coa and nuc gene which are known to be specific for Staphylococcus aureus.

Secondly, to appreciate the effect of UVc radiation on slim production. For that purpose, we adopted two techniques: the qualitative technique on Congo Red Agar plates and the quantitative technique using sterile 96-well-polystyrene microtiter plates (ELISA).

PCR amplification of the specific genes coa and nuc shows respectively, the presence of a single variable-sized fragment going from 500 to 900 pb and a 280 pb fragment.

The study of the bacteria adhesion on CRA plates and on abiotic surface, proved a difference between the Staphylococcus aureus exposed to a determined UVc dose (Jm^{-2}) and the others not exposed.

Keywords: Staphylococcus aureus, coa, nuc, UVc, biofilm.

Design of an autonomous solar vacuum membrane distillation for seawater desalination

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Abstract

At the request of new sources of drinking water, desalination of seawater is increasingly recognized as a promising alternative. In arid regions, the lack of fresh water often coincides with an abundance of solar energy. The coupling of desalination systems with renewable energy technologies is of great importance. The objective of this work is to present a methodology for choosing the design of an autonomous solar vacuum membrane distillation for seawater desalination. The pilot plant (Fig. 1) is designed to provide high quality drinking water with weak infrastructure and without connection to an electrical network. The system is completely autonomous, indeed the only source solar energy. The electrical energy required to operate the pilot plant is produced by means of a field of photovoltaic cells, and the heating of seawater is provided by a field of solar collectors. A techno-economic study of different types of solar collectors (flat plate collectors, parabolic trough collectors, PTC ...) led to the choice of selective flat plate collectors. The collector array contains 35 collectors required with a total area of 70 m^2. Energy optimization of the arrangement of collectors has allowed us to choose a field comprised of seven cascades, each with five collectors in series. The auxiliary power is needed to power the pumps is provided by PV collectors. The field of photovoltaic cells has 16 modules and ensures the production of 1.5 kW with the ability to store energy generated from 8 batteries.

The energy performance of the desalination unit are enhanced by a recovery of the latent energy of condensation.

The choice of the membrane module is a 806 hollow fibers PVDF and 4 m^2 exchange.

A heat exchanger plate ensures the heat exchange between the collectors and the pilot plant.

A condenser tube is used to condense the steam produced. The vacuum is provided by a peristaltic pump.

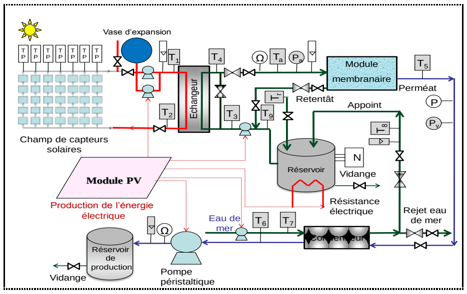

Figure 1. Diagram of the desalination membrane vacuum

Acknowledgements: The authors address their thanks to the European Commission for funding the cooperation project FP6 Membrane-Based Desalination: An Integrated Approach. MEDINA Project No: 036997.

Simulation of an autonomous solar vacuum membrane distillation for seawater desalination

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Abstract

The crisis of drinking water for the coming years a strong revival of interest quickly develop desalination cheaper, simpler, more robust, more reliable and if possible less energy and the environment. In this context and within the European project MEDINA, we have designed and produced a membrane distillation unit coupled with solar energy. The pilot plant is completely autonomous, in fact the only source of energy is the sun. The electrical energy required to operate the plant is produced by means of a field of photovoltaic cells, and the heating of sea water is provided by a field of solar collectors with a total area of 70 m^2.

We have developed a model describing the operation of the plant. This model is derived from the balance of mass and heat transfer equations on the differents elements of the pilot plant (membrane, exchanger, condenser, collectors field, tank). The model used to evaluate variation in the distillate flow with variation in temperature and salinity. The model developed allowed us to study the influence of operating parameters on the performance of the unit (discharge rate, feed rate, coolant flow).

As an example we present in the following figure the instantaneous variation of desalinated water production for the four typical days of the year (June 21, September 21, December 21 and March 21).

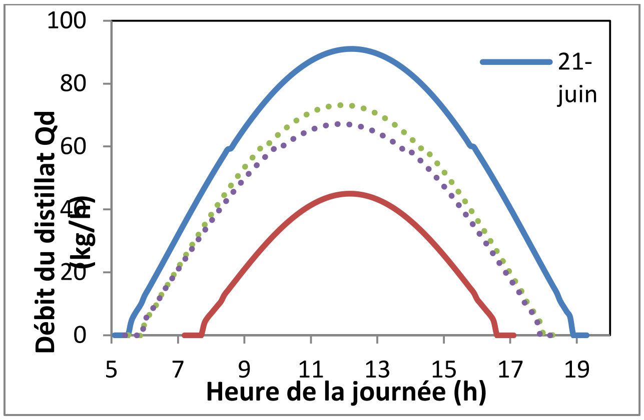

Figure : Variation of the distillate flow rate versus time for different days.

The simulation shows that the distilled daily production water will be between 260 liters at December 21 and 780 liters at June 21.

Acknowledgements: The authors address their thanks to the European Commission for funding the cooperation project FP6 Membrane-Based Desalination: An Integrated Approach. MEDINA Project No: 036997.

Quantitative and qualitative characteristics of greywater for reuse requirements and treatment alternatives : the case of the Student Housing complex at Tunisia

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Abstract

Having the advantage of being less polluted, greywater can be a valuable resource, if properly managed, and can be reused for various purposes as flushing toilets, cleaning and irrigation. However greywater treatment and reuse are, in fact, complicated by issues not only on technical feasibility but also on human issues. The main objective of this paper is to evaluate the potential water savings by using greywater and to plan a technical feasibility system to recycling water in student housing complex at Tunisia. Studies of water consumption revealed that more than 45% of the water used in the student housing was for showers. This may be reused for other purposes especially toilet flushing (30% of water used) and landscape irrigation. Greywater from showers has been examined for physical, chemical and microbiological parameters to determine the potential health and environmental risks associated with reuse. The constituent of greywater was similar to those of domestic wastewater. However, it contained much less pathogens, carbon and nutriments (nitrogen and phosphor). The highly variable organic concentrations in shower greywater was directed the selection of biological systems as a suitable processes to treat and recycling this effluent for the toilets. The economic analysis showed that on-site greywater reuse can be economically feasible especially where water prices continually increase.

Etude de l'élimination du phénol, par adsorption, sur un charbon actif

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Résumé

L'objectif principal de ce travail a été d'étudier l'efficacité d'un charbon issu des noyaux de dattes, activé à l'acide sulfurique, pour l'élimination du phénol dans une solution aqueuse.

La surface spécifique du charbon a été déterminée par la méthode BET.

Les essais de dépollution ont montré l'efficacité de notre support pour la rétention du polluant.

L'étude de l'isotherme d'adsorption a montré que seul le model de Langmuir est applicable, par ailleurs, les résultats de l'étude cinétique ont indiqué que le processus d'adsorption est du psuedo 2ème ordre. Enfin, l'étude thermodynamique a montré que l'adsorption du phénol sur le charbon est spontanée.

Mots clés: Adsorption, Polluant organique, Phénol, Charbon actif, Isotherme

Contribution to the study of phosphate sorption on sediments

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Abstract

The present work is an evaluation of phosphorus sorption on sediments. The effects of time and phosphate concentration are studied. The sorption mechanism is evaluated by infrared and speciation analyses.

The results of macroscopic study, indicate that the phosphate sorption kinetics is characterises by two steps: a first rapid and a second slow. It is well represented by the second order kinetics model. The effect of phosphate concentration, reveals the presence of preferential sites. The adsorption isotherm is well described by the Freundlich equation.

After sorption, the IR spectra indicate the formation of inner sphere complex. The results of sequential extractions show that phosphorus is mainly associates to calcium and oxyhydroxydes of iron and aluminium.

Key words: Phosphates; Sediments; Sorption; Speciation; Sequential extractions

Etude comparative des propriétés d’adsorption du paracétamol et de l’ibuprofen sur un charbon actif et une biomasse

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Abstract

The active charcoal and marine biomasse were used as chemical and biological adsobentfor the removal of paracetamol and ibuprofenfrom artificially contaminated aqueous solution.

Experiments were carried out for isotherms.

The operating variables studied were pH, temperature, adsorbent quantity and initial paracetamol and ubuprofen contamination.

Study of the removal of dyes on activated carbon issued from cryogenic grinding of scrap tires

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Abstract

The aim of our study is the removal of dyes in solution by using activated carbon issued from the cryogenic grinding of scrap tires.

An used car tire was first shredded in small pieces, and then immersed in liquid nitrogen bath to harden them. these pieces were subjected to a cryogenic grinding to obtain a fine powder. The steel and the rubber were separated by screening and by a magnetic separation.

Finally, the crumb which diameter varies between 0.06 mm and 2 mm were used in the synthesis of an activated carbon.

In this way a chemical activation using phosphoric acid was performed. The impregnated powder is then placed in a stainless steel tubular reactor and we proceeded to the carbonization under an inert atmosphere at a temperature of 450 ° C.

The resulting product is washed with distilled water until pH 7 is reached, dried in an oven all the night, and then stored in a container in a dry place.

The textural and chemical characterization, (porosity, moisture content, ash content, density, specific surface, and the degree of activation) were studied by using techniques as SEM, and FTIR.

The second part of this study was focused on the study of the adsorption of three cationic textile dyes (Methylene blue, Methyl green and Congo red) on the obtained activated carbon. The adsorption was achieved under constant temperature and pH.

We noticed that the needed mass of the activated carbon to complete discoloration depend on the nature of the dye, the equilibrium time and the performance.

The optimum parameters for the kinetic study were determined through the influence of the temperature, the mass of activated carbon, the pH, and the concentration, and then used to show that the reaction is pseudo first order. Finally, the adsorption isotherm model responds to the Langmuir-type S.

Keywords: Adsorption, Activated Carbon, cryogenic grinding, tire recycling, textile dyes

Adsorption of cadmium from aqueous solution onto untreated orange barks

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Abstract

Adsorption can be used as a cost effective and efficient technique for the removal of toxic heavy metals from wastewater. Waste materials with no further treatment such as orange barks from commercial oranges may act as adsorbent for the removal of cadmium. Batch kinetic and equilibrium experiments were conducted to study the effects of contact time, adsorbent dose, initial pH, particle size, initial concentration of cadmium and temperature. Three adsorption isotherm models namely, Langmuir, Freundlich and Dubinin-Radushkevich were used to analyse the equilibrium data. The Langmuir isotherm which provided the best correlation for Cd^{2+} adsorption onto orange barks shows that the adsorption was favourable and the adsorption capacity found was equal to 54.92 $mg.g^{-1}$. Thermodynamic parameters were evaluated and the adsorption was endothermic. The equilibrium was achieved less than 25 min. The adsorption kinetic data was fitted with first and second order kinetic models.

It was concluded that the cadmium adsorption kinetic onto orange barks was well fitted by second order kinetic model rather than first order model. The results suggest that orange barks have high possibility to be used as effective and economical adsorbent for Cd^{2+} removal.

Keywords: Cadmium, Adsorption, Kinetic study, Thermodynamic study, Equilibrium isotherm.

Impact of the addition of a commercial fungal consortium for the biodegradation of a dairy wastewater

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Abstract

The management of wastewater coming from manufacturing processes is a central point for the dairy industries. One of the main characteristics of these effluents is the variability of these because they depend of milk itself (breeding technique, season), the type of processing, the cleaning and all the other factors which can change the milk composition (Rico Gutiérrez et al., 1991). For the treatment of their effluents, the dairy industries can either join up with the municipal wastewater treatment, or have their own wastewater treatment plant (WWTP). The treatment is often conducted with activated sludge (Loperena et al., 2007), because of the effluent biodegradability.

The main subject of this study was to accelerate the decomposition of refractory OM of dairy industry by using a fungal consortium. How the microorganisms degrade a synthetic dairy wastewater, as well as to observe fungal growth and the biodegradation of the OM in a synthetic and an industrial dairy wastewater were examined. The behaviour of the fungi with respect to the endogenous flora of an industrial wastewater was also investigated. For this purpose, a fungal consortium including the fungi Mucor hiemalis, Aspergillus niger and Galactomyces geotrichum was used in aerobic treatment at room temperature.

In presence of only endogenous microorganisms, an almost total consumption of the soluble COD, while a low decrease of the total COD was recorded in the meanwhile characterising most likely a production of refractory COD. Irrespective of the presence of the endogenous flora, the addition of fungal consortium resulted in a significant decrease of the total and the soluble COD, 22 and 28 % in presence or not of the endogenous flora respectively, while soluble COD removal remained at a high level.

The use of the fungal consortium accelerated by pre-cultivation during 48 h on the same medium confirmed the positive impact of the fungal consortium addition, especially on the total COD removal, since the observed yields were 62 and 59 % in presence or not of whey as a co-substrate. The used of the fungal consortium is therefore a promising tool to improve effluent treatment. However, subsequent work is needed, especially dealing with the optimisation of fungal pre-cultivation

Preliminary experiments on a pilot plant (1000 L) confirmed the above results, which should however be subsequently confirmed and optimised.

Keywords: Biodegradation; Dairy waste; Endogenous flora; Filamentous fungi

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Removal of Cr (III) from model solutions by isolated Aspergillus Niger and Aspergillus oryzae living microorganisms: equilibrium and kinetic studies

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Abstract

The aim of the present work was the seeking and the isolation of sustainable microorganisms and their application for the removal of Cr (III) from simulated aqueous solutions. To isolate sustainable microorganisms, soil samples were taken from rawhide, tannery tanks and effluents discharged environment. Aspergillus niger and Aspergillus oryzae were the two types of isolated fungi from tanning factory environment. Fungal growth and chromium removal efficiency were studied as a function of maximum fungal tolerance to Cr (III) concentration, pH, temperature, contact time, agitation speed and nutrients addition. The optimal conditions for fungal growth were 30 h at pH 5.2, an agitation speed of 150 rpm and

30°C in a medium containing yeast powder and di-hydrogen ammonium phosphate as nutrients. Maximum growth concentration increased from 0.8 to 4 g/L for both fungi at the above mentioned conditions. Maximum fungal tolerance and chromium removal were found to be 600 mg/L and 95-98% of Cr (III). Equilibrium data were found to follow a Langmuir isotherm model and maximum sorption capacities were 185 and 208 mg/g for A. niger and A. oryzae, respectively. Experimental data was accurately fitted onto pseudo-second order kinetic model.

Keywords: tanning effluents; Cr (III); batch system; nutrients; fungal biomass

Nitrogen and phosphorus Removal at the Membrane bioreactor and the conventional activated sludge

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Abstract

This present study has for the principal objective to study the evolution of the nitrogen and phosphorus removal during 08 days. For that, an urban wastewater from the wastewater treatment plant of Beni Messous (Algiers) with the average characteristics in the chemical oxygen demand is 586 mg/L and 188 mg/L in the biochemical oxygen demand and 14 NTU of turbidity was treated

The membrane bioreactor received the domestic wastewater in side stream with an ultrafiltration membrane under the following conditions: mixed liquor suspended solids concentration 4g/L; cross flow velocity U= 4m/s at constant transmembrane pressure 0.8 bar. A tubular inorganic membrane CARBOSEP M2 with cut off = 15 kg/mol was used (porous carbon support and membrane layer of ZrO_2).

We observe a good removal for the ammonium in the membrane bioreactor compared to the conventional activated sludge during the days of the study, with a retention rate of 90.82% ammonium 73.05% for conventional activated sludge.

It is due to the presence of the ultrafiltration membrane, and good operating conditions in the membrane bioreactor (temperature, sludge age, agitation, aeration and velocity).

A very good retention rate of nitrite in the membrane bioreactor was obtained. Therefore an average value of 94.01% against 81.69% in the conventional activated sludge.

We observe an increase in the concentration of nitrates for the conventional activated sludge however we obtained a good nitrate removal in the membrane bioreactor (89%).

The results showed a very low removal of the phosphorus for the conventional activated sludge (17.98%). We note, however, a removal rate in PO_4^{3-}slightly higher for the system to membrane bioreactor (88.54%).

Photo réduction du chrome par voie photo catalytique sur l'hétero-système $ZnFe_2O_4/TiO_2$

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Abstract

Les métaux lourds dans les eaux sont encore peu étudiés, et sont beaucoup moins surveillés que l'azote et le phosphore par exemple. Pourtant ce sont des micropolluants de nature à entraîner les nuisances même quand ils sont rejetés en quantités très faibles. Il existe deux formes du chrome (trivalent et hexavalent). Le chrome métal et le chrome trivalent ne sont pas toxiques. En revanche, l'état hexavalent, qui entraîne des inflammations des muqueuses et des ulcères, est cancérigène. Le présent travail consiste en la photo réduction du chrome hexa valent hautement toxique à l'état trivalent par voie photo catalytique sur l'hétero-système $ZnFe_2O_4$/ TiO_2

Le catalyseur $ZnFe_2O_4$ a été choisi pour son faible coût, sa stabilité chimique sur une large gamme de pH et sa couleur marron qui lui permet d'absorber ~60% du spectre solaire. Il a été synthétisé par voie sol-gel dans le but d'augmenter sa surface active (41 m^2/g), et cristallise dans une structure spinelle normale : $Zn[Fe]_2O_4$. Le semi-conducteur a été caractérisé par différentes techniques (DRX, spectrophotométrie IR, réflectance diffuse, propriétés de transport et photo électrochimie). Ces caractérisations nous ont permis d'établir un diagramme de bande énergétique pour la prévision des réactions photo catalytiques. Le potentiel libre du couple $HCrO_4^-/Cr^{3+}$ et le temps d'adsorption ont été déterminés par chrono potentiométrie. De plus, la performance photo catalytique a été améliorée de façon significative sur l'hétéro-système $ZnFe_2O_4$ (75%)/TiO_2 (anatase, 25%) avec un rendement de 60% sous lumière visible. Les paramètres physiques tels que le pH, le rapport de masse $ZnFe_2O_4$ /TiO_2 et la nature de l'acide ont été étudiés.

Mots clés: chromate, hétéro-système, spinelle $ZnFe_2O_4$, lumière visible, photo catalytique.

Photoreduction de l'ions metalliques Cd^{2}, Zn^{2+} Sur $CuFeO_2$

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Résumé

Les ions métalliques, particulièrement ceux de transition, possèdent une toxicité au delà d'un certain seuil. Les méthodes physiques actuelles pour purifier l'eau telles que les résines échangeuses d'ions ou l'alumine activé ne sont pas pratiques à mettre en œuvre. Dans notre travail, nous avons testé les méthodes photo électrochimiques sur un oxyde inédit et qui consiste à électro déposer les ions M^{2+} en espèces métalliques M, en présence de lumière visible. L'oxyde sélectionné $CuFeO_2$ cristallise dans la structure delafossite avec des bandes électroniques à caractère cationique et par conséquent un potentiel assez réducteur pour réduire certains ions métalliques en particulier les ions Cd^{2+}, Zn^{2+}. L'oxyde est préparé par voie humide dans le but d'augmenter la surface spécifique. La conductivité de type *p* est attribué a l'insertion de l'oxygène dans le réseau bidimensionnel et entraîne une oxydation du cuivre monovalent. Il possède un gap optique de 1.28 eV, proche de la valeur idéale pour la conversion solaire, et une énergie d'activation de 0.22 eV. Les photoélectrons localisés dans la bande de conduction (-1.06 V_{ecs}) permettent de réduire les ions dont le potentiel est moins négatif avec un rendement excédant 80% et un temps de réaction ne dépassant pas 5 heures.

Mots clés: Cd, Zn, toxicité, delafossite $CuFeO_2$, lumière visible, photo catalytique.

Enzymatic Decolourization of textile effluents by turnip and courgette peroxidase

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Abstract

Azo dyes are recalcitrant carcinogenic compounds and might have dermal and immunological effects on human beings. Conventional methods are not always effective in the treatment of azo dyes. The enzyme peroxidase is known for its capacity to remove phenolic compounds and aromatic amines from aqueous solutions and also to decolorize textile effluents. This study evaluates the potential of plant enzymes of turnip (*Brassica napus)* and courgette (*Cucurbita pepo*) peroxidase in the decolourization of textile azo dyes and effluents. Azo dyes, Congo Red (CR) and Direct Yellow, were used as model pollutants to be treated by the enzymatic process. The effects of different operating conditions like, pH, temperature, initial dye concentration, contact time, and the amount of H_2O_2 and the enzyme were evaluated in order to determine the optimum conditions for the enzyme performance for the decolourization of Congo red solutions. The results indicated that the optimum conditions for maximum color removal was at pH 2.0, temperature 40 °C, with hydrogen peroxide (H_2O_2) concentration 50mM, CR dye concentration 50 mg/L and enzyme activity of 0.45 U/ml within 10 min of incubation time. Analysis of enzymatic treatment by-products by UV-vis and IR spectroscopy showed no residual compounds in the aqueous phase and a polymeric precipitated solid with no toxic effect. A test on an industrial textile effluent was also performed under optimum conditions and 75% decolourization yield was obtained.

Keywords: Congo red; direct yellow; decolourization; peroxidase; Toxicity; Enzy.

Mathematical modeling of a solar still coupled to a compression heat pump

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Abstract

Solar distillation is one of the simplest and most important processes of separation. However, the productivity is very low. In this study, a solar distiller was coupled with a heat pump to augment the distilled water productivity. This system was modeled and simulated. Initially, we have developed a computer code allows to obtain the temperatures and condensation rate of these distiller. The performance has evaluated by comparison with the performance of the conventional still under the same weather conditions. The results show that the solar still coupled to a heat pump had more than 75% higher productivity in comparison with the conventional solar still. The influence of many parameters was studied to define the optimal operating conditions for the solar distiller. The thicknesses of basin water and insulation have a significant effect on the productivity of the solar still. A good agreement had been achieved with experimental results.

Key words: Solar still, compression heat pump, modeled, simulated, performance.

Modification of bentonite with diphosphonium salts: synthesis and characterisation

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Abstract

The surface properties of bentonite can be greatly modified by simple ion-exchange reaction between organic surfactant cations and the adsorbate. The introduction of organic cations changes the bentonite from a hydrophilic to a hydrophobic form. For example, quaternary ammonium salts have been used very often to turn bentonite into hydrophobic form and recently quaternary monophosphonium salts were reported. The bentonites modified with phosphonium salts have an appreciably higher thermal stability than the ammonium salts-modified bentonites and may be potentially useful materials for melt processing of polymer/layered silicates nanocomposites. Hence, it is worth broadening the range of compounds suitable for this purpose. Diphosphonium salts fulfil the main requirements of materials that are suitable for bentonite transformation into a thermically more stable species. In the present study, in order to prepare the new materials, modification of bentonite with diphosphonium salts was carried out through the ion-exchange of a purified bentonite with a solution of diphosphonium salts.

Presence of trihalomethanes in drinking tap water in the region of Mostaganem (northern west Algeria)

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Abstract

The trihalomethanes (THMs) are a commonly monitored class of drinking water disinfection by-products (DBPs). They are formed when free available chlorine reacts with natural organic matter in raw water during water disinfection. This study is based for collecting tap water samples from each city of Mostaganem center also the deferent neighbourhoods in order to analyse trihalomethanes, we have utilised the HS-SPME method for determination of trihalomethanes in drinking tap water. A total of 30 samples were collected for the different cities which are marked a higher level of residual chlorine for the year 2009. The results of measurement of THM showed that the maximum value is about172,61µg/l registrated in the region of Achaacha , however, the lower value 17.54µg/l is noted in the CIA region.

Our drinking tap water samples include a large quantity of THMs with different concentrations, where the dibromochloromethane and the bromoform constitute the major portion of THMs.

Keywords: Analyse, drinking tap water, trihalomethanes.

Comparative anodic oxidation on boron doped diamond electrode of two different families of dyes : separately and mixed

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Abstract

The most commonly used dyestuffs in textile industry are azoic and anthraquinone dyes. One dye from each major group Acid orange 8(AO8: azo) and Alizarin Blue Black B (ABB: anthraquinone) was chosen to study its electrochemical oxidation on a boron-doped diamond electrode (BDD).

The influence of the initial pH (2 and 8), current density (20, 40 and 80 mA/cm^2) and initial dye concentration (0.3, 0.5, 0.8 mM) were investigated on discoloration and global mineralization kinetics. The results obtained show that complete chemical oxygen demand (COD) and color removal was obtained for both wastewaters. However, the structural features of the pollutant, and especially the presence of functional groups (anthraquinone and azoic group) seems to influence the performance and efficiency of the electrochemical process.

The results obtained show that alkaline pH improves fast anthraquinone dye oxidation. After 3 hours of electrolysis, color and DCO removal reach 98 and 80% at pH2 respectively, and achieve a complete discoloration and mineralization at pH 8. In contrast, the AO8 azo dye shows a maximum degradation in acidic medium.

Moreover, an increase in the current density leads to accelerate the rate of degradation of ABB and AO8 results to accelerate of electrogenerated of powerful oxidation agents. However, a decrease in the current efficiency was noted. This may be due to the fact that part of the electrogenerated radicals are wasted to side reactions such as O_2 evolution and this phenomenon is more pronounced at higher current intensities. This behavior is characteristic of mass transfer controlled processes in which an increase in the current density favors anodic side reactions.

Results show also that the influence of ABB and AO8 initial concentration on the evolution of COD during electrolysis proves that the electrochemical process is mass-transfer controlled in the range of concentration studied.

Treatment of textile effluents supplied from rinsing operations using Nanofiltration for on-site reuse

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Abstract

As a starting point to implement reuse strategies, rinsing effluents were considered for on-site treatment and reuse in the same or in other production processes, being characterized by a large volume but low concentration of contaminants. Their direct reuse is not suggested for the wide quality variability in contrast to the standard quality required in the processes.

Such wastewaters typically contain by-products, residual dyes and auxiliary chemicals. Therefore, parameters of major interest in the textile dyeing wastewaters are chemical oxygen demand (COD), salinity and colour. For that, it was studied the influence of such high range of volume concentration factors on the membrane fouling and the final permeates quality.

In this study, experiments were carried out to evaluate the nanofiltration membrane performance for three rinsing textile effluents treatment. The aim of this work was to establish the permeate quality obtainable with a single nanofiltration step by using NF270 and NF HL membranes.

More than 95% of COD retention and more than 98% of colour retention were observed for all transmembrane pressure range using NF 270 membrane. It can be also observed that an important improvement was occurred for conductivity retention rates. In fact, this parameter increases with the transmembrane pressure and reaches 71% at 15 bar. These results demonstrate that nanofiltration using NF 270 membrane highly improves the rinsing wastewater quality.

Using HL membrane, results demonstrate good COD and colour retentions that were also obtained, in the treatment of other two samples of rinsing textile effluents. These retention rates were respectively 100% and 97% at the highest volume retention factor.

However, conductivity retention rates didn't exceed 34% even at high transmembrane pressure. These results confirm the fouling problem of HL membrane, even it presented a good efficiency to improve water quality in terms of COD and colour.

Keywords: nanofiltration, textile rinsing effluents, permeate quality

Electrochemical degradation of *Bifenox* on Boron doped diamond electrode

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Abstract

Bifenox is an herbicide deriving from nitrodiphenyl ether. This compound is not readily biodegradable and presents a bioaccumulation potential. The present study concerns its electrochemical degradation in aqueous NaOH medium using doped diamond anode. The galvanostatic electrolysis leads ultimately to the mineralization of the substrate. The monitoring of the mineralization process is performed by measuring the COD, and by UV-visible absorption spectrophotometry at different current densities and different concentrations. It is found that the rate of mineralization increases with increasing concentrations and decreasing current densities.

The analysis of the solution during the electrolysis shows that the first step of oxidation is the cleavage of the phenoxy phenol bond leading to the formation of 2,4-dichlorophenol(P1) and 2-nitro-benzoic acid (P2). Then the subsequent oxidation of P1 and P2 leads to several other phenolic intermediates.

A mechanistic scheme is proposed to account for all the results. It consists of two paths: at the beginning *bifenox* is oxidized directly on the electrode and then the oxidation process is mediated by hydroxyl radicals which are generated by the discharge of water.

Keywords: Bifenox, boron-doped diamond (BDD), degradation, oxidation.

Measurements and Correlations of viscosity, conductivity and density of an hydrophobic ionic liquid (Aliquat 336) mixtures with a polar protic solvent (FA)

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Abstract

Ionic liquid “Aliquat 336”, a promising electrolyte for electrochemical devices, was investigated. The transport physicochemical properties of binary mixture ionic liquid (Aliquat 336)/organic solvent (FA) were studied. Systematical measurements of viscosities (η), conductivities (Λ) and densities (ρ) for the binary mixture, over the whole composition range and at temperature ranging from 298.15 K to 318.15 K, were performed. The variation tendency of viscosities/conductivities with composition of the mixtures was explained through the disruption of molecular solutes to ionic association or aggregation. Correlation between these two parameters was carried out by means of Walden product (W). A semi-empirical equation proposed by Jones and Dole was used to describe the variation of viscosity with salt concentration (C). At low concentration of Aliquat 336, molar conductivity follows the cube root law which was predicted by the quasilattice model. The two transport processes were well described by Arrhenius law. From this later, the activation energies for the viscosity ($E_{a,\eta}$) and conductivity ($E_{a,\Lambda}$) are deduced. Molecular interactions and structures of binary mixtures have been discussed from the excess molar volumes V_E.

keywords: Aliquat 336, FA, conductivity, viscosity.

L'utilisation rationnelle des differentes energies pour le dessalement des eaux en afrique du nord : une solution contre la crise de l'eau ?

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Résumé

Le dessalement de l'eau devient une nécessité pour l'Afrique du Nord, ou le problème de l'eau se pose de plus en plus avec acuité. Le problème est de savoir quel est le prix du mètre cube d'eau dessalée. Pour cela en fonction du type d'énergie, le dessalement de l'eau de mer peut s'avérer une solution très intéressante et utile. L'Algérie, le Maroc, la Tunisie, la Lybie, la Mauritanie, occupe actuellement un rang mondial parmi les pays qui souffre de manque d'eau, et souffrent d'un stress hydrique, et s'il n'y aura pas de démarches réelles et efficaces, la situation s'empirera à l'horizon 2020, vu que la quantité d'eau disponible actuellement est inferieur à 1000 m3/hab./an, ce qui est en deça des normes internationales. L'Afrique du Nord qui compte presque 100 millions d'Habitants, et qui se trouve dans une région semi arde, voire aride, souffre actuellement plus que jamais du problème d'insuffisance des ressources en eau. La variante de dessalement de l'eau de mer s'avère la solution convenable, idoine car les 5 pays dispose de plusieurs milliers de km de côtes sur la mer méditerranée et l'atlantique, et de plusieurs types d'énergie.

Les changements climatiques touchent sévèrement l'Afrique du Nord, et une stratégie, une vision, relative à l'utilisation de l'eau de mer devient une nécessité absolue. Dans ce papier seront développés:- *Les ressources en eau en Afrique du Nord*

- Le dessalement de l'eau de mer en Afrique du Nord
- les énergies renouvelables (solaire, éolien, …)
- Les techniques de dessalement
- Les différentes énergies pouvant être utilisées non renouvelable
- La proposition d'un certain nombre de stratégies et une vision sur le dessalement en Afrique du Nord.

Mots clés: Energie, solaire, dessalement eau de mer, osmose inverse, stratégie, vision

Chronoamperometry study of the inhibition of groundwater scaling deposits in fourchi

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Abstract

Scaling deposits in industrial and domestic installations where natural water flows or is distributed cause many technical and economic problems.

In this study, electrochemical methods were used at laboratory scale to evaluate and to inhibit the tendency to form deposits of water in Fourchi.

The results of chemical analysis showed that groundwater hardness is quite high with a value of 76 °F. In addition, the index value for water scaling is within the scale-forming field. It should be noted that the chronoamperometric tests (accelerated scaling) applied to the hard water of Fourchi were performed at 20 °C.

The shape of the curve corresponds to water with scale forming materials having t_E = 20.3 min and a residual current of 26.9 μA/cm^2, causing the formation of a compact and adherent precipitate of $CaCO_3$.

In addition, it should be noted that when temperature increases the scaling time duration decreases and the scale-forming reaction is stimulated as the reduction of oxygen is accelerated by an increase in temperature. Inhibition of calcification was performed at 20 °C with water containing of K_3PO_4 and NaOH.

It should be noted that the scaling duration increases with the concentration of the inhibitors. In addition, the inhibitory effect of K_3PO_4 and NaOH occurs with concentrations starting from 0.2 mg/L and 0.3 mg/L successively.

We noted that the complete inhibition of scaling is obtained with the addition of 3.5 mg/L of K_3PO_4 or the addition of 150 mg/L of NaOH. This leads to an infinite scaling time (t_E) while calcium carbonate does not adhere to the working electrode. Tests carried out at 50 °C in the presence of K_3PO_4, NaOH showed that the effect of temperature significantly reduces the scaling time compared to 20 ° C.

Keywords: Scaling, Inhibition, K_3PO_4, NaOH.

Sulfate Removal from water using ion exchangers
IRN-78 and A21

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Abstract

Sulfate ions are common constituents of natural waters that substantially impact water treatment processes. In the present work, a laboratory study was conducted to investigate the ability of a strongly basic (IRN78) and a weakly basic (A21) ion-exchange resins for the removal of sulfate ions from water. Batch shaking experiments were carried out to evaluate the adsorption capacity of the resins. The effects of resin amounts, contact time and sulfate concentration were studied. In column experiments the efficiency of the resins was evaluated after two uses.

For the two resins, rapid adsorption of sulfate is observed then plateau values are gradually reached. The sorption kinetics follow the second order model. The calculated maximum sorption capacities of IRN78, and A21 are 446 and 511 mg/g respectively. Langmuir-type model is proposed for sulfate removal by IRN78. In column experiments, the IRN78 shows more efficiency than A21 resin.

Keywords: *Ion-exchange; water treatmen ; Amberlite IRN-78; A21 ; sulfate*

Water softening using Amberlite IRN-120 and IR86

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Abstract

Comparative study of softening of hard water with both strongly acidic IR120 and weakly acidic IR86 ion exchangers was carried out in batch and column experiments. The effects of resin amounts, contact time and hardness were studied. In column experiments the efficiency of the resins was evaluated after two cycles use.

The obtained results show that the two resins have a high potential for hardness removal from water. The equilibrium time is reached within 60 min then plateau values are gradually reached. The sorption kinetics follow the second order model. The total ion exchange capacity of IRN120 and IR86 for hardness removal is about 190 mg ($CaCO_3$)/g.

The experimental results obtained at various concentrations show that the removal of hardness by IR86 is well described by Langmuir-type model. The two resins show a slight decrease of efficiency after two cycles of use.

Keywords: Ion-exchange ; water softening ; Amberlite IRN-78; A21 ; hardness

Optimization of chromium removal by Cross-fluxes dialysis with anion-exchange membranes

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Abstract

The removal of chromium (VI) from aqueous solutions by cross-fluxes dialysis has been investigated. The cross-fluxes dialysis is a useful membrane processes and used to recovery of valuable ions and removal of undesired ions from the waste effluents. For the Cross-fluxes dialysis process we used tows AEMs: Selemion AMV and Neosepta AFN (Tokuyama Corp.). The amount of chromium removed was determined on the basis of the following parameters: initial chromium concentration, type of anion exchange membranes, co-ion concentration and magnetic stirring.

A 2^4 full factorial design analysis was performed to screen the parameters affecting Cr (VI) removal efficiency were examined. Using the experimental results, a linear mathematical model representing the influence of the different parameters and their interactions was obtained. The type of anion exchange membrane is the most significant parameter affecting chromium (VI) removal. The co-ion concentration is also affecting the removal of chromium. The analysis of variance showed of satisfactory prediction regression model was derived.

Keywords: Cross-fluxes dialysis, Cr (VI), AEM, factorial design, optimization.

Reverse Osmosis, Ultrafiltration & Nanofiltration – optimization

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Abstract

It is well accepted that membrane technology has advanced formidably in water , non –water applications. Numerous , rather innumerable facilities exist where a combination of any two or all three of RO/UF/NF/MF is installed. Case by case studies abound which is brought –out and discussed along with reference to energy consumption . One fundamental reason for all round success of membrane technology is lower energy consumption as compared to thermal desalination. A plant in US treats Caloosahatchee river water for taste and odor, color, organics, hardness , and turbidity with conventional alum coagulation, flocculation, sedimentation , and granular dual-media filtration followed by GAC adsorbers. Powdered activated carbon is seasonally added upstream of coagulation to a dedicated contact basin to reduce taste and odor. For long, seasonal salinity, taste and odor problems, and algal blooms in the river have negatively affected plant operations and caused regulatory concerns. This is succinctly brought out in the presentation.

Appropriate pretreatment techniques for challenging surface waters is addressed with an effect on the reduction of fouling and highest MF flux. Higher chemical doses or IX (ion exchange) resin has a profound negative effect . Bench tests have demonstrated 99 % reduction of taste/odor with 95% reduction of DOC.

Keywords: *UF, NF,RO , optimization, flux , energy*

Hydrothermal synthesis of mesoporous phosphate materials
Application to dye removal

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Abstract

Over the last decade, increasing emphasis has been devoted to the development of mesoporous compounds. Among them, metal phosphate materials have received considerable attention due to their potential applications in various fields such as catalysis, adsorption, separations, etc.

This paper deals with the synthesis and characterization of transition metal phosphates prepared under hydrothermal conditions, in the presence of a cationic surfactant.

The as made materials have been characterized by means of several physicochemical techniques including: chemical and thermal analyses, FTIR, scanning electron microscopy, N_2 adsorption-desorption isotherms and UV-Visible-NIR diffuse reflectance measurements.

The influence of the starting molar composition and metal nature as well as that of other chemical parameters, such as crystallization temperature and time and pH, have been investigated.

The surfactant acted differently, giving rise to various phases, with textural and structural differences.

For comparative purposes, some of the as synthesized materials have been tested in the adsorption of dye pollutants. Batch studies were performed to address various experimental parameters like contact time, temperature and initial concentration. The materials were more efficient with the anionic dyes. Adsorption kinetic study was described using pseudo-first-order, pseudo-second-order and intra-particle diffusion models. Equilibrium isotherms were analysed by Freundlich, Langmuir and Dubinin Radushkevich equations. Freundlich model had better performance for representation of the experimental data.

Thermodynamic parameters such as change in free energy ΔG^0, enthalpy ΔH^0 and entropy ΔS^0 were evaluated.

Keywords: Transition metal phosphate, Hydrothermal synthesis, Surfactant, Dye removal.

Feasibility study of wind-desalination systems in southern Algeria

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Abstract

The scarcity of fresh water is a growing global problem. According to the World Water Development Report (WWDR), the worldwide need for water in 2025 is expected to be billions of cubic meters per day. Desalination of brackish and sea water has become one of the most widely applicable methods to meet water demand and it is today widely applied in areas with limited water resources. Because desalination is an energy-intensive process, energy cost has been the greatest barrier to its development. Among all the desalination process technologies, reverse osmosis (RO) has demonstrated the highest electrical energy efficiency (3–8 kWh/m3 water). Even so, energy cost accounts for about 40% of total desalinated water cost by RO. From both an energy cost and an environmental point of view, inexpensive and clean alternative power sources are needed to provide a low-cost desalination solution. Wind power is the least expensive renewable power source, so it is a desirable option for integration with desalination technologies. Studies of indigenous wind resources in Algeria performed by Centre de Développement des Energies Renouvelables (CDER) during recent years show that the climatic conditions in Algeria are favourable for wind energy utilisation. The best wind energy potential is in the South especially in the southwestern region where the wind velocity is higher than 6 m/s. This study explores the feasibility of wind-desalination concepts in Algeria, and evaluates their economic viability. A RO desalination system equiped with Energy Recovery Device (ERD) and powered by 1 MW wind turbine is then proposed to produce fresh water from wells located in three potentially high-wind sites in the southwest of Algeria, namely Adrar, Timimoun and Tindouf characterized respectively by annual mean wind speeds 6.3 m/s, 5.8 m/s, and 5.1 m/s.

Keywords: *Renewable energy, Wind power, Reverse Osmosis Desalination, Energy recovery*

Etude de l'elimination du colorant acide rouge par une bentonite brute et sodique

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Résumé

Les eaux résiduaires des industries manufacturières sont chargées de nombreux micropolluants organiques notamment certains détergents et colorants. Il est estimé que 10-15% de ces composés chimiques sont déchargés dans les effluents. Lors du procédé de teinture les colorants sont souvent utilisés en excès pour améliorer la teinture et de ce fait les eaux de rejet se trouvent fortement concentrées en colorant.

Le traitement des effluents chargés en colorant est devenu une nécessité compte tenu de ses répercutions négatives sur les écosystèmes essentiellement dus au caractère polluant des colorants synthétiques et particulièrement les colorants solubles tels que les colorants acides.

La technologie de séparation par adsorption constitue aujourd'hui une des technologies de séparation de traitements les plus importants.

Le choix porté à l'utilisation d'une bentonite survient dans le but d'utiliser un remplaçant aussi efficace et moins coûteux que le charbon actif. Ce choix est aussi justifié par l'importance de la surface développée par ce matériau, par la possibilité d'échange de cations et par une grande disponibilité dans notre pays.

Au cours de cette étude, nous testerons donc cette argile dont le principal constituant est la montmorillonite, dont les propriétés les plus remarquables est sa capacité de gonflement résultant de la présence d'eau dans l'espace entre les feuillets et sa structure fibreuse pour l'adsorption du colorant acide « rouge Bemacid ».

L'étude des différents paramètres à savoir le temps , température, et PH a montré que l'adsorption est la plus favorable à la température de 19 °C pendant 240 minutes à un Ph égal à 2.Des modèles d'adsorption type Langmuir et Freundlich ont été appliqués pour décrire les isothermes. Les résultats obtenus montrent que la bentonite sodique semble influer sur la capacité et l'efficacité pour adsorber le colorant.Les quantites ultimes sont respectivement de 0.629mg/g et de 0.589mg/g pour la bentonite sodique et la bentonite brute.

Mots clés: Bentonite, Traitement des eaux polluées, Colorants acides, Adsorption

Kinetic and thermodinamic studie of removel of ortho chlorophenol from potable water using activated carbon

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Abstract

The adsorption of *o*-chlorophenol on date carbon was investigated to assess its possible use as an adsorbent for the processing of phenolic waste water .The influences of various factors such as initial concentration, the temperature and speed agitation on the adsorption capacity has been studied. The percentage removal 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 . Process parameters including the rate of agitation, initial concentration and temperature were examined and the obtained data were modelled using four kinetic models including a pseudo-first-order, pseudo-second-order the pore diffusion model and the Elovich equation to understand the reaction mechanism. Thermodynamic parameters such as enthalpy, entropy and Gibb’s free energy changes were also calculated.

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

Evaluation de l’effet antidote de l’acide ascorbique ”vitamine C” sur la toxicité rénale des rats wistar intoxiqués par le cadmium

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Abstract

La pollution des écosystèmes aquatiques est marquée par la présence de contaminants dans les sédiments et les poissons consommés par les populations. La plupart des métaux lourds, en effet, sont susceptibles de s’accumuler dans l’organisme par l’alimentation et de générer ainsi un stress oxydant qui altère les fonctions vitales de l’organisme. L’apport d’antioxydants semble être donc un moyen de limiter les effets toxiques du stress oxydant. L’acide ascorbique, en particulier, est connu comme un antioxydant qui empêche la formation par les métaux lourds, (le cadmium), de radicaux libres susceptibles d’altérer les tissus. La vitamine C stimulerait aussi dans l’organisme l’augmentation du taux de glutathion, un autre puissant antioxydant.

Cette étude se propose de mettre en évidence le cadmium dans certains poissons les plus consommés du lac Nokoué du Bénin et de proposer une solution aux risques sanitaires liés à la présence de ce métal dans l’organisme des consommateurs.

L’impact de la consommation de la vitamine C sur la toxicité rénale du cadmium au niveau des appareils rénal des rats est fait tenant compte de la recherche du cadmium, de minéraux (Ca, Fe) et de protéines dans les urines et les selles, la variation pondérale des souris, le dosage du glutathion, le dosage de l’acétylcholinestérase et les observations histopathologiques du rein.

L’étude suggérera plusieurs recommandations, dont la prise de la vitamine C comme complément alimentaire pour la population afin de réduire les effets toxiques du cadmium sur les reins qui représentent l’un des organes clé du métabolisme au niveau de l’organisme humain.

Mots clés: métaux lourds, cadmium, vitamine c, antioxydant.

Utilisation des eaux usées épurées et des boues d'épuration dans l'agriculture

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Résumé

L'objectif de cette étude est d'examiner les eaux épurées ainsi que les boues d'épuration en vue de leur valorisation agricole.

Le type d'approche qui a été suivie dans l'étude de la qualité des eaux d'irrigation concerne des problèmes entrant généralement dans les quatre grandes catégories suivantes : salinité, perméabilité, toxicité et état sanitaire.

Les analyses physico-chimiques des eaux épurées révèlent une conformité de la majorité des paramètres par rapport aux normes de réutilisation de ces eaux en irrigation.

Les analyses bactériologiques des eaux épurées révèlent une diminution significative du nombre de bactéries, mais le nombre de germes pathogènes reste supérieur aux normes de l'OMS, ce qui impose une désinfection des eaux épurées, avec interdiction de les utiliser sur des crudités.

Nous avons étudié les risques de toxicité par les métaux lourds et les composés traces organiques dans les boues, ainsi que les apports en matière organiques et en fertilisants.

Une étude comparative entre la composition des boues, celle du compost urbain et du fumier de ferme a été réalisée.

Les boues d'épuration sont des cadavres microbiens, elles sont riches en en éléments fertilisants mais ne contiennent ni cellulose, ni lignine qui sont indispensables à la formation de l'humus.

Pour compenser ce déficit, nous recommandons d'utiliser les boues en mélange avec du compost urbain ou du fumier de ferme.

Les proportions seront calculées en fonction de la composition de chaque produit, en tenant compte des critères de maîtrise de la pollution du milieu ainsi que des besoins des sols et des plantes en matière organique et en éléments fertilisants.

Mots clés: eau usées, irrigation, boues, pollution, toxicité.

Modélisation des paramètres physico-chimiques de la coagulation floculation pour le traitement des eaux de surface

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Résumé:

Le procédé de coagulation floculation est très complexe. Pour trouver la concentration du coagulant à injecter dans l'eau, l'opérateur de la station de traitement des eaux potables se trouve obligé de faire des essais de coagulation floculation à l'aide du jar test, à cause de l'influence de quelques paramètres physico-chimiques sur ce procédé, qui peuvent changer d'un jour à l'autre.

Le but de l'étude consiste à trouver un modèle mathématique à l'aide duquel on peut estimer la concentration du coagulant en sachant les valeurs des différents paramètres physico-chimiques de l'eau brute.

On a travaillé sur l'eau traitée dans la station de traitement des eaux de surface (ville de Boudouaou, Boumerdes-Algérie) sur les résultats de 5 ans (de 2004 à 2008) et les paramètres suivants: température, pH, conductivité, turbidité, TAC et l'oxygène dissous ont été pris en considérations.

Nous avons trouvé un modèle mathématique pour chaque paramètre et on a pu aboutir à trouver un modèle qui englobe la totalité des paramètres cités.

Ce modèle global reflète assez bien des résultats expérimentaux trouvés par le jar test sur la station de traitement. Un logiciel adéquat a été mis en place.

Mots clés: Modélisation, Paramètres physico-chimiques, Coagulation floculation, eaux potables.

The efficiency of bubble plume diffuser in the control of eutrophication in the water supply

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Abstract

The techniques of restoration of lakes or the prevention against eutrophication are numerous (chemical, biologic, mechanical…). Due to their excessive cost and the relatively insignificant income of some of these techniques, the process of dynamic aeration is one of the most promising methods.
Several techniques of the control of nutritional elements are selected for this study: artificial destratification by the bubble plume, partial (or total) lift hypolimnetic aerator, bubble plume oxygenation and speece cone oxygenation in the hypolimnetic aeration. Each of these methods has its advantages and inconveniences. A technical and economic analysis established by different researches reveals that the hypolimnetic oxygenation is the most favorable for the control of nutrional elements. In hypolimnetic aeration systems, the aeration system by bubble plume appears to be the most economic and perhaps the most simple among the systems used in standley lake (colorado, u.s.a), even as other researches select speece cone aeration system.

We found that the aeration by oxygen limits the nitrogen saturation and in contrast the aeration creates it. We demonstrate that the most efficient hypolimnetic aeration system is the bubble plume diffuser; although an accidental destratification may occur. We show as well that the destratification can be used in winter because the temperature of the lake is not modified. However, the hypolimnetic aeration is used in summer in order to avoid the homogenization of the lake temperature during this period.

The work presented in this paper is a review of aeration techniques and their impacts on water reservoirs. As well, this study concentrate on the economic and technical sides associated to these aeration systems.

Keywords: artificial aeration, destratification, hyolimnetic aeration, dissolved oxygen, thermal stratification, bubble plume, lake.

Study of the restoration of the lakes against the phenomenon of eutrophication

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Abstract

The techniques of restoration of the lakes or prevention against eutrophication are numerous (chemical, biological, mechanical,...). Considering the excessive cost and the relatively low efficiency of some of these ones, the process of dynamic aeration is one of the most promising means.

Thermal stratification of lakes and reservoirs can result in substantial hypolimnetic oxygen depletion, which may have a negative impact on the cold-water fisheries, the drinking- water treatment process, and water quality downstream of hydropower reservoirs.

The main purpose of this study is to show the efficient of hypolimnetic aeration process in the preservation of the stratification thermique, increasing the amount of oxygen dissolved, and reduction in phosphorus in the depths of the lake.

The 10.3 km2 of the water of Lake Hallwil are an important tourist center for the canton of Lucerne (Switzerland). In fact fishing and water sports are practiced. Before its restoration in the winter of the year 1985/1986, this lake eutrophication showed significant disruption of aquatic activities, and pollution damage to its various uses, and thus inhibited the development of tourism in the region.

For this, EAWAG, to address the eutrophication of Hallwil lake, put into service in the winter of 1985/1986, an installation of a aeration system in two alternate modes of aeration namely by a aeration system in winter destratification and aeration hypolimnètic in summer (air / pure oxygen).

As a result, we find the values of the concentrations of dissolved oxygen during the aeration as:

[O2] min ≥ 4.5 g/m3 in the spatial variation and 5 g/m3 the temporal variation

Also, the heating of the hypolimnion did not reach the thermocline and hence the thermal stratification is preserved.

Keywords : hypolimetic aeration; dissolved oxygen; thermal stratification, phosphorus, hypolimnion, temperature.

Contribution to the purification of surface water around the sugar factory Namakia Commune Rural MATSAKABANJA-MADAGASCAR

Rasoanandrasana Emilienne, Rasolonjatovo Martial Zozime

Abstract

Environmental problems related to water quality of daily use (wells, rivers and lakes) resulting from irrigation (runoff, nutrients and pesticides, erosion) and industrial use is in a critical situation right now.

Regarding the issues of sewage and effluents, there is the problem of organic and inorganic pollutants that accompany them.

Then, the sealing of waste disturbs the environment. Waste management is a process that incorporates both waste generation and treatment.

In Madagascar, a country that is still developing, production of industrial effluent reaches thousands of tons per year and can not find the most from treatment before release into the wild. Little practice Madagascar industries treat their effluents

Waste management poses problems in Madagascar. View these problems, the Ministry of the Environment, Water, Forests and Tourism, in its current policy requires companies and public and private companies working in the country establish a management plan for these wastes to prevent or reduce effects and environmental impacts.

Today, one billion people lack access to safe water and 2.6 billion have no sanitation and water is the number one killer of humans on our planet and c is one of the possible causes of future conflict.

Our study focused on the consequences of releases of the sugar industry to Namakia, as it applies in combination with sugar production, the production of alcohol for consumption and for other uses such as biofuel.

This amounts to our goal of contributing to the purification of surface water at the sugar industries in Madagascar: the case of sugar Namakia West Plant - City-Region Rural Matsakabanja Boeny-MADAGASCAR-Mahajanga.

Given the large quantities of wastewater generation and effluent at the industry level, it is not surprising that environmental concerns are increasing and have focused on the development of research of the effectiveness of water treatment technology wastewater.

Our goal is to reduce pollutants in discharges of effluent and sewage to the purification of surface waters receiving end of coagulation flocculation static mixer, retention of chemical and biological contaminants and control colloidal fouling of membranes production of drinking water.

Keywords: Water, Problems, environment, Sugar factory, waste, treatment

Valorisation des liqueurs noires de délignification de l'alfa par un procédé kraft

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Résumé

Presque la totalité des pâtes à papier produites de nos jours est obtenue par un procédé kraft dont la liqueur de cuisson dite blanche ou fraiche, est constituée essentiellement de soude NaOH, de sulfure de sodium Na_2S et d'une petite quantité de carbonate de sodium Na_2CO_3 provenant de la liqueur de récupération;

La cuisson vise à dissoudre les lignines contenues dans le végétal en minimisant la solubilisation des polysaccharides ; ce rôle est assuré par les liqueurs fraiches suite aux différentes réactions chimiques avec les constituants du végétal en présence d'une température qu'on a maintenue à 95°c sur un palier de cuisson de 50 min, relativement aux facteurs chimiques de la liqueur, qui ont été comme suit :

- Alcali effectif, ($NaOH + ½ Na_2S$): 16 % du poids de végétal sec absolu
- Taux de sulfidité: $S\% = Na_2S / (NaOH + Na_2S) \times 100 = Na_2S / Aa = 20\%$;

La concentration de la solution de délignification étant de 80 g Na_2O par litre, sur la liqueur blanche, est diminuée à 60g / litre suite à l'addition de la liqueur noire de récupération. Durant la cuisson, la liqueur blanche, se transforme en liqueur noire, suite aux réactions chimiques qui ont lieu entre le végétal et l'alcali ; c'est une suspension formée de composés complexes organiques avec l'alcali et le soufre. Notre travail consiste à essayer de recycler cette solution, ce qui pourrait faire profit d'un double avantage : D'une part on baisse le prix de revient de cuisson en récupérant les agents chimiques présents dans la liqueur noire ; d'autre part on éviterait le problème de pollution que pourrait engendrer le rejet de ces produits dans les rivières. Ce travail compte 2 volets:

1. – La récupération des agents actifs minéraux effectué au laboratoire, par un procédé de caustification, durant lequel la liqueur noire obtenue après une cuisson d'alfa réalisée dans un autoclave de laboratoire, est récupérée, séchée par évaporation dans une étuve à 105°c jusqu'à la concentration maximale (humidité 10%) puis brûlée dans un four à 750 °c ; Les substances organiques sont transformées en CO_2 et H_2O et la partie minérale est récupérée sous forme de salin.

Ce salin est dissout dans de l'eau distillée, et a donné ce qu'on appelle la liqueur verte. La teinte verte est due à la présence dans des sels de fer et substances organiques non consumées.

On a procédé ensuite à une caustification menant à la transformation des minéraux en soude et carbonate de sodium selon la réaction: $Na_2CO_3 + Ca(OH)_2 \Longleftrightarrow 2NaOH + CaCO_3$, qui a permis un degré de caustification de 14% ce qui est largement encourageant du point de vue économique puisque permettant de diminuer la consommation de produits frais dans une certaine mesure.

2.- La 2^{ième} partie serait de récupérer l'énergie engendrée par la combustion des matières organiques qu'on pourrait évaluer pour se prononcer quant à son usage comme combustibles grâce aux réactions exothermiques d'oxydation ; Cette partie nécessitant des moyens plus sophistiqués sera traitée ultérieurement.

Mots clés: *Traitement d'effluents résiduaires, Récupération de liqueurs noires, Liqueurs de cuisson, Procédé kraft.*

Modification of an anion exchange membrane surface: Temperature dependence of anion exchange equilibrium

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Abstract

In order to improve the selectivity of the AMX membrane, a polyethyleneimine (PEI) layer was adsorbed on its surface by immersion of the considered membrane in a solution of PEI. Many conditions of modification of the AMX membrane surface were studied and the results obtained have shown that the initial concentration of polyethyleneimine and the solution pH were the main influent parameters on the adsorption of polyethyleneimine on the membrane surface.

Equilibrium ion exchange isotherms of (Cl^-/NO_3^-), (Cl^-/SO_4^{2-}) and (NO_3^-/SO_4^{2-}) using modified AMX membrane were established at different temperatures (from 283 to 313K) and at constant concentration of 0.3 mol.L^{-1}.

The results obtained with the modified membrane, in this range of temperature, show that chloride was the most sorbed and the selectivity order was: $Cl^- > NO_3^- > SO_4^{2-}$. Selectivity coefficients K_i^j and thermodynamic equilibrium constants $K_i^{\circ j}$ were determined for the three binary systems and increase with increasing temperature. These results were compared with those obtained with the unmodified membrane. It was observed that for the modified membrane the selectivity towards sulfate ion decreased and the modified membrane became more selective towards monovalent anions.

Thermodynamic parameters such as standard free enthalpy change, standard enthalpy change, and standard entropy change were calculated.

Keywords : Anion exchange membrane, Membrane modification, Polyethyleneimine, Selectivity coefficient, Binary system Isotherms, Temperature effect, Thermodynamics.

Treating salt and color water by ceramic membrane

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Abstract

Ceramic membranes are nowadays being developed as a mature technology to deal with polluted waters. Although inorganic membranes have replaced organic membranes in many industrial applications, they have yet been used widely in desalination processes. In this paper, the retention of a series of salt molecules (NaCl, Na_2SO_4, $MgSO_4$, $MgCl_2$) and Congo red by two membranes (symbolized SMC and SMCA) was studied. Filtration tests were performed on a laboratory scale filtration, using a recycling configuration at 5 bar.

The results showed the permeate flux for the different wastewaters through these membranes varied from 274.28L/hm^2 (for SMCA) to 514.29L/h.m^2 (for SMC).

The rejection rate salts and Congo red was strongly influenced by the electrical interactions between ionic species and surface membrane. The maximum observed solute retention, using SMCA membrane, of Congo red and NaCl was 95% and 47% respectively.

Key words: *ceramic membrane, synthesis, salt and flux*

Study of some parameters affecting efficiency of paracetamol

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Abstract

Recently, the attention of many researchers working in the environmental field was focused on the presence in the environment (and more specifically in waters) of pharmaceuticals as a new class of pollutants. The occurrence of these substances in the environment shows that are only partially removed during conventional wastewater treatment. Among the processes used to eliminate them from waters we can cite: degradation, sorption, advanced oxidation processes (AOP) particularly the ozonation process, photodegradation, membrane filtration using nanofiltration or reverse osmosis and membrane bioreactors, adsorption on activated carbon. In this work we have studied the recovery of a pharmaceutical metabolite, acetaminophen, from aqueous solution by membrane technology and particularly the supported liquid membrane (SLM) process using the tricaprylylmethyl ammonium chloride (Aliquat 336®) as carrier. Several parameters have been investigated such as the strippant nature, the concentration of the receiving phase, the diluent nature, the concentration of the organic phase and the pH of the feed phase. We have also evaluated the stability of the system. Finally we have tried to remove acetaminophen from some medicines in order to see the efficacity of the system.

CMTDE_194

The technique of water desalination in Algeria:
between the social need and the environmental fears

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Abstract

The issue of the lack of water and its decrease of quality is considered one of the most important environmental, economical and political issues which interests the countries of the Arabregion. Forthis, it is viewed that desalination technique is one of the present strategic possibility for the countries of the region in reinforcing continuous security for water, the need of natural water from one side, the rapid growth population from the second side, and the industrial agricultural progress from the third side.

According to the increasing demand for water, in the last years, Algeria has dealt with relying on desalination technique of the sea water as a practical solution and a strategic substitute especially our country is endowed with a coast extending at a length of 1200 km, and most of the inhabitants and the factories, having large consumption for water, exist on the coastline.

A numerous technological ways are used in the desalination operations, Among these the use of electric or chemical or solar or nuclear energy, and the striking factor in the use between one method and another is the financial expenditure and the environmental impact resulting from the production of one meter cube from desalinated water.

From this scientific foundation, the countries concerned with desalination are linked with economic factors and environmental issues related with sound regulation and security of remaining concentrated salty desalinated, after removing salts mainly in the coastal regions, we have worked, through this scientific modest paper, to study deeply desalination in Algeria in the light of a dire necessity for varying and developing the supplying stems with water from one side and the harms and the environmental disturbances from the other side.

Key words: water, desalination, policy, society, environment, Algeria.

Long term effects of treated wastewater irrigation on a soil properties and fertility: a case study of Sfax-Tunisia

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Abstract

The use of treated wastewater effluents (TWE) for irrigation is increasingly being considered as a technical solution to minimize soil degradation and to restore nutrient content of soils. Indeed, TWE usually contain large amounts of nutrient elements. The objective of this study was to evaluate the impact of long term TWE irrigation on soil fertility. In the real condition of TWE irrigation at the city of Sfax, a calcosol field irrigated since more 15 years was selected. Soil was sampled at three different depths (0-30, 30-60 and 60-90 cm) in the TWE irrigated zone as well as in a non irrigated zone (control). Several parameters have been characterized in the irrigated and non irrigated study soils: pH, nitrates and ammonia water extract of soil, electrical conductivity of extract past of soil (ECs), exchangeable cations, soil organic matter (SOM) and total nitrogen. C/N ratio and SUVA were also calculated.

The TWE irrigation has, in one hand, increased the SOM content of surface layer and in the other hand, enhanced the SOM turnover. A negative relationship was shown between ECs and dissolved organic carbon of soil. The salinity increase is thus already related to a loss of soil fertility. Moreover the exchangeable Mg^{2+}, K^+, Na^+, ammonia and nitrate contents generally increase in the irrigated soil only. These increases are in agreement with the relatively high concentrations of these cations in the treated effluent used for irrigation. However, due to the higher rate of irrigation and lower CEC of the soil, the added nutrient cations are removed with leaching waters.

Key words: arid region, wastewater, irrigation, fertility, El Hajeb-Sfax

CMTDE_197

Kinetic and adsorption study of thioanisole onto carbon prepared from olive stone

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Abstract

Activated carbon is widely used as an adsorbent due to its high adsorption capacity, high surface area, microporous structure, and high degree of surface repectively. The preparation and effective utilization of activated carbon generated from natural materials have attracted worldide attention in view of the large disposal problem detrimental to the environment.

Many human–made organic chemical coumpounds are currently possible to be detected in drinking water sources, hence, they are inreasing interest , because of their potential toxicity , carcinogenicity and mutagenicity effects. Among them, organosulfur compounds (thioanisole) can enter in drinking water supplies.

This study is aimed to remove organic compound (thioanisole) from aqueous solution by adsorption. As adsorbent, activated carbon prepared from olive stone. The adsorption experiments were conducted at different parameters such as, adsorbent dose, equilibrium time and pH . According to the experments results , the equilibrium time, optimum pH, adsorbent dosage were found 90mn, pH > 6, and 10mg/5ml respectively. Adsorption capacities were 40mg/g for the particule size of 400-800nm. The adsorption data were fitted with the langmuir and freundlich isotherms (Fig.1.).

Physical properties including surface area, average pore diameter and micropore volume and chemical structure of the activated carbons were characterized by N_2 adsorption experiment, Electron micrograph (TEM) ,X-ray diffraction(XRD) analysis, elemental analysis and FT-IR spectroscopy.

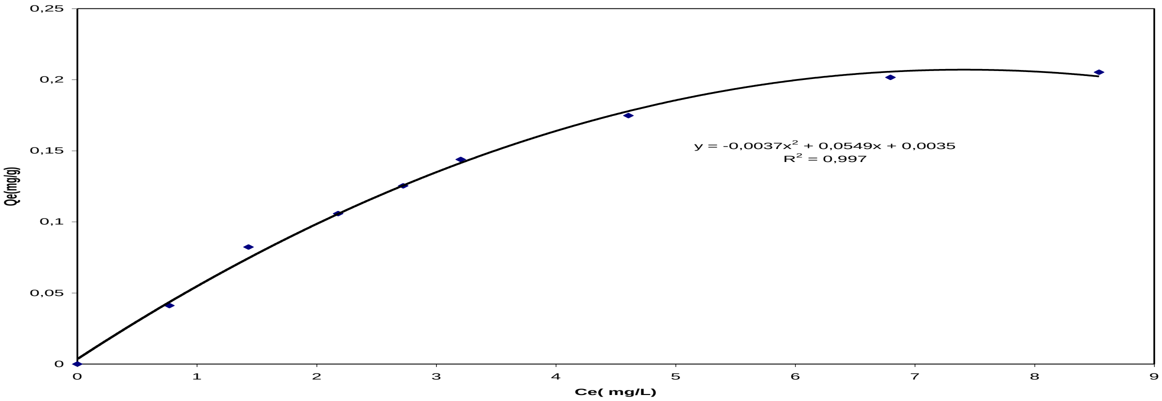

Fig.1. Isotherms for adsorption of thioanisole onto activated carbon

Keywords: Activated carbon, Adsorption, Thioanisole, Kinetics, Isotherms.

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Assessment of adsorption behaviour of inorganic effluents onto activated bentonite from maghnia

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Abstract

A series of samples of bentonite from Maghnia (N.W. Algeria) were treated with HCl (0.05M; 0.5M and 1M), polluted with inorganic effluents and characterized by powder X-ray diffraction (DRX), DTA and GTA. The results showed that the deshydroxylation was obtained at 137 ^{0}C, the recristallisation peak appeared at 400 ^{0}C and the lost of weight was 15%. The removal percentages were 91% for activated clay with 0.05M HCl, 72% in the cas of activated clay with 0.05M HCl and polluted. These removal percentages were 94% for activated clay with 0.5M HCl and 98% in the cas of activated clay with 0.5M HCl and polluted.

Keywords: Bentonite, DRX, DTA, GTA Removal, Effluent.

CMTDE_199

New alternatives cellulosic source: *Posidonia oceanica*, as bio-sorbent substrate

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Abstract

The present work is focused on treating organic industrial wastewaters by alternative Tunisian source powder, namely: *Posidonia oceanica*. This agricultural residue was investigated as bio-sorbent for the removal of a typical organic pollutant in water effluents, from industrial wastewaters. Thus, phenanthrene, a polycyclic aromatic hydrocarbon was deeply studied. Several experimental parameters, such as the pH, the adsorption time and the absorbent weight were investigated and the optimal operating conditions established. Then, a comparison of the adsorption performance between a conventional commercial activated carbon (Charcol Activated) and that prepared from *Posidonia oceanica* was carried out. The adsorption data were modelled using both Langmuir and Freundlich classical adsorption isotherms, suggesting monolayer coverage of molecules onto the substrate surfaces. This data processing showed that the adsorption onto *Posidonia oceanica* and activated carbon fitted well to Langmuir model, as shown in *Figure 1*.

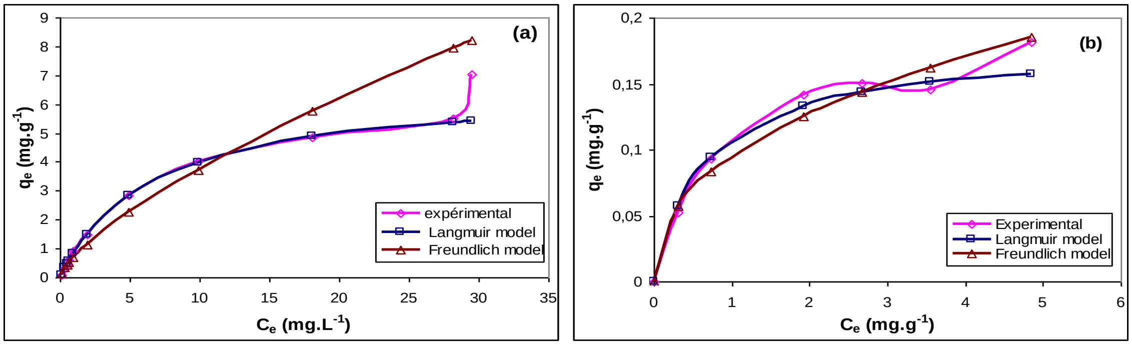

Figure 1: Langmuir and Freundlich isotherms modeling of phenanthrene adsorption on the surface of activated carbon (a) and *Posidonia oceanica* (b) powders.

Characterization of mineral surface by streaming induced potential

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Abstract

This work was completed at the Institute of Chemistry of Surfaces and Interface- UHA Mulhouse France, in order to elucidate the mechanism of interaction between the clay particles and the various cation ions in aqueous medium, the effects of various symmetrical and dissymmetrical electrolytes (NaCl, KCl, $CaCl_2$ and $BaCl_2$) on the load of surface of two montmorillonites, illites and kaolinites were studied by measurement of the streaming induced potential. In addition the adsorption of cationic surfactant from water onto minerals surface were followed by SIP.

When one disperses a solid in an unspecified solution and in order to respect the electroneutrality of the suspension, a layer of against-ions is established on the surface of the solid in question. The backward and forward motion and from of the piston of μ Mütek deforms the ionic layer and involves the against-ions in the opposite direction of the movement of the piston. The centre of gravity of the loads carried by the against-ions is then modified; it results creation from it from multiples small dipoles between negative charges and positive.

In our case we have to determine the quantity of surface-active adsorbed on clays. We carried out measurements of SIP with a detector of load of particles μ Mütek PCD 02 (Particle Charge Detector), based on the principle of the potential of flow. This apparatus allows the quantitative proportioning of the loads of surfaces from its design.

Briefly let us recall that the evolution of the sign of the load of surface makes it possible to know the interaction between adsorbate and adsorbent and thus the curve of adsorption of surface-active on a solid surface. This result depends closely on the value and the sign of the load of surface and thus, indirectly, of the streaming induced potential (SIP).

The potential induced potential decreases in absolute value when the salt concentration increases in the electrolytic solution for two montmorillonites, signs of a stronger affinity of the cation exchanged for the surface, which thus compensates for more effectively the negative charges.

Key words : Charge of surface, Points of zero loads, Adsorption, Clays, Salts.

Ofloxacine oxidation by hydrogen peroxide in the presence of a promoted Fe/ Alginate support

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Abstract

Effective treatment of industrial wastewaters has become an increasingly concerning problem in the last decades. These effluents frequently contain pollutants which are resistant to conventional wastewater treatments. The development of new efficient technologies becomes a need to treat pollution.

The application of advanced oxidation process such as Fenton process in wastewater treatment is attractive due to the fact that iron is a widely available and non-toxic element and hydrogen peroxide is easy to handle and the excess decomposes to environmentally safe products. However, this treatment shows some inconveniences derived from the need of removing iron after the treatment, which requires additional separation steps increasing the treatment cost. This can be overcome by the use of heterogeneous catalysts in the so called catalytic wet peroxide oxidation (CWPO). Several supports have been used, like zeolites, pillared clays, alumina, silica and activated carbon; there are no works in the literature dealing with sodium alginate supported catalysts for CWPO. Alginate is a natural, biodegradable and non toxic polymer extracted from a brown seaweed named *Laminaria digitata.*

A Fe on sodium alginate catalyst has been prepared and tested for ofloxacin oxidation with H_2O_2 in aqueous solution at a concentration of 30 mg/L. This antibiotic was selected as model pollutant because of its current use in the drugs industry, its chemical structure and finally, because the removal of pharmaceuticals from effluents has been an issue of very active research in the field of wastewater treatment, due to the high environmental problems associated with this type of pollution.

The strategy of the water security in Algeria

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Abstract

Scientists of the environment and geography at the national and international level, have agreed that the third millenary is the millenary of the blue gold (water). Its importance, presently and in the future exceeds the importance of the rare yellow gold, it also exceeds the value of the black gold (oil). For this, the twenty first century is witnessing a reel challenge for the mankind in acquiring water quantitatively and qualitatively.

Beginning on the basis, I have tried to study and analyse the problem of water in Algeria, and what is the policy taken-if there is a policy- in the management of water resources in Algeria? And whether there is an efficient policy in the management of the water resources or not ?

For this reason, I have dealt with natural and unnatural water resources existing in Algeria, and the reel amounts exploited. Then, I have drawn a comparison between the water resources available and the inhabitants needs in the field of drinkable water and industrial and agricultural activities, for a short and a long term.

After this, I have tackled the concretisation and analysis of the fundamental factors that lead to the water crisis in Algeria starting from natural climatic judicial and organizational factors , then financial and material ones to human and technical factors which have contributed greatly to the occurrence of the water crisis .

Moreover, in this thesis, I have dealt with the analysis and the study of the most important and the greatest axis formed in the new policy taken by the state (the government) in the management of the water resources in Algeria through the judicial base, the institutional framework. Finally the field of achievements and projects.

So as to fight against the increasing sharp crisis of water, I have suggested a study, after evaluating the plans which were taken in the past , in scientific and an objective manner , and take strategies and policies for providing water resources in Algeria and managing them rationally and taking these strategies and policies for the purpose of reaching global , balanced and sustainable development .

Keywords: *water resources, water crisis, water policy, water strategy, water security,Algeria.*

Ofloxacine adsorption on a natural clay

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Abstract

Drugs are frequently detected in effluents and their elimination in sewage treatment plants is often incomplete. These substances can bioaccumulate and their presence in the aquatic ecosystems is a real concern. Many chemical and biological technologies have been reported for the treatment of these pollutants in aqueous matrices.

Removal of pharmaceuticals by adsorption is one of the most promising treatments for its simplicity, flexibility and high efficiency. The use of clays as sorbents is an interesting technique for decontamination of industrial effluents because they are natural, abundant, inexpensive, and environmentally friendly developing “green chemistry”.

In this study, a natural montmorillonite clay was tested for the adsorption of ofloxacin, a quinolone antibiotic, under ambient conditions. This natural material was chosen because of its high specific surface area. Ofloxacin was selected because it is one of the most frequently used fluoroquinolone. Significant concentrations of this pharmaceutical have been detected in municipal sewage. Even under low concentrations, ofloxacin present in wastewater may induce antibiotic resistance of aquatic species. Thus, from a risk assessment point of view, it might be considered as an environmental hazard.

The main objectives of the work were to examine the influence of various parameters on the drug conversion such as pH, dosage of montmorillonite and initial drug concentration. A kinetic study was also assessed.

Biodecolorization of reactive dye by natural and modified material

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Abstract

Many dyes are ubiquitous in the environment, since 15-20% of the word dye production is estimated to be released into the environment. Dyes are not easily biodegradable because of increased complexity of chemical structures and presence of aromatic rings. Recent work has reported the use of TiO_2 in the photocatalytic degradation of textile dye, yet TiO2 powder used as an aqueous dispersion is very difficult to recover. TiO_2 supported on different minerals or TiO_2 thin films therefore appeared to be a promising way to enlarge application fields and overcome TiO_2 recovery problems, mesoporous materials based on clay minerals have been synthesized

In this investigation pillared bentonite composites were synthesized by dispersion of TiO_2 on the surface of a purified bentonite (bentonite –Na) in order to increase the sorption ability of the purified bentonite. Different materials with various loading in TiO_2 were prepared and characterized by several analytical technique including XRD, BET and SEM analysis. The synthetic procedure allows the formation of a more lamellar-like aggregation for the bentonite-TiO_2 sample relatively to the purified one (bentonite-Na). It was found that the greater pore volume and surface area was reached in the case of the greater percent of TiO_2.

bentonite-TiO_2 samples were calcined at different temperatures (200-800°C) in order to prepare a TiO_2-pillared bentonite samples witch having more mechanical stability. All theses samples (before and after change) were tested as a support to remove a toxic textile dye from aqueous solution (reactive blue II). Experiments were carried out with an aqueous dye concentration of 10^{-4}M at different pH, greater percent of dye removed was observed when used TiO_2-bentonite and TiO_2-pillared bentonite than the purified one. According to UV results, the higher amount of the dye removed was found at acidic rather than at basic pH. Adsorption results followed pseudo-first order kinetics according to the Langmuir-Hinshelwood model. In conclusion, together with their good sedimentation ability the composite materials (TiO_2-bent and TiO_2-pillared bentonite) could be considered as a promising alternative for the removal of organic water contaminants.

Optimization of the evaporation of a falling film in a vertical channel

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Abstract

The evaporation of falling liquid film in a channel has been widely used in many industrial applications such as distillers, cooling towers.

The studied channel is a vertical and rectangular with a form factor equal to 10, the two parallel plates are submitted or not at a constant heat flux density and wetted by a liquid film also heated or not.

Under the effect of the heat flux, a natural convection heat and mass transfer occurs and the falling liquid film undergoes evaporation along the plates.

In this work, the heat and mass transfer phenomena are studied in natural convection in the three different media: the solid medium of the heated plate, the liquid falling film and the gaseous medium represented by the air-vapor mixture.

The results obtained are exploited to compare the two following cases:

- The channel is formed by two insulated plates and a constant heat flux is directly applied to the liquid water films falling on both sides of the channel walls
- The same constant heat flux is used to heat symmetrically the channel walls wherever the liquid water film is not preheated.

This comparison allows us to better understand the characteristics and the nature of transfers in order to optimize the energy required for evaporation. The results enabled us to identify some origins of the low performances of the evaporator, for example, the sensible heat losses through the outlet water and back-condensation of a part of the vapor produced on the liquid film in some configurations.

Furthermore, in addition to this critical analysis of the nature of the transfer phenomena, we proposed a configuration improved for the evaporator which consists in using a channel with insulated plates and to preheat the water before its introduction into the evaporator using the same heat flux as in the initial configuration.

Using the parameters adopted in the simulation, this new configuration improves significantly the performance of the evaporator.

Keywords: *evaporation, liquid film, natural convection, modeling, conduction*

Effect of pH, ionic strength and coexisting ions on silica and boron removal by adsorption: Application to natural waters

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Abstract

Desalination of seawater and brackish water has become increasingly important as a source of water supply to contend with the population burden worldwide. The occurrence of silica and boron which exist mainly in the form of silicic acid (H4SiO4) and boric acid (H3BO3) in water is undesirable.

In recent years, some sorption (adsorption, biosorption and ion exchange) processes have gained importance as effective purification and separation techniques for removal of toxic substances from water due to the preparation of some innovative materials. One of these promising materials is activated alumina.

The objective of the present study was to evaluate the potential of activated alumina for the removal of boron from sea water and silica from brackish water. The point of zero charge (PZC) of the alumina was determined and the effects of some chemical parameters on the adsorption onto activated alumina have been investigated. It was observed that the adsorption of silica was not significantly decreased by the addition of other anions while the removal efficiency of boron decreased with the addition of HCO_3^- , NO_3^- and silica. Then, adsorption tests were performed to treat Tunisian brackish and sea waters for silica and boron removal respectively.

Keywords : Boron, Silica, Removal, Adsorption, equilibrium, pH, Ionic strength, coexisting ions, brackish waters, Sea waters

Traitement physico-chimique des eaux usées industrielles « Cas de la STIR »

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Résumé

La société Tunisienne des Industries de Raffinage STIR traite annuellement 1,8 millions de tonnes de pétrole brut et utilise environ 9 000 000 m^3 d'eaux par an.

Les effluents produits par la société STIR sont chargés en polluants organiques se manifestant par des teneurs en DCO et en HCT (respectivement de l'ordre 400 et 36 mg/L) non conformes aux normes Tunisiennes relatives au rejet dans le domaine public maritime.

L'API séparateur est le bassin collecteur-décanteur des différents rejets hydriques issus des unités de fabrication (eaux huileuses et chimiques), du lavage des circuits et des pompes ainsi que du traitement des eaux de drainage des réservoirs et des eaux de déballastage des tankers.

Le traitement de ces eaux par les coagulants suivants : le chlorure ferrique, le sulfate ferreux et le sulfate d'alumine a montré un abattement de la DCO et des HCT variant respectivement de 52 à 56 % et de 54 à 84 % avec les doses optimales déterminées.

Par ailleurs, l'utilisation du sulfate ferreux et du sulfate d'alumine nécessitent la régulation du pH du milieu afin d'améliorer le rendement épuratoire.

L'optimisation du traitement a été réalisée par l'ajout d'un agent floculant : le poly électrolyte anionique dK floc A23. Les doses optimales étaient de l'ordre de 10, 12 et 6 mg/L respectivement pour les coagulants chlorure ferrique, sulfate ferreux et sulfate d'alumine. Elles ont permis l'amélioration de l'abattement de 3 à 23 % pour la DCO et de 5,5 à 11 % pour HCT.

Compte tenu de l'étude économique et l'efficacité épuratoire, il ressort que le chlorure ferrique est le mieux adapté dans le cas de la STIR.

Le traitement par coagulation-floculation (chlorure ferrique et dK floc A23) de l'effluent préalablement décanté a permis une amélioration de l'abattement de la DCO et de la HCT de l'ordre de 10% permettant ainsi de respecter les normes de rejet dans le milieu récepteur.

Evaporation liquid film enhancement in the vertical annulus with preheated air flow

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Abstract

The evaporation by mixed convection of water film falling on the inner wall of a vertical annulus was studied numerically. The outer wall is assumed insulated and dry. A counter courant flow of a preheated and dry air is drawn between the two concentric cylinders. This air flow is preheated at the inlet of the annulus allows the evaporation phenomenon. The equations governing the gaz flow are solved by the finite volume method. The heat and mass balances written for an element of liquid film allow us to calculate the average temperature of liquid film and the evaporated average mass flux density. The results obtained are exploited to study the influence of the operating parameters on the evaporated average mass flux density. The increase of this density obtained by increasing the temperature and a velocity of air flow or decreasing the vapor mass fraction at the inlet. The curvature intensifies also the heat and mass transfer in this annular geometry. These parameters are important factors to enhance the film evaporation in the vertical annulus.

Keywords: Evaporation, Liquid film, evaporated average mass flux density, annulus.

Gestion des ressources en eau et leurs effets sur l'environnement a l'ouest algerien

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Abstract

La région de l'Ouest Algérien est très limité du point de vue ressources en eau, et il est nécessaire de bien quantifier les ressources en eau, leur exploitation rationnelles, et aussi de voir les effets sur l'environnement

Les potentialités étant faible, l'utilisation de l'eau par l'agriculture, l'industrie et la population font qu'une réelle stratégie et exploitation doit être faite. L'intensification agricole, le développement industriel, l'augmentation croissante de la population rend plus difficile le partage et la gestion de la ressources.

La région de l'oranie vit une phase de transition vers un devenir mal délimité où se mélangent le revers des politiques de développement, un accroissement démographique et le sacrifice d'un patrimoine agricole au profit d'une urbanisation inquiétante. De plus, et devant une longue période sèche (plus d'une trentaine d'années), le rabattement généralisé des nappes, a suscité des conflits et des tensions de plus en plus graves entre l'amont et l'aval des ressources en eau.

Pour répondre aux besoins des activités concentrés sur une mince frange littorale; il a été retenue en plus des ressources superficielles, la déminéralisation des eaux saumâtres de la nappe. La déminéralisation d'une eau pompée à 7g/ l à raison de 20.000m3/jour rejette 140qx/j de résidu sur les terres agricoles depuis sa mise en production (septembre 2005).

De plus, de grandes stations de dessalement sont programmées dont celle de la Macta qui fait 500 000 M3 /j, la plus grande d'Algérie, d'Afrique, ...

La saumure générée par les stations de dessalement et ses effets sur l'environnement, la faune et la flore sont à étudier avec une grande attention, et les études d'impacts sont une réelle nécessité, pour ne pas compromettre notre développement.

Dans cette communication seront développées les réalités de la région en ressources en eau et les solutions à apporter pour un développement harmonieux.

Mots-clés: *Eau, dessalement, agriculture, eaux non conventionnelles, déminéralisation, environnement*

Adsorption of anionic dye «Nylosan Red N-2RBL» on the carbons prepared from coffee grounds: experimental and theoretical study

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Abstract

Numerous industries (textile, paper, plastics…) use synthetic dyes in order to color their products and also consume substantial volumes of water. As a result, they generate a considerable amount of colored wastewater. The presence of very small amounts of dyes in water is highly visible and undesirable. Due to increasingly stringent restrictions on the organic content of industrial effluents, it is necessary to eliminate dyes from wastewater before their release in the environment. Therefore, there is a need to develop technologies that can remove dyes found in wastewaters. The increasing number of publications on adsorption of dyes by activated carbons shows that there is a recent increasing interest in the synthesis of activated carbons by phosphoric acid activation from Arabica coffee grounds.

The adsorption of "Nylosan Red" was studied as a function of contact time, and the concentration of dye. The kinetics of adsorption were well reproduced by a second order law. The adsorption isotherms of "Nylosan Red" onto the prepared activated carbons were well reproduced by the Langmuir model, suggesting a monolayer adsorption.

KeyWords: coffe grounds; H_3PO_4 activated carbons; dye adsorption; pollution.

Study of interactions crystal violet Poly(ammonium acrylate) by polyelectrolyte enhanced Ultrafiltration

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Abstract

The interaction of crystal violet with Poly(Ammonium Acrylate) in aqueous solution has been studied by Polyelectrolyte Enhanced Ultrafiltration. The solution is processed by ultrafiltration using a membrane with pore sizes (10KDa)small enough to block the passage of the polymer and adsorbed colorant. Rejection coefficients higher than 95% are reached in optimal conditions of pressure, concentration in polymer and filtered volume. The rejection rate depends on the polymer concentration, polymer molecular weight, ionic strength and pH. At constant ionic strength, the compositions of colorant bound to the polymer and free in solution follow both Langmuir and Freundlich isotherms. The results resulting from this study showed that the interaction between the polyelectrolyte and the dye arises at the same time as being a reversible balance in combination with an irreversible coordination of the CV on the PA-NH4+. Thus, it was deduced that the electrostatic interactions and the connections of coordination between the ammonium poly(acrylate) and colouring it purple crystal can occur simultaneously considering the chains of the polyelectrolyte are rather long and can play the role of ligands by the doublets of the oxygen of functional grouping COO- to form chelates with the ions of dye.

Keywords: Poly(ammonium acrylate), crystal violet, Polyelectrolyte Enhanced-UltraFiltration, Langmuir and Freundlich isotherms.

PEBAX membranes for water desalination by pervaporation process

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Abstract

Hydrophobic dense PEBA membranes were prepared, and their suitability for a water pervaporation process was studied. The effects of the following parameters on the water flux were determined: membrane thickness (80-140µm) and operating conditions (brine inlet temperature (30-70 °C) and NaCl concentration in the feed brine (0-3.5M)). A water flux of 1.3-7 $Kg.m^{-2}.h^{-1}$ was obtained using this type of membranes with an inlet temperature of 25-65 °C. It was found that, for our application , the optimal specifications for our membrane is a thickness of 100µm and an operating temperature of 60°C that allow to us to have a water flux of 7 $Kg.m^{-2}.h^{-1}$ in the permeate side. These data are required for a manufacturing of a novel desalination system based on this type of dense membranes.

Keywords: PEBAX membrane; pervaporation; permeate flux; activation energy.

Treatment of textile wastewater by ceramic ultrafiltration membrane

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Abstract

The textile industry is a large wastewater producer and many processes have been applied for its treatment. In order to be able to reuse these effluents, membrane processes have been proven as a viable alternative. In this work ultrafiltration was used as pre-treatment of textile effluent previously biologically treated by activated sludge. A tubular ceramic UF (ZrO_2) was employed.

The results showed that the average removal efficiencies of COD, turbidity and dissolved salt were about 30%, 90% and 29% respectively.

The study at different transmembrane pressure shows that critical pressure value below which the concentration of polarization is negligible is about 2, 55 bar.

The variation of permeate flux through time at different temperature permits to calculate the values of concentration polarization and adsorption resistance (R_{cp} and R_a) and index fouling (IC).

Keywords : Ultrafiltration, ceramic membrane, fouling, textile wastewater

Removal of boron from seawaters by electrocoagulation using experimental design methodology

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Abstract

Desalination of seawater has become increasingly important for drinking water supply in a greater part of the world. However, some serious limitations had recently been discovered during field practice, among them the boron problem seems to have a critical meaning. According to the WHO regulations (2011), the boron concentration should be reduced to less than 2.4 mg L^{-1} for drinking water. The purpose of this study is to investigate the feasibility of electrocoagulation (EC) as a pretreatment process to remove boron from seawaters.

To optimize the experimental conditions of boron removal, the effects of the inter-electrode distance (d_{ie}), the electrode connection mode, the ratio (S/V), the pH and the conductivity of the solution (σ_i) were studied. Experimental results obtained showed that optimal boron removal was achieved for: d_{ie} =1cm, bipolar connection mode, (S/V) = 52,8 m^{-1}, pH = 8 and σ_i = 32,5 mS cm^{-1}.

Subsequently, an experimental design methodology was implemented to evaluate statistically the most significant operating parameters. The effects of current density, EC time and initial concentration of boron and their mutual interaction were investigated using 2^3 full factorial design. From the statistical analysis, it is inferred that current density (J) and EC time (t_{EC}) had a considerable effect on boron removal by EC. Nevertheless, initial boron concentration was estimated as unimportant factor. The experimental data showed that optimum operating conditions were J = 14 mA cm^{-2} and t_{EC} = 60 min. At optimal conditions, boron removal from synthetic aqueous solutions containing initial boron concentrations of 5 and 50 mg L^{-1} reached 81% and 79%, respectively.

In order to study the applicability of the process, experiments were conducted to determine the effectiveness of EC treatment for boron removal from natural Tunisian seawaters. Removal efficiency up to 55% was achieved under optimal parameters. But energy consumption was quite high.

Keywords : Boron removal, Electrocoagulation, Connection mode, die, (S/V), pH, Conductivity, Current density , Time EC, Initial concentration of boron, Full factorial design, Boron seawater.

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