CMTDE

2019

PROCEEDING BOOKS

7th Maghreb Conference on Desalination and Water Treatment

22 - 25 December 2019
Sol Azur Beach Congress Hotel 4★, Hammamet, Tunisia

Organized by

الجمعية التونسية لتحلية المياه
TDA
Tunisian Desalination Association

Laboratoire de Recherche
"Dessalement et Traitement des Eaux"
LRDTE
Code : LR19ES01
Université de Tunis El Manar
Faculté des Sciences de Tunis

With the collaboration of

European Deasalination Society

PREFACE

The Maghreb Conference on Desalination and Water Treatment CMTDE was initiated in 2007 by the Tunisian Desalination Association and Desalination and Water Treatment Laboratory, with the support of the European Desalination Society.

CMTDE is the unique Conference organized in the field of desalination and water treatment. It is held every 2 years and has become a successful platform to discuss advances and share experiences in desalination processes, water and wastewater treatments.

Selected manuscripts will be published on Desalination and Water Treatment (DESWATER).
Selected Student Oral Presentations and Student Poster Presentations will be awarded. The details will be announced soon.

On the behalf of the organizing committee, I would like to thank Prof. Miriam Balaban, all my team members and also all of you who participated 7th Maghreb Conference on Desalination and Water Treatment.

Sincerely yours,

Prof. Béchir HAMROUNI

Chair of Organizing Committee

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EXPLOITATION COST IN NITRATE REMOVAL OF GROUND WATER BY NANOFILTRATION, REVERSE OSMOSIS AND ELECTRODIALYSIS

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ABSTRACT

Nitrate contamination of groundwater becomes more and more a worldwide preoccupation, especially in Morocco. With the decrease in water resources, especially underground water, and the frequent excess observed during these last decades. In Morocco the concentration of nitrate in underground water in some agricol regions greatly exceed the WHO standards, the dilution solution becomes unattainable in a short term.

Denitratation operation of brackish underground water has been carried in the center of Morocco by three separation processes: Electrodialysis using a pilote plant with a capacity of 24m3/h equipped with membranes CMX/ACS previously selectied ; Nanofiltration and Reverse Osmosis using a pilote plant with two modules equipped with membranes NF90 and BW 30-30. The results indicate that the performances of the three processes were proved, the influence of various experimental parameters for each processes were studied. The Results indicate also that the three processes Nanofiltration, Reverse Osmosis and Electrodialysis demonstrate their capacity to remove Nitrate of ground water with minimal cost exploitation for the Electrodialysis opération.

Keyword : Nitrate removal ; Exploitation cost; Electrodialysis ; Nanofiltration ; Reverse Osmosis; Ground water.

MODELISATION DE LA CINETIQUE DE TRANSFORMATION CHIMIQUE DU BLEU DISPERSE 77

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RESUME

Cette étude est basée sur l'élimination d'un colorant textile : bleu disperse 77 en utilisant le procédé Fenton.

Nous avons évalué l'influence de quelques paramètres sur le rendement et la cinétique de décoloration tels que : le pH, la concentration de H_2O_2, de Fe^{2+} et celle de la concentration bleue disperse 77.

A partir des résultats trouvés, les valeurs optimales des concentrations de H_2O_2, de Fe^{2+} et de bleu disperse 77 (à pH2) sont estimées aux : 5 Mm, 1.25 Mm et 50 mg/l respectivement. Ces valeurs correspondent à un rendement de décoloration de 97.73%.

La cinétique de décoloration a suivi le modèle mathématique proposé par Behnajady et al.

L'étude spectrale par UV-visible a confirmé la disparition des pics à la longueur d'onde maximale du Bleu Disperse 77.

MOTS CLES : Bleu Disperse 77, cinétique, décoloration, Fenton, rendement.

STRUVITE REMOVAL USING ULTASONIC SYSTEM

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ABSTRACT

Due to an increased need to treat wastewater from domestic and industrial sources to conform to Urban Waste Water Directive (91/271/EEC), wastewater treatment plants are faced with the deposition of Struvite causing pipe blockages and reduction in the rate of discharge flow thereby affecting cost and operation. The struvite is formed when the concentration of NH_4^+, Mg^{2+}, and HPO_4^3 ions reaches Supersaturation ; however, its formation is controlled by pH, mixing energy, temperature and the presence of foreign ions in the solution. And when struvite is used as a fertilizer it displays good agricultural properties. Conventional methods for Struvite Removal like the use of highly corrosive chemicals and other mechanical methods may cause change in the quality of output water, pipe damages and lengthy time and cost of operation. Following a review of current and previous literature, analysis was carried out to encourage the formation of a synthetic struvite and break it off using pressure waves from an ultrasonic system while at the same time finding out most appropriate pH for the formation of struvite and analyse the solubility of struvite and one of its derivatives. Results indicated that pressure waves can break off struvite coated on glass, plastic and metallic pipes within 2, 3 and 15 minutes respectively. While struvite is best formed at pH level of 9, Newberyite is less soluble than struvite due to loss of crystalline water and ammonia holding the Newberyite crystals.

PROBIOTIC EFFECT IN KILLING E. COLI EPIDEMIOLOGICAL STRAINS

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ABSTRACT

This study evaluated the efficacy of different bacteria isolated from fruits and vegetables sampled from three different geographical points (Tunisia, Canada and Finland) as biocontrol agents against epidemiological strains of Escherichia coli: Enteropathogenic E. coli (EPEC), enterotoxigenic E. coli (ETEC), Uropathogenic E. coli (UPEC), E. coli K12, adherent invasive E. coli (AIEC). Among 20 isolated strains, four (MS3, CIT, TOM and P4') showed antagonistic activity (diameter> 15mm) against E. coli strains of UPEC, E. coli EPEC and E.coli ETEC epidemiological for humans and animals. A primarily identification of the four isolated bacteria was carried out. The Gram staining and the microscopic examination have shown a four rod-shaped Gram-positive bacteria. A test of their requirements and abilities for growth at different salinities, pH range and temperatures were, then, realized. Only two isolates (CIT and P4') were tolerant of moderate salinities (7.5% NaCl), the other two strains, TOM and MS3 were tolerant of less than 5% salinity but did not require these high salinities for growth. The strains (P4'and MS3) supported a variable pH from 2 to 14, while the isolated strain (CIT) supported only acidic pH (pH = 2). Considering their heat resistance, the four isolated strains (P4', CIT and MS3) have tolerate temperatures from 4°C to 70°C. Also, these strains may be considered as probiotic as they have shown resistance to gastric conditions and high acidity (pH = 2), as well as resistance to enzymes such as pepsin, pancreatin and bile salts.

KEYWORDS : Antagonisms, bacteria, fruits and vegetables, Probiotics, E.coli EPEC, E.coli ETEC, E.coli UPEC, E.coli AIEC, E.coli K12.

MICROALGAE AT THE RESCUE OF ENVIRONMENT : CASE OF WASTEWATER TREATMENT USING DIATOMS

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ABSTRACT

Sewage constitutes a major component of wastewater generated every day in developing countries like Algeria. One of the highly significant and rapidly developing methods for sewage treatment is the use of photosynthesis by growing algae. The use of microalgae for the municipal wastewater treatment has been subject of research and development for several decades. Growing microalgae such as diatom Algae in selective growth media enables N and P removal, and as diatoms consumes CO_2 and release oxygen, COD and BOD_5 will also be reduced further. Diatoms are grown at the laboratory scale conditions in a photo-bioreactor with artificial lighting. The oxygen released during the photosynthesis helps aerobic bacteria in breaking down the organic matters and converting the pollutants to base constituents. The stinking odor of anaerobic system is thus eliminated. The yields obtained at the end of the biological treatment in the algal photobioreactor were very promising. The BOD_5 was reduced with 78.01%. The yields of removal of phosphorus and nitrogen were 71.91%, and 98.47% respectively.

KEY WORDS : Diatom algae, photobioreactor, wastewater, biological treatment

LA FORMULATION D'EMULSION DANS L'EXTRACTION DU Pb(II) PAR MEMBRANE LIQUIDE

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ABSTRACT

Les métaux lourds (plomb, cuivre, cadmium) constituent un problème préoccupant lorsqu'ils sont impliqués dans la pollution des ressources en eau. Leur impact sur l'environnement se manifeste, non seulement, par leur toxicité fort dommageable pour le milieu aquatique, mais également par leur accumulation au fil de la chaîne alimentaire qui menace directement la santé des êtres vivants.

Devant ces inquiétudes, plusieurs efforts ont été engagés par les communautés industrielles et scientifiques, tant sur le plan de récupération et recyclage que sur le plan de la préservation de l'environnement, conformément à la législation en vigueur qui devient de plus en plus étroite.

Durant ces dernières décennies, La technologie de (MLE) a gagné une grande importance parmi les autres méthodes de séparation conventionnelles [1].

L'extraction par MLE couvre de nombreuses études dans différents domaines tels que l'hydrométallurgie, le génie des procédés, la chimie inorganique, la chimie analytique, la physiologie, la biotechnologie et le génie biomédical [2].

L'objectif de notre travail est d'étudier l'élimination du plomb(II) à travers la membrane liquide émulsionnée par un extractant acide ; le di (2-éthylhéxyl) phosphorique (D2EHPA) comme transporteur et le triton X-100 comme tensioactif. Les paramètres expérimentaux étudiées sont : 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 plomb, Les résultats ont montré que le Pb(II) est extrait à 100%.

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RESPONSE SURFACE MODELING AND OPTIMIZATION OF Hg(II) REMOVAL BY FUNCTIONALIZED NANO-CELLULOSE

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ABSTRACT

The aim of this work was to investigate Hg(II) removal from aqueous solutions by using functionalized nano-cellulose (FNC) as adsorbent in batch technique. The investigation was carried out by studying the influence of initial solution pH (5-7), adsorbent dosage (0.5-1.5 g/l) and initial concentration of Hg(II) (20-100 mg/L). The removal ratio of Hg(II) has been investigated using response surface methodology. In order to designing the experiments we have used the Box-Behnken experimental design (BBD) in response surface methodology with full response surface estimation, finally we have determined the optimum conditions for highest removal ratio of Hg(II) from aqueous solution, were as follows : pH (6.33), adsorbent dosage (1.125 g/l) and the initial concentration of Hg(II) (25.66 mg/l) to reach highest removal ratio equal to (99.07%), the correlation coefficient (R2=0.9976), we have also determined the mathematical model that describe this process, the relationships between the response and the independent variables.

KEYWORDS : Nano-Cellulose, Adsorption, Mercury Ions, Box-Behnken Experimental Design.

OPTIMIZATION OF COAGULATION TREATMENT OF LANDFILL LEACHATE USING CENTRAL COMPOSITE DESIGN (CCD)

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ABSTRACT

Assessement of the COD and turbidity removal from landfill leachate using Coagulation treatment was investigated. The main objective of the study is to optimize the operating parameters, pH and poly-aluminum chloride (PAC) dosage (m), by response surface methodology (RSM) based on a central composite design (CCD). The quadratic polynomial models developed for COD and turbidity responses indicated that the optimum conditions were PAC dose of 5.55 g/L at pH 7.05 with an R^2 of 99.33%, 99.92% and adjusted R^2 of 98.85%, 99.86% for both COD and turbidity. The experimental data and model predictions agreed well. COD and turbidity removal efficiency of 61% and 96.4 %, respectively, were obtained.

KEYWORDS : Landfill leachate, Coagulation–flocculation, poly-aluminum chloride, Central composite design (CCD), RSM

FLUORIDE REMOVAL FROM BRACKISH WATER BY ELECTRODIALYSIS USING NEW CROSSLINKED MEMBRANE

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ABSTRACT

The aim of this work is to study the removal of fluoride from brackish water using electrodialysis with new cation exchange membrane called ClNH2 at different current densities and feed solution concentrations. In this study, experiments were carried out on synthetic brackish water solutions prepared from sodium chloride salts. The concentrations of these solutions are varying from 0.5 to 3 g/L. The influence of several parameters such as initial feed concentration and co-existing ions on process efficiency were studied. This efficiency is evaluated by the removal rate, demineralization rate, ionic flux and power consumption.

The concentration of different species in the obtained treated water during electrodialysis defluoridation of brackish water are below the amounts recommended by the World Health Organization (WHO) for drinking water (1.5 mg/L). For example, the fluoride concentration could be reduced from 3 to 0.3 mg/L (removal close to 100 %). These results showed that this ClNH2 membrane presented very promising performances for use in electrodialysis applications.

KEYWORDS : Ionic conductivity, Crosslinked membrane, fluoride removal, electrodialysis.

CARACTERISATION PHYSICO-CHIMIQUES DES EAUX DE L'OUED MEBOUDJA, NORD EST DE L'ALGERIE.

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RESUME

L'eau est l'élément autour duquel ce maintien la vie, une expansion industrielle et une croissance alarmante de la pollution des eaux entraîne des difficultés énormes d'alimentation ce qui nous oblige à nous inquiéter à notre santé et notre condition de vie, car leurs répercussions s'avèrent très grave sur notre environnement.

Dans ce contexte, nous avons essayé de donner un aperçu détaille sur la pollution de l'oued Meboudja (Nord Est de l'Algérie) par un protocole de travail basé sur des prélèvements des eaux de surface de cet oued en vue d'établir la qualité des eaux et d'obtenir des bases de données relatives à la pollution hydrique en Algérie.

Et dans ce cadre, l'analyse des paramètres physico-chimiques tel que : (T°, pH, CE, DO, DBO_5, , , Cl^-, MES et les huiles grasses) est nécessaire dans tous le long de l'oued Meboudja (amant, centre et aval), afin d'établir un diagnostic de l'état de la pollution des eaux de surface de ce fleuve.

Les résultats obtenus montrent qu'au niveau des sites où se déversent les eaux usées de la commune d'El Hdjar -Annaba et les rejets industriels du complexe de transformation sidérurgique (Arcelormittal), la zone industriel de Chaiba et Pont Bouchet, avec les rejets des produits agricoles issus de la plaine d'El Hadjar – willaya d'Annaba; on assiste à une augmentation des teneurs en nitrates, nitrites et chlorures ainsi que le potentiel d'hydrogène, de la conductivité électrique et même la teneur en matière en suspension et les huiles grasses ; et toutes cette dernières conduits à la contamination et l'augmentation de degrés de la pollution des eaux de cet oued qui deviennent inutilisable et qui engendre un danger alarmant par le fait que ce dernier se situe dans une zone urbaine, agricole et surmontant une nappe phréatique sub-affleurante. De plus, les eaux de l'oued se déversent directement dans la mer méditerranée par le biais d'oued Seybouse sans traitement préalable.

Donc cette situation nécessite un contrôle et des traitements biologique, chimique et physique afin d'être utilisables par le publique.

MOTS CLES : Oued Meboudja, eau, pollution, rejets, contamination.

YNTHESIS AND DEVELOPMENT OF A NOVEL IRON PHOSPHOTUNGSTIC CATALYST FOR THE REMOVAL OF AN ORGANIC POLLUTANT FROM WASTEWATER

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ABSTRACT

Wastewater discharged by the petrochemical, agro-food and textile industries causes a great deal of nuisance to the environment and public health. Certain pollutants present in these waste waters, especially dyes, are found in liquid discharges destined for groundwater, rivers and seas.

These waters must therefore be treated before their final discharge, for environmental and legal reasons. It therefore becomes necessary, to develop effective and specific processes for their elimination. Among these processes, advanced oxidation processes (AOPs) in homogeneous phase which can be a promising alternative. This study investigates the removal of a dangerous dye, Congo Red (R.C) in aqueous media by a modified advanced oxidation process using a Dawson-type synthesized phosphotungstic catalyst $(\alpha_2P_2W_{17}O_61Fe)^{7-}$, which has specific physicochemical properties as a catalyst in the presence of an oxidant hydrogen peroxide (H_2O_2), it is the modified system (H_2O_2 / $P_2W_{17}O_{61}Fe$). The advantage of this system is that reaction by-products are very low in toxicity.

The optimization of the operating conditions for the elimination of Congo red was carried out by varying the following parameters:

Initial pH of the solution to be treated, concentration of the oxidant (H2O2), mass of catalyst $(\alpha_2P_2W_{17}O_{61}Fe)^{7-}$, concentration of the dye (R.C), effect of temperature, effect of the nature of catalyst. Under optimal conditions the discoloration efficiency of Congo red is 95%.

KEYWORDS : water pollution, homogenous catalysis, phosphotungstic material.

CHARACTERIZATION OF NATURAL AND ACTIVATED BENTONITE

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ABSTRACT

Minerals clays have been in use as raw materials for hundreds of industrial applications due to its abundant availability, low cost and interesting properties in the adsorption field. Bentonite which is mainly formed by montmorillonite has been treated and modified with several methods to improve its physicochemical properties. The sulfuric acid activation is one of the most used methods due to its simple protocol and the low cost of the sulfuric acid.

The purpose of this work is to present the protocol of the purification of crude clay and the sulfuric acid activation as first step. In second step, several characterization techniques are citing such as Measurement of Specific Surface (BET Method), Mineralogical Analysis (DRX), Infrared Spectroscopy Analysis (FTIR-IR) and a thermogravimetric analysis (TGA) that were used to have insights to these materials.

KEYWORDS : Minerals clays, Activation, Sulfuric acid, FTIR-IR, DRX, BET, TGA

CO_2 ADSORPTION CAPACITIES OF NATURAL AND ACTIVATED CLAY

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ABSTRACT

Clays are very important industrial minerals; they have been in use as raw materials for the adsorption of CO_2. The aim of this work is to improve the adsorption capacity of clay by making modification in their structure. A natural clay preparation was made by purifying the crude clay to remove the impurities. An alteration of the natural clay's structure was carried out through its acid activation by sulfuric acid at 35% concentration by mass. This modification is performed in a double jacketed reactor at a temperature of 96.2 °C during 3.75 h.100 g of natural clay is added with maximum mechanical agitation in order to ensure mixture's homogenization. The textural properties of the obtained clays were characterized by BET. The maximum adsorption capacity of CO_2 has been increased from 0.212 mmol/g for natural clay to 0.384 mmol/g for activated one at 25°C and 772.57 mm Hg. Finally, a significant increase in the CO_2 adsorption capacity has been shown after activation treatment.

KEYWORDS : clay, CO_2 adsorption, capacity, activation

PREPARATION ET FONCTIONNALISATION D'UN BIOADSORBANT A BASE DES FIBRES CELLULOSIQUES POUR L'ADSORPTION D'UN POLLUANT ORGANIQUE IMMERGEANT (IBUPROFENE)

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RESUME

Les fibres végétales fibres naturelles telles que (l'Alfa.) ont été utilisées en tant que matrice adsorbante constituée majoritairement de la fibre cellulosique, pour l'adsorption d'un polluant organique (Ibuprofène) contenu dans les eaux usées. Des essais en batch ont été réalisées pour évaluer la cinétique et les facteurs influençant sur le processus d'adsorption. Les variables expérimentales étudiées sont la température et les traitements chimiques. L'état d'équilibre est atteint au bout de quelques minutes. La capacité de biosorption semble être affectée par différents facteurs. La température a également un effet stimulant sur la biosorption de l'Ibuprofène. Le maximum de biosorption a été observé à pH plus au moins basique. Le prétraitement préalable des fibres permet d'augmenter considérablement leurs capacités d'adsorption. La déduction des paramètres thermodynamique ont montrés que l'adsorption de l'ibuprofène par la biomasse est un phénomène favorable, endothermique et spontané.

MOTS CLES : fibre d'Alfa, adsorption, Ibuprofène, isothermes, cinétiques.

IMPACT OF SURFACE MODIFICATION FOR ADSORPTIVE REMOVAL OF AMOXICILLINE USING POSIDONIA OCEANICA AS A CHEAP BIOSORBANT

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ABSTRACT

Marine biomass (*Posidonia Oceanica*) (P.O), in both its unmodified P.O and basic-modified (Na-PO) forms, was studied for its possible utilization as a cheap biosorbent for the retention of amoxicilline (AMX). Biosorption studies were carried out in a batch system and the effects of solution pH, biosorbent dose, initial dye concentration, contact time and temperature were studied in detail. Characterization of the biosorbents was performed using Fourier transforms infra-red spectroscopy (FTIR) and pH_{PZC}. For the biosorption of AMX were adjusted by Langmuir and Freundlich isotherm models, equilibrium isotherms were applicable with maximum monolayer biosorption capacity of 50.89 mg/g and 75.33 mg/g for P.O and Na-PO, respectively. Kinetics investigations showed that both biosorbents followed the pseudo-second order. Thermodynamics studies indicated that the biosorption of AMX onto P.O and Na-PO was spontaneous and endothermic in nature. Those results proved that the *Posidonia Oceanica* modified by NaOH was an effective biosorbent for AMX removal from aqueous media.

KEY WORDS : Amoxicilline; Modified marine biomass ; Bioadsorption ; Wastewater.

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SYNTHESIS, CHARACTERIZATION AND APPLICATION OF DAWSON CERIUM HETEROPOLYANIONS COMPOUNDS TOWARDS NITRITES ELECTROCATALYSIS

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ABSTRACT

Heteropolyanions (HPAs) are a structurally diverse class of metal-oxide clusters with varied compositions and structures [1-2]. An important property of the Dawson-type heteropolyanions is the ability to replace one or several of the tungsten centers by transition metal cations [3]. This further enhances the redox properties of these compounds and therefore their catalytic and electrocatalytic properties.
In recent years, drinking water has become increasingly contaminated by nitrites (NO_2^-), resulting from the excessive use of fertilizers in agriculture and the discharge of industrial wastewater. Exposure of the human body to nitrite can cause some cancers. The World Health Organization (WHO) has determined 3mg/L as the allowable concentration of nitrite [4-5].
The aim of this work is the synthesis and characterization of Dawson heteropolyanions by adding the Ce^{3+} metal ions to the monolacunary species $\alpha_2[K_{10}P_2W_{12}Mo_5O_{61}]$ $\alpha_1[K_9LiP_2W_{12}Mo_5O_{61}]$ to investigate its electrocatalytic activity towards nitrites reduction. The compounds were characterized by IR, DRX and cyclic voltammetry. Nitrites reduction products were analyzed by UV-Visible spectroscopy.

KEYWORDS : Dawson Heteropolyanion, electrocatalysis, nitrites

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APTITUDE DES AGREGATS LEGERS A TRAITER LES EAUX USEES

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RESUME

Chaque année d'importantes quantités d'eaux usées sont évacuées dans les cours d'eau sans traitement, entraînant une pollution des ressources d'eau douce et des systèmes aquatiques. Ce problème environnemental a poussé les scientifiques, chacun dans son domaine, à chercher des solutions pour traiter les eaux usées et les réutiliser dans d'autres secteurs. Le but de ce travail est d'étudier l'aptitude de différents types d'agrégats légers à traiter les eaux usées. Sur base de Diffraction des rayons X, la caractérisation des agrégats légers industriels considérés dans ce travail montre la présence de quartz, feldspaths, spinelle ainsi qu'une phase amorphe. L'analyse chimique, quant à elle, montre la présence de SiO_2, Al_2O_3 comme composants majeurs, qui peuvent atteindre respectivement 57% et 21%, avec des pourcentages variables de Fe_2O_3, CaO, K_2O et MgO. La porosité inter-granulaire (20 à 30%), observée par microscopie électronique à balayage, influence la capacité des agrégats légers à absorber l'eau, ce qui explique les résultats d'absorption d'eau variant entre 17% et 40%. Les agrégats ont été mis en contact avec des solutions synthétiques préparées au laboratoire pour observer leur manière d'agir sur les différents paramètres physicochimiques qui caractérisent les eaux comme le pH, la conductivité, la couleur, la température, la matière en suspension (MES), l'absorption des éléments chimiques (nitrates, phosphates, azote…). D'autres analyses seront faites comme la demande chimique en oxygène (DCO) et la demande biochimique en oxygène (DBO). Les résultats montrent des comportements variables, certains granulats ont tendance à acidifier les solutions (pH de l'ordre de 4) alors que d'autres ont tendance à maintenir le pH entre 6 et 7. Ces résultats vont influencer le choix des agrégats dans le traitement des eaux usées. En ce qui concerne les résultats d'absorption, on observe une diminution de la concentration des éléments chimiques dans les solutions. Les résultats d'absorption varient selon le type de granulats utilisés.

MOTS CLES : agrégats légers- traitement- eaux usées- absorption d'eau- porosité- éléments chimiques.

TREATMENT OF LANDFILL LEACHATE FROM FEZ CITY USING A COMBINATION OF FENTON AND ADSORPTION PROCESSES

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ABSTRACT

Landfill leachate is considered a potential contamination source of water resources and causing serious environmental damage if they are discharged without any treatment [1]. In order to reduce its effects on the environment and to reach the liquid discharge standards many treatments have been carried out, separated or combined, mainly : Coagulation-flocculation, adsorption, Fenton, and Fenton-like [2, 3, 4].

In this work, leachate sample from Fez city landfill was collected and characterized. Thereafter, the application of the combined processes of Fenton and adsorption using Bentonite clay as adsorbent to remove the COD in stabilized leachate treatment was investigated.
During treatment by adsorption, the influence of main parameters (adsorbent mass, contact time, pH, and temperature) on COD removal was studied.
The use of Fenton process lead to a COD removal of 73%, which was not enough to satisfy the Moroccan legislation. However, combining Fenton with adsorption process, enhanced the leachate treatment with a cumulative elimination of 83%, using 3g of Bentonite/L.

KEYWORDS : Landfill leachate; Fenton process; Advanced oxidation; Bentonite; Adsorption.

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APPLICATION DU PROCEDE SAVMIN AU TRAITEMENT DES SAUMURES ET DE L'EAU BRUTE DE LA STATION DE DESSALEMENT DE KEBILI

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ABSTRACT

This work consists of desalination of brines and feed water of the Kebili reverse osmosis desalination plant (SDK) by applying the SAVMIN process, which relies on three successive precipitations with lime ($Ca(OH)_2$), aluminum hydroxide ($Al(OH)_3$) and carbon dioxide (CO_2).

The results obtained show that in the case of brines :

- $Ca(OH)_2$ provides total precipitation of magnesium and partial precipitation of sulphate (61%) in the presence of gypsum seed of 6 g l after 30 min of reaction and 10 min of decantation;
- $Al(OH)_3$, causing the precipitation of sulphate and calcium in the form of ettringite ($3CaO.3CaSO_4.Al_2O_3.31H_2O$), led to 85 % of sulphate removal after 30 min of reaction and 30 min of decantation in presence of 20 g/l of ettringite as seed;
- CO_2, by precipitating calcium in the form of $CaCO_3$, causes the drop in calcium concentration from 625 in the brine to 240 mg/l in the treated water.
- The SAVMIN process makes possible the reduction of the brine salinity from 7670 to 2430 mg/l, which corresponds to 68 % of the salinity elimination and induces the removal of approximately of 100, 95 and 62 % respectively of magnesium, sulphate and calcium.

In the case of feed water, 100 % magnesium, 75 % sulphate and 38 % calcium are removed. The salinity of the water is reduced from 2100 to 1350 mg/l.

These results clearly show that the SAVMIN process can be successfully applied to desalt brines and also feed water from reverse osmosis desalination plants.

KEYWORDS : Desalination, Brines, Reverses Osmosis, SAVMIN Process, Chemical Precipitation, Ettringite

EVALUATION OF TWO BIOSORBENTS, OLIVE STONES AND PINE CONE, FOR THE REMOVAL OF TOXIC METALS FROM AQUEOUS EFLUENTS

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ABSTRACT

The discharge of metal-containing aqueous effluents from plating, pigment mining, electroplating, tanning and other industries is the main contribute to metal pollution which is a serious environmental concern due to the toxicity and non-biodegradability of the metals resulting in a health risk to living organisms. Adsorption is deemed as the most effective technique to remove heavy metals in wastewater. However, it is important to find low cost alternative materials instead of traditional sorbents like activated carbon, given that it has drawbacks as their high initial and regeneration costs.

The use of olive stone-a residue of the olive oil industry- and pine cone as biosorbents to remove Cd(II), Cu(II), Pb(II) and Cr (VI) from aqueous solutions is evaluated here. Both are low-cost adsorbents, since they are produced in great quantities in the Mediterranean area as wastes of the food industry. The physico-chemical properties of both biosorbents were characterized by several techniques including porosimetry, scanning electron microscopy, elemental analysis and Fourier infrared spectrophotometry. The effect of different parameters such as pH, contact time, amount of adsorbent and initial metal concentration was also performed showing that pine cone is more efficient than milled olive stone in removing the target metals. Maximum adsorption percentages of 82.24%, 93.71%, 94.67% and 88.8% were obtained for Cd(II), Cu(II), Pb(II) and Cr(VI), respectively while in the case of milled olive stone, these values were of 77.4%, 80.5%, 94.5% and 46%. Equilibrium data was analyzed by Langmuir, Freundlich and Temkin models and the kinetics of the adsorption processes were also studied. Moreover, competitive experiments using multi-metal solutions were performed. The results showed that both biosorbents can be used for the removal toxic metals from aqueous solutions. However, the capacity of pine cone to adsorb Cr(VI) is higher than that of milled olive stone.

KEYWORDS : Biosorption, Olive stone, pine cone.

ELIMINATION OF SAFRANINE O FROM WATER USING UV/TiO_2 SYSTEM IN AQUEOUS SOLUTION : EFFECT OF OPERATIONAL CONDITIONS AND DEGRADATION PATHWAY

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ABSTRACT

Organic dyes are highly non-degradable compounds that cause serious problems; their direct release into the environment adversely affects human health and wildlife, mainly by contaminating water. Several methods have failed to eliminate these compounds refer to their high stability against traditional treatment.

The advanced oxidation processes, like photocatalysis, seem to be more promising because they can degrade a wide range of recalcitrant pollutants due to the generation of powerful oxidizing species especially •OH. Among these methods, heterogeneous photocatalysis, by using titanium dioxide (TiO_2) and UV light can efficiently mineralize persistent organic pollutants in water.

In this study, the elimination of Safranine O, a cationic dye, through the photocatalytic process in aqueous media was investigated. The effect of initial pH (2-12) and temperature changing (15-45) °C on degradation rate was examined. The results showed that the process was significantly enhanced in alkaline medium without remarkable effect of temperature. In order to define the mechanism pathway, phenol and sucrose were used in different concentrations as scavengers of oxidizing radicals.

KEY WORDS: Advanced Oxidation Processes; Heterogeneous photocatalysis; Safranine O; Radical scavengers.

STUDY OF PARAMETERS AFFECTING THE PHOTOCATALYTIC DEGRADATION OF A CATIONIC TEXTILE DYE IN WASTEWATER

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ABSTRACT

The degradation of Methylene blue, commonly used as a textile dye, can be photocatalyzed by TiO2. In this study, a detailed investigation of photocatalytic degradation of BM is presented. Photodegradation efficiency was low when the photolysis was carried out in the absence of TiO2 and it was also negligible in the absence of UV light. The semi-log plot of dye concentration versus time was linear, suggesting first order reaction. The effects of some parameters such as pH, amount of photocatalyst, hydrogen peroxide, were also examined. The addition of proper amount of hydrogen peroxide improved the decolorization, while the excess hydrogen peroxide could quench the formation of hydroxyl radicals (•OH).

KEY WORDS : textile dye, photocatalysis, wastewater treatment, dye degradation

ELECTROCATALYSIS OF NITRITE BY α_1-YTTRIUM-PENTAMOLYBDO–DODECATUNGSTO-DIPHOSPHATES DAWSON HETEROPOLYANION

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ABSTRACT

Heteroplyanions (HPAs) are early transition metal oxo clusters with diverse compositions, structures, and properties that result in a variety of applications in catalysis and electrocatalysis. Up to now, several transition-metal-substituted Dawson type polytungstates have been reported [1-2]. The most commonly used are the metals of the first transition period. However, the addition of yttrium on heteropolyanions has been little explored.

In this work, we report the synthesis of yttrium Dawson heteropolyanion. It was characterize by several techniques; FTIR spectroscopy, X-ray powder diffraction and cyclic voltammetry. This compound was successfully reducing the nitrite anion, which is an important reaction in biological metabolism [3]. The reduction reaction was conducted by cyclic voltammetry and the products resulting from the electroreduction were analyzed by UV-Visible spectrometry.

KEY WORDS : Yttrium Dawson Heteropolyanion, electrocatalysis, nitrites

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EFFECT OF PHASE CHANGE MATERIAL AND HEAT EXCHANGER ON THE PERFORMANCE OF A DOUBLE EFFECT SOLAR STILL 'COMPARISON STUDY'

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ABSTRACT

The present work is a contribution, to improve thermal performance in double effect solar stills and increasing their daily operating length.

However this study is focused to compares the effect of phase change materials (PCM) with the heat exchanger are integrated and coupled in two units of stills respectively under the same conditions of the area of Constantine (lat. 36°21′54 N, long. 6°36′52″E).

The use of layer of phase change material storage and heat exchanger are beneficial to enhance the heat transfer in the still case to improving system performance

Further, the influence of some factors of climatic and operational parameters on the productivity of solar still was investigated.

The results revealed that the presence of phase change material affects the daytime freshwater productivity with a significant increment in the overall freshwater yield of the still. Also, solar still with phase change material-based Parafin (Case 1) achieves the best thermal performance compared to conventional still with heat exchanger (Case 2). It is perceived that the total daily cumulative yield of distillated water of (Case1) is higher by 13, 28%.

KEY WORDS : solar still with double effect, phase change material, Heat exchanger, performance.

ETUDE D'ELIMINATION DU METHYLE ORANGE PAR ADSORPTION SUR UN CHARBON ACTIF PREPARE A BASE DES COQUES D'ARACHIDES

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RESUME

Dans le but de porter une contribution à la protection de l'environnement en général, et aux traitements des eaux pollués en particulier, nous nous sommes intéressés dans cette étude à étudier l'élimination d'un colorant synthétique tel que le méthyle orange par adsorption sur la coque d'arachide. Nous avons utilisé ce dernier, une fois comme un adsorbant brut, et autre fois comme un support pour préparer un charbon actif par une activation chimique et thermique.

L'étude de l'influence des quelques paramètres sur la capacité d'adsorption, à savoir, la concentration initiale, la masse d'adsorbant et le temps de contacte donne des résultats promoteurs avec un rendement de 55.4% pour le charbon activé et 48.2% pour les coques d'arachides brute.

MOTS CLES : Eaux pollués, colorant synthétique, adsorption, coque d'arachide, activation, charbon actif.

ETUDE DE L'ELIMINATION PAR ADSORPTION DU RG 12 EN SOLUTION AQUEUSE SUR UN BIOMATERIAU ACTIVE CHIMIQUEMENT

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RESUME

Le but de cette étude est de tester la capacité d'adsorption d'un biosorbant issu d'une biomasse végétale, activée chimiquement par une solution saline, pour l'élimination d'un colorant textile de type anionique, le RG12, très utilisé dans l'industrie textile.

L'effet du pH, de la concentration initiale du colorant (C_0), de la dose du biosorbant (m_b) et de la température ont été étudiés. Il ressort de cette étude que ces paramètres ont une influence sur le rendement d'élimination, ainsi que la quantité adsorbée du colorant. Des rendements d'élimination de 45 (%) sont atteints. L'analyse des isothermes d'adsorption du colorant étudié par le biosorbant activé est ajusté convenablement par le modèle de Freundlich, avec un coefficient de régression R^2 = 0,91. L'étude cinétique montre que la réaction d'adsorption est mieux représentée par le modèle de pseudo-second.

MOTS CLES : Adsorption, Biosorbant, Colorant Anionique, RG12

ETUDE CINETIQUE, THERMODYNAMIQUE ET DES ISOTHERMES D'EQUILIBRE DE L'ELIMINATION D'UN COLORANT CATIONIQUE PAR ADSORPTION SUR UNE BIOMASSE VEGETALE ACTIVEE CHIMIQUEMENT

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RESUME

Ce travail consiste en la valorisation d'une biomasse végétale, qui a été activée chimiquement à l'aide d'un mélange de sel pour l'élimination d'un colorant cationique, qui est le bleu de méthylène, à partir d'une solution aqueuse. Les tests de sorption du bleu de méthylène sur le biosorbant élaboré ont été effectués en mode batch.

Différents paramètres ont été investigués pour étudier leur influence sur le rendement d'élimination. Ces paramètres sont le temps de contact (t), la concentration initiale en polluant (C_0), la température (T), la dose du biosorbant (m_b) et le pH du milieu. Le rendement maximal est obtenu dans les conditions opératoires suivantes : (t = 60 min ; C_0 = 10 mg.L-1 ; m_b= 2 g.L^{-1} ; T =20 °C ; pH = 5,85).

L'équilibre d'adsorption est représenté par l'isotherme d'équilibre de type L, et le modèle de Langmuir décrit mieux les résultats obtenus, avec un coefficient d'ajustement relativement élevé.

L'analyse thermodynamique révèle que le processus d'adsorption est un processus spontané et exothermique, avec une bonne affinité du matériau au polluant.

L'étude cinétique a montré que la réaction d'adsorption du Bleu de Méthylène sur le biosorbant activé est du pseudo-second ordre.

MOTS CLES : Biosorbant, sorption, Bleu de Méthylène, activation chimique.

EVALUATION DES EMISSIONS DANS L'AIR DANS UN PROCEDE DE TRAITEMENT

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RESUME

Le procédé de déshuilage est un traitement indispensable, qui permet de récupérer l'huile et traiter l'eau avant la réinjection dans les puits. L'élimination des polluants principalement l'huile et métaux dans les eaux huileuses est toujours accompagnée par des émissions atmosphériques. Ces dernières sont évaluées par simulation sur deux stations de déshuilage chois

ies pour leurs différences dans les caractéristiques des rejets pétroliers, les quantités d'huile dans l'eau (22,7mg/l) et (0,5mg/l), ainsi que les équipements présents dans les unités de traitement.

Les résultats obtenus concernant les émissions dans l'air sont très faibles, largement conformes aux normes nationale et internationale. Les concentrations des métaux les élevées dans l'effluent à l'entrée sont le Fer (85mg/l), le Manganèse (9mg/l) et le Zinc (5mg/l), ils ont très peu diminué tout le long du traitement. Le procédé de traitement optimisé a donné des traces d'huile avec une concentration très négligeable de 2,93 10^{-6} mg/l et une faible présence des métaux. Le total des émissions atmosphériques dans toute la station de déshuilage est de 0,8372 mg/an.

ETUDE COMPARATIVE DE LA CAPACITE D'ADSORPTION DU PLOMB (II) PAR UNE ARGILE CATIONIQUE DE TYPE KAOLIN ET ANIONIQUE DE TYPE MGALCO$_3$ (R=3)

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RESUME

L'application des adsorbants synthétiques et naturels pour le traitement des eaux, est l'un des voies utilisées par plusieurs travaux scientifiques pour savoir l'efficacité d'élimination des métaux lourd dans les eaux par ces types d'argiles. MgAlCO$_3$ et kaolin sont des argiles de nature différente. Le premier est une argile anionique simple, synthétisé dans laboratoire par la méthode de co-précipitation directe, tandis que le kaolin est un adsorbant naturel subit d'un processus simple de prétraitement par étapes comprenant le séchage, et le dégraissage. Ensuite, l'adsorbant obtenu a été traité avec du peroxyde d'hydrogène pour éliminer la matière organique. En fin l'eau distillée a été utilisée pour rincer l'adsorbant, puis le matériau a été séché à 80 ° C pendant 24 h.

Pour caractériser ces argiles, plusieurs techniques ont été sollicitées : DRX, FTIR et volumétrie d'adsorption d'azote (BET). Dans une deuxième étape, nous avons étudié l'adsorption de pb(II) par ces argiles. La capacité d'adsorption qui a été déterminée par l'isotherme de Langmuir est de l'ordre de 57.30 mg•g^{-1}, 125 mg•g^{-1} pour Kaolin et MgAlCO$_3$ (R=3), respectivement. L'adsorption de pb(II) sur le kaolin (1 min) est plus rapide que celle de MgAlCO$_3$ (R=3) (35 min). L'adsorption du pb(II) est décrite par le modèle d'Elovish, et pseudo second ordre pour MgAlCO$_3$ (R=3) et kaolin respectivement. L'isotherme de Temkin est favorable pour l'adsorption de Pb(II) par kaolin, par contre l'argile de type Mg-Al-CO$_3$, le modèle le plus fiable pour ce dernier et celui de Dubinin-Radushkevich.

Mots-clés : Adsorption, plomb, argile anionique, argile cationique, isotherme d'adsorption.

ELIMINATION DE LA MATIERE ORGANIQUE NEUTRE DISSOUTE DANS LES EAUX DE SURFACE PAR LE CHARBON ACTIF

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RESUME

L'importance de la matière organique dans les systèmes aquatiques a été clairement reconnue au cours des dernières siècle [1]. En effet, l'élimination et le contrôle de la matière organique dissoute (MOD) dans l'eau potable présente un grand intérêt pour la santé des êtres humains, elle est typiquement retirée de l'eau potable pour des raisons esthétiquess telles que la couleur, l'odeur et le goût, aussi peut réagir avec des produits chimiques utilisées dans le processus de traitement de l'eau, ce qui peut conduire à la formation des sous-produits de désinfection (DBP), tels que les trihalométhanes (THM), dont certains peuvent être cancérogène [2]. Pour cela, il est nécessaire de l'éliminer pour éviter tout problème éventuel causé par leur présence.

Dans cette recherche nous avons effectué une étude d'adsorption complète (isotherme et cinétique) afin d'éliminer une fraction spécifique de la matière organique dissoute «la matière organique neutre dissoute» isolée à partir deux barrages algériens (Barrage de Batna et barrage de Constantine), par le charbon actif dans le but de déterminer les meilleurs conditions qui permettant une élimination maximale de cette fraction.

L'efficacité du traitement utilisant du charbon actif a été contrôlée en mesurant la quantité de la matière organique dissoute restante après chaque processus de traitement en termes demande chimique en oxygène (DCO) et en termes UV à 254 nm [3, 4].

Les résultats étaient comme attendus avec les rendements d'éliminations suivantes :

- Le rendement d'élimination était entre 64 et 77 % en terme DCO et entre 68 et 78% en terme UV_{254} pour le barrage de Batna ;

- Le rendement d'élimination était entre 63 et 70 % en terme DCO et entre 64 et 76% en terme UV_{254} pour le barrage de Constantine.

Les résultats obtenus ont montré que l'élimination de cette fraction par le charbon actif était très efficace

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ETUDE DE L'ELIMINATION DE LA MATIERE ORGANIQUE NEUTRE DISSOUTE DANS LES EAUX DE SURFACE PAR DES TECHNIQUES MEMBRANAIRES

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RESUME

La matière organique (MO) est présente dans tous les milieux aquatiques. C'est un mélange hétérogène complexe de divers composés organiques qui varie selon la taille moléculaire, la structure, et la composition chimique [1]. A cause de sa structure complexe cette matière organique joue un rôle clé dans la détermination de la qualité de l'eau, et le traitement dépend essentiellement de la nature de cette matière organique [2].

De nombreuses études [3, 4] ont prouvés que la chloration des eaux destinées à la consommation humaine, en présence de la matière organique dissoute (MOD) conduit à la formation des sous-produits de désinfections telles que les trihalogénométhanes (THM), des composés organiques cancérogènes et toxiques. Pour cela des nombreux chercheurs ont été motivés à faire plusieurs études afin d'analyser et de caractériser la MOD pour mieux comprendre son comportement et trouver la meilleure technique adaptée au traitement.

Dans cette étude nous avons essayé d'éliminer une fraction spécifique de la matière organique dissoute « la matière organique neutre dissoute » à partir deux barrages algériens (Barrage de Batna et barrage de Constantine), en utilisant deux techniques membranaires (la **Nanofiltration** et l'**Ultrafiltration**) dans le but d'adapter la meilleure technique permettant une élimination maximale de cette fraction.

Comme résultat principale l'élimination de cette fraction de la matière organique neutre dissoute en utilisant deux techniques techniques membranaires (la Nanofiltration et l'ultrafiltration) était très effecace et le rendement d'abattement était compris entre 75 et 90 %.

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EXPERIMENTAL STUDY OF A MEMBRANE DISTILLATION UNIT COUPLED TO SOLAR ENERGY

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ABSTRACT

this paper tackles an experimental investigation of a new solar desalination prototype using the permeate gap membrane distillation (PGMD) principle at the weather conditions of Kairouan City, Tunisia. The pilot is totally autonomous; the only source of energy is the sun. The electrical energy required to operate the unit is generated through a field of photovoltaic cells, and the heating of brackish water is provided by a field of solar collectors. The collector field required consists of 3 collectors offering a total area of 6 m². The field of photovoltaic cells comprises 4 modules and ensures the production of 1 kW with the ability to store energy generated from 2 batteries. The membrane module used was a spiral-wound module with an area of 10 m².

MOTS CLES : Membrane Distillation,Solar Collectors, Photovoltaic Cells.

COTTON MILL WASTEWATER DECONTAMINATION USING COMBINED PROCESS BASED ON ADSORPTION-OZONATION

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ABSTRACT

This work aims to study and to optimize the capability to decontaminate a real textile effluent using adsorption process on local raw clay, and then to enhance the treatment by ozonation in order to reuse them in input process or in agriculture irrigation. The response surface methodology (RSM) technique based on central composite design (CCD) was used to investigate the effect of the tree effective parameters on adsorption, namely the pH solution, the clay weight and the contact time. The clay characterization shows that the collected Rommana green clay (RGC) is a smectite-rich clay. This study proves that the color removal efficiency (Re%) increases slightly after 50 minutes and the highest value is achieved at the lowest pH solution (pH = 3.98). At optimum conditions for color removal, the achieved color removal efficiencies, chemical oxygen demand (COD) removal efficiencies and a total suspended solids (TSS) removal efficiencies were respectively 86.89 %, 57.2 % and 80.7 %. Finally, the enhancement of the first process by ozonation allows reaching a color removal efficiencies, COD removal efficiencies and TSS removal efficiencies respectively of 98.2 %, 71.4 % and 89.3 % .

KEYWORDS : Real effluent; response surface methodology; adsorption; ozonation; Decontamination

TEXTILE DYES REMOVAL CAPACITY BY TUNISIAN CLAYS

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ABSTRACT

Several studies focused on processes to remove pollutants using natural, economical and simple materials such as clays due to their high adsorption characteristics. This work focused in using natural kaolinitic clays from Northern Tunisia to remove textile dyes: methylene blue (BM) and methyl red (MR).

The collected clays (55-78 wt.% kaolinite) were characterized by different techniques, such as X-ray diffraction (XRD), X-ray fluorescence (XRF), scanning electron microscopy (SEM), specific surface area measurement (BET), cation exchange capacity (CEC), particle size and calcimetry.

In order to study the adsorption of methylene blue (MB) and methyl red (MR) by the raw clays, the adsorption kinetics were performed in batch mode and many parameters were tested, such as the initial adsorbent mass, the initial dye concentration, the adsorbent adsorbate contact time and the pH effect.

The results show high dye retention efficiency by all clay samples. With just 0.1g as added adsorbent, the discolouration reached 98% after 180 minutes (case of MB solution). The preliminary tests indicated that the kinetics adsorption by kaolinite are consistent with the pseudo-second order model.

KEYWORDS : Tunisian clays, adsorption kinetics, methylene bleu, methyl red.

ENVIRONMENTAL APPLICATIONS OF BDD-MICROELECTRODE BASED ON BIOPOLYMERS FOR ELECTROCHEMICAL SENSING OF HEAVY METALS

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ABSTRACT

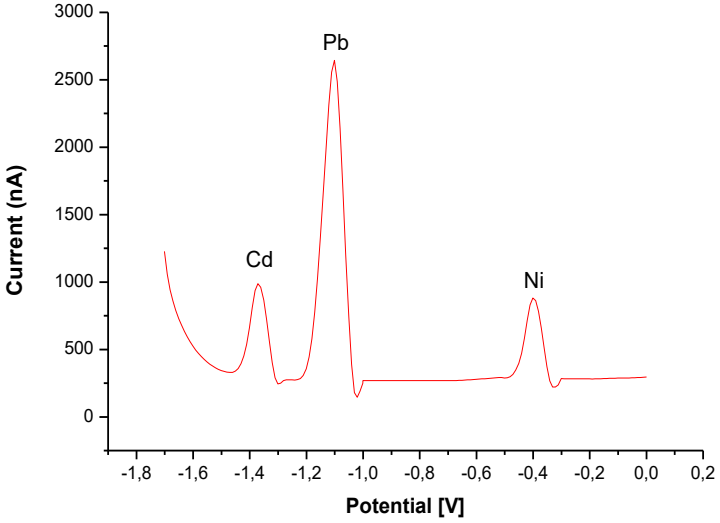
In natural aquatic ecosystems, heavy metals are found at low concentrations, usually in the nanogram or microgram per liter range. In recent times the presence of heavy metals contaminants and at concentrations higher than natural loads has become a growing concern

Different analytical techniques for heavy metals detection have been deposited such as atomic absorption spectrometry. These analyzers are generally relatively complex systems combining different mechanical, chemical and electrical elements. The set is often expensive, cumbersome and energy-intensive, which makes them unsuitable for *on-site* measurements. Moreover, these instruments are often afflicted by a long response time either by the detection technique itself or by the need to manipulate the samples.

Chemical or biochemical sensors are generally simple systems, consisting of a sensitive layer allowing the recognition of the species with which it interacts, and a transducer system transforming the chemical interaction into an electrical signal.

In this work, we used biopolymers, from vegetable waste, transforming them as a gel and finally using them as a sensitive part in miniaturized electrochemical sensors for the *in-situ* detection of heavy metals in water environments. The new sensors developed are characterized electrochemically and morphologically. The electrochemical characterization was carried out by electrochemical impedance spectroscopy EIS and square wave voltammetry SWV. Other morphological and structural analyzes were carried out. The results obtained showed the high sensitivity of the developed device (detection limit up to 10^{-10} M) as well as the possibility of detecting several heavy metals at the same time in a highly selective manner for each metal.

KEYWORDS : Heavy metals; BDD microelectrode; Electrochemical sensors; SWV; EIS; biopolymers.



DPASV obtained with the biopolymer modified electrode, on a standard solution of Cd (25 nM), Pb (75 nM), and Ni (5,5nM) in 0.1 M potassium citrate/HCl buffer, pH 2

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CHEMICAL PRETREATMENT OF AGRO-INDUSTRIAL EFFLUENTS FOR ECO-FUEL PRODUCTION

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ABSTRACT

As the global oil reserves and raw materials are finite, a renewed interest in alternative fuels research has been conducted. Biofuels remain an alternative source of energy for the foreseeable future and may offer the basis of sustainable development towards by combining environmental, economic and social considerations. Concerns have arisen on the basis of the dwindling of oil and gas reserves as well as the growing worldwide consumption of fossil fuels and the increase in oil prices. Biofuels derived from agro-industrial effluents, promise to become attractive future sources of energy, in particularly in the transport sector.

This study was designed to assess chemical pretreatments to extract sugars from agro-industrial effluents, then transform them into ethanol. Different chemical compounds are tested: hydrogen peroxide, sulfuric acid and sodium hydroxide. Note that the chemical compounds concentration varied from 1 to 7% (v/v). The characteristics of agro-industrial effluents showed that effluents contained high total sugars, 89.54 g/L and low ash contents, 0.81% and protein 5.4 g/L. It can be seen that the total sugars extracted gradually till to reach a maximum sugar yield of 93.05 g/L, this value was reached using 0.5% of H_2SO_4 and after 3 hours of hydrolysis.

KEYWORD : Agro-industrial effluents, biofuel, pretreatment, hydrolysis, sugars.

STUDY OF THE ADSORBENT CAPACITIES AND PHYSICOCHEMICAL CHARACTERIZATION OF A MATERIAL WITH A VIEW TO THE ELIMINATION OF INDUSTRIAL POLLUTANTS

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ABSTRACT

This work is a contribution to the limitation of the toxic effect of a polluant (pesticide) used in agriculture, to protect certain food and fruits against insects. The aim is therfore to find mechanisms to limit the effects of these polluants. We opted for adsorption and choose two adsorbents : industrial activated carbon and animal bone carbon: this last is prepared in the laboratory. The results showed that the two carbons have similar characteristics: the maximum yield (or adsorption equilibrium) is similar for both: the equilibrium is obtained after seven days. The equilibriuum isotherm equation check of Freundlich gave a value of slope n=0.907 for animal coal and n= 0.937 for industrial coal. The elimination method chosen to carry out this work is sample and could be used without greet expense to clean up waste or conteminated water. This process involves the uses of solid inert biomaterials.

KEYWORDS : Acetampirid, activated carbon, animal bone cabon, polluant, pesticide

HYBRID ELECTROCHEMICAL/ MEMBRANE COUPLINGS AS PRETREATMENT PROCESSES FOR SEAWATER DESALINATION

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ABSTRACT

This study was carried out to examine the performance of hybrid couplings electrochemical/membrane in order to improve the quality of seawater and to consider the possibility of desalination.

The results of this study show that the electrocoagulation process seems to be an efficient technique for the pretreatment of seawater when optimal conditions are satisfied.

Indeed, the first part of the study was devoted to a preliminary study for optimization of the major parameters of the electrocoagulation (EC) process using aluminum (Al) and iron (Fe) electrodes. The obtained results show that the optimal parameters chosen are as following: the electrode width (7 cm), the imposed current density (40 mA.cm-2), the electrolysis time (100 min), the initial pH (9 (Al) and 7,5 (Fe) (real)), the interelectrode distance (1 cm), the temperature (25°C), and the electrode type (Fe-Fe).

The second part of the work concerns membrane filtration (ultrafiltration (UF ES10B membrane) and nanofiltration (NF UTC60 and NF200 membranes)) as a post-treatment step after EC process, and this by performing six hybrid couplings: EC (Al) /UF (ES10B), EC (Al)/NF (UTC60), EC (Al) /NF (200), EC (Fe) /UF (ES10B), EC (Fe)/ NF (UTC60), EC (Fe) / NF (NF200).

The experimental results show that the best rate of organic matter removal is obtained by using NF UTC60 membrane. The main experimental results of the EC (Al) / NF (UTC60) and EC (Fe) /NF (UTC60) couplings gave similar retention rates: COD (98%), TOC (95%), turbidity (70%) and conductivity (60%). With regard to the removal of major ions, a maximum rate of 55% was obtained after EC (Al) /NF (UTC60) coupling.

Therefore, we can conclude that hybrid coupling EC (Al) / NF (UTC60) seems to be an effective pretreatment of seawater.

KEYWORDS : seawater, desalination, pretreatment, electrocoagulation, ultrafiltration, nanofiltration.

DEGRADATION OF SULFAQUINOXALINE BY UV/$Na_2S_2O_8$ AND UV/$Na_2S_2O_8$/Fe(II) : EFFECTIVENESS AND TOXICOLOGICAL EVALUATION

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ABSTRACT

In order to improve existing treatment technologies for polluted waters, especially those with refractory organic contaminants, scientists have focused on advanced oxidation processes (AOPs), which have clearly proven effective in the treatment of various effluents [1-3].

This study compares the degradation performance of one antibiotic, the sulfaquinoxaline, by two AOPs processes, using photolysis (UV) in the presence of sodium persulfate and photo-fenton oxidation. The results revealed that with the () process at optimal concentration of oxidant (200 $mg.L^{-1}$), the degradation rate reaches 90% within 5 h of irradiation. While, photo-fenton process (/Fe^{2+}), seems to be more effective than (UV/) for removing sulfaquinoxaline from water, since the degradation rate reaches 100% within only 60 min of irradiations.

The phytotoxicity and ecotoxicity of the treated samples were studied against one plant species (Sinapis alba) and a crustacean (Daphnia magna), respectively. At the end of the process, byproducts resulting from sulfaquinoxaline oxidation by photo-fenton process appear to be more toxic towards *S. alba* and *D. magna* than those obtained by UV-C process, although the last is less effective in eliminating the antibiotic.

KEYWORDS : Sulfaquinoxaline, Degradation, AOPs, Phytotoxicity, Ecotoxicity.

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EFFECT OF ULTRASOUND ON BIOSORPTION KINETICS OF ACID BLUE 25 FROM AQUEOUS MEDIA BY USING *CYCADS PALM AS NOVEL BIOSORBENT:* CHARACTERIZATION

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ABSTRACT

In this work, the Cycads palm was tested as a novel biosorbent for the removal of acid blue 25 (Ab25) from aqueous media in the absence and presence of ultrasonic irradiation. Batch biosorption studies were conducted to study the effects of different parameters such as initial pH solution, biosorbent dose, initial dye concentration and ultrasonic power on AB25 dye biosorption in order to explain the influence of ultrasonic irradiation on biosorption kinetics. Ultrasonic power and initial pH solution played a key role in the removal of acid dye. The biosorption kinetic data were found to be well-represented by the pseudo-second-order rate equation, both in the absence and presence of ultrasound.

Additionally, the biosorbent surface was characterized by surface specific area (SSA), isoelectric potential (pH_{ZPC}), surface functional groups and scanning electron microscopy (SEM).

KEYWORDS : Ultrasonic irradiation; Biosorption; Cycads palm**; Acid blue 25;** Kinetics; Characterization.

REMOVAL OF BASIC VIOLET 3 BY BIOSORPTION FROM AQUEOUS PHASE BY USING POSIDONIA OCEANICA ALGA: BATCH AND COLUMN STUDY

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ABSTRACT

This study involves the removal of dye containing synthetic wastewater using Posidonia oceanica alga, as biosorbent by batch and column methods. The effect of different process parameters such as contact time, initial dye concentration, medium pH, biosorbent dose and temperature on the biosorption ability (capacity) of Posidonia oceanica alga was investigated in batch study. Pseudo-second-order kinetic model was better fitted to the experimental data. The equilibrium experimental data were analyzed by the Langmuir, Freundlich, Flory-Huggins and Kiselev models. Thermodynamic study showed that the biosorption is a spontaneous. A series of column tests using Posidonia oceanica alga as biosorbent were performed to determine the breakthrough curves with varying bed height and flow rates. To predict the breakthrough curves and to determine the characteristic parameters of the column useful for process design, three kinetic models namely Bohart and Adams, Clark and Wolborska were applied to experimental data.

KEYWORDS : Biosorption; Basic violet 3; Kinetics; Dynamic; Posidonia oceanica alga; Modeling

ASSESSING THE PERFORMANCE OF SOLAR THERMAL DRIVEN MEMBRANE DISTILLATION FOR SEAWATER DESALINATION BY TRNSYS DYNAMIC SIMULATION

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ABSTRACT

This paper deals with the modeling and simulation of a direct contact membrane distillation (DCMD) technologies and solar energy system with flat plate solar collector (FPC). This is a combined system consisting of a solar thermal collector, auxiliary heater, heat exchanger, pump and DCMD unit for freshwater production from seawater. The simulation is carried out using commercial software, Transient System Simulation (TRNSYS). New model-type has been included in TRNSYS in order to include the DCMD unit in the scheme. The simulation of the solar distillation system consists of 10 h per day and typical mete orological year (TMY) for Ain Témouchent, Algeria. The results show that increasing in the inlet feed temperature from 40 °C to 80 °C for PTFE membrane module; the modeling predictions permeate flux increases in the range of 10 to 80 L/h.m^2. Furthermore, the permeation flux increased with increasing circulating velocity of the feed fluid from 0.20 to 0.40 m/s, fixed feed inlet temperatures of 60°C and it appears to achieve the most extreme esteems asymptotical ly 32.5 L/h.m^2 for high velocity 0.40m/s. However, TRNSYS simulation results show that when the highest ambient temperature was 30°C, the maximum value of the average solar intensity was 834.7 W/m^2.

KEYWORDS : Direct contact membrane distillation TRNSYS Solar thermal collector Freshwater seawater.

LES PROBLEMES D'INJECTION D'EAU DANS LE CHAMP HMD

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RESUME

L'exploitation d'un gisement conduit naturellement à une diminution de la productivité des puits, pour continuer à l'exploiter dans les meilleures conditions, il est indispensable de passer au stade de récupération assistée.

L'injection d'eau dans les réservoirs est la méthode la plus employée dans la récupération du pétrole, Malheureusement, il existe une incompatibilité entre l'eau de formation et l'eau de gisement, ce qui pose énormément de problèmes tels que la formation des dépôts minéraux.

Les eaux de gisement peuvent contenir des ions alcalino-terreux et être mise en contact avec l'eau de lavage qui contient des ions de sulfates.

L'eau injectée finit par atteindre les puits producteurs et c'est dans ces puits le mélange se fait et la précipitation de sulfate de baryum (BaSO4) a lieu. Les cristaux se collent alors aux parois des tubings, selon un processus qui peut être semblable à celui du chlorure de sodium, mais cette fois-ci le problème est plus grave, car il s'agit d'un dépôt et très compact insoluble dans l'eau et dans les acides forts.

Les dépôts qui se forment au cours de la production et l'expédition représentent une véritable calamité contre laquelle les producteurs de pétrole luttent depuis plusieurs décennies, provoquant des dégradations irréversibles particulièrement dangereuses pour les installations de production de fond Comme de surface et quelque fois, pour la roche elle-même.

ENERGETIC STUDY OF A HUMIDIFICATION-DEHUMIDIFICATION DESALINATION PLANT COUPLED WITH SOLAR ENERGY

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ABSTRACT

In recent years, the lack of fresh water is considered as a serious problem that is constantly increasing, due to the population growth and changes in weather conditions. In fact, by 2025, 60% of the earth's population is expected to suffer from serious water scarcity.

Among the solutions presented to tackle such problem, the process of desalination has been in operation over 50 years among different technologies. Some technologies have not been developed at commercial level yet because the major drawback of these systems is that they are energy-intensive and inefficient in terms of the amount of fresh water produced. In this work, we are interested in humidification - dehumidification technology coupled with a simple solar still. In comparison with other desalination methods, humidification - dehumidification has several advantages. In fact, there is 100% rejection of non-volatile components, and no pretreatment of feed water is necessary. Besides, the system efficiency and high product water quality are almost independent from the salinity of the feed water.

The unit presented in this paper is designed to provide high quality drinking water in remote coastal areas with low infrastructure and without connection to an electrical network. The designed installation is completely autonomous, indeed the only energy source is the sun.

The electrical energy required to operate the plant is produced by a photovoltaic cells field, and the sea water heating is provided by a simple solar still. An energy study made it possible to estimate the electrical energy required for the operation of the ventilation system. We have taken into account the losses of air charges in the pipes and the losses within the diffuser immersed in the solar still.

The power of the various pumps supplying the solar basin and the circulation of cold water at the dehumidifier were calculated. The daily energy requirements of the entire installation were estimated at 5 kWh. The field of photovoltaic cells required has 9 modules offering an area of 9 m^2 and ensures the production of 1kW.

A technical-economic study of the system, taking into account the average daily production of the installation and the costs of investment and maintenance, made it possible to estimate the specific cost of the water produced. The aim of the exergy study is to characterize the efficiency of the system. This study makes it possible to determine the distribution of the energy degradation on all the organs of the installation; this will make it possible to propose improvements aimed at the energy efficiency of the system.

PERFORMANCE EVALUATION OF A MEMBRANE DISTILLATION SYSTEM COUPLED WITH SOLAR ENERGY

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ABSTRACT

The drinking water crisis announced for the coming years strongly revives the interest of rapidly developing cheaper desalination techniques, simpler, more robust, more reliable, if possible, less consuming energy and respecting the environment. Solar energy has gained increasing attention because of its abundance in places that suffer from freshwater shortages. The coupling of solar energy with desalination techniques makes it possible to ensure their autonomies from an energy point of view, and to adapt them to arid and undeveloped regions. Membrane distillation is a relatively new and very promising process. This method uses hydrophobic porous membranes to physically separate a saline solution. In this work we propose to estimate the potential of vacuum membrane distillation of seawater using a solar membrane module coupled to solar energy. We compare the performance of a desalination system coupling the membrane module with three different solar technologies: the flat solar collector, the cylindro-parabolic collector and the solar pond. A model describing the operation with the three solar technologies has been proposed. The model was established on the basis of material and transient heat balances. From this model, we have developed a simulation program that evaluates and compares the performance of different configurations. This study also quantified the production of the system with and without retentate recycling.

The following figure shows the operating principle of the studied system.

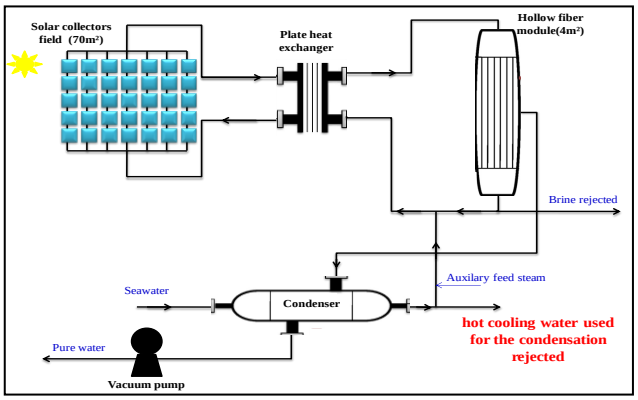

Figure 1: Principle of operation of the system studied.

The models developed are able to determine the temperature evolution and the distillate flow during the time and for any day of the year during the day. The comparison of the performances of the different configurations studied showed that the CPC is the most efficient solar collector. Indeed, with 70 m^2 of catchment area we estimate an annual production of about 31.8 m^3 per m^2 of membrane. In addition, the study showed that retentate recycling increases production by a remarkable amount. In fact, recycling makes it possible to recover the sensible heat of the retentate, thus making it possible to reach temperatures at the inlet of the relatively high module.

COUPLAGE DE PROCEDES INNOVANTS POUR LE TRAITEMENT DES REJETS DE TEXTILES

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RESUME

Ce travail a pour objectif de traiter des rejets de textile générés par le complexe de coton de Draa Ben Khedda. Le colorant réactif « Bleu Turquoise Cibacron P-GR » représente la particule de base des rejets considérés et, l'électrocoagulation avec la nanofiltration sont utilisés comme moyen de traitement. Plusieurs paramètres d'étude sont considérés dans ce travail. L'électrocoagulation en continu donne le meilleur abattement 88.71% avec une consommation d'énerger de 451.14.10-3kwh/m 3 pour une concentration de colorant de 174.32mg/l (pHsol =7.33 ; j = 2.125mA /cm^2 ; [NaCl]ajouté = 3g/l ; QM = 0.5911ml/s).

La nanofitration donne une meilleure rétention 87% pour une concentration de colorant de 127.47mg/l avec pH0=7.64 ; k=4,47mS/cm). Le couplage des procédés (électrocoagulation-nonofiltration) donne une décoloration totale généralement pour toutes les solutions traitées. Le résultat obtenu montre l'efficacité du couplage avec une réduction de quantité de boue résultante à la fin de traitement.

MOTS CLES : Rejet textile - Electrocoagulation –Nanofiltration – membrane organique

CHARACTERIZATION OF HYBRID NANOMATERIALS BASED ON DICALIX DERIVATIVE AND BENTONITIC CLAY MINERAL

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ABSTRACT

Calixarenes have been exploited in all fields of supramolecular chemistry over the last five decades and many recent development concerns their applications in the production of chemical entities to the dimensions of nanometer as well as in nano-chemistry.

The most important use of calixarenes is their involvement in the treatment of nuclear waste such as the removal of radioactive cesium from wastewater.

In this investigation, we present at first, the synthesis of a dicalix derivative at the nanometric scale, with a size variance between 17.74Åto 28.01Å. The Reaction yield was 48%. Complexion properties of the latter were made with respect to the lanthanide cations (La^{3+}, Pr^{3+}, Nd^{3+}, Eu^{3+}, Gd^{3+}, Er^{3+} and Yb^{3+}) and transition metals (Co^{2+}, Zn^{2+}, Cu^{2+} and Cd^{2+}) as well as the extraction properties of the picrates of these same cations. The complexometric study was carried out in acetonitrile and followed by Uv-visible spectrophotometry and the metallic extraction was made of water towards dichloromethane.

Then Hybrid nanomaterial: clay-calixarenic involving Tunisian bentonite and the dicalixarenic derivative was synthesized based on solid-solid reaction. Samples were caracterized by X-ray diffraction, IR spectroscopy and UV-visible spectroscopy. Results show an imporatant increase in the interlayer space of clay mineral after calix intercalation compared with the natural one; interlayer space increase from 12.6Å to 24.81Å. By comparing this distance to the size of the organic molecule, it was possible to confirm its intercalation in the interfoliar space and to estimate its disposition in the latter (fig). IR spectroscopy showed the appearance of important adsorption band that corresponds to functional group of employed calix.

Structural measurments with BET method suggest that specific surface area increase with the amount of intercalated calix.

KEYWORDS : Calixarene, synthesis, complexation, extraction, argilo-calixarenic hybrid.

PHOTOCATALYTIC DEGRADATION OF PHENOL IN WATER ON CoMo NANOPARTICLES

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ABSTRACT

Phenol and its derivatives are the primary pollutants detected in water and wastewater. This pollution comes mainly from chemicals industries (petrochemical, pharmaceutical). The presence of phenol, toxic compounds, reduces significantly the biological biodegradation of the other components.

This work represents an attempt to eliminate the phenol compounds in water using CoMo nanoparticles as photocatalyst under UV radiation. CoMo nanoparticles have been successfully synthesized by coprecipitation method. The optimum conditions for the elaboration, obtained by Taguchi design optimization method, are: Mo/Co molar ratio=0.75, time=60 min and PVP as surfactant. The obtained catalysts were characterized using XRD, FTIR, Laser gananulometry, DSC, SEM, BET.

Photocatalytic tests were carried out using a cylindrical Pyrex reactor system. The CoMo catalysts remain in contact for 10 min with the phenolic pollutant under stirring and and different pH values (3, 5, 7 and 9). The solution was irradiated during 120 min using UV lamp. The pollutant concentrations before and after photodegradation process were determined using liquid phase chromatography (HPLC) and carbon analyzer. The obtained results are promising and very interesting.

KEYWORDS : Water treatment, phenol, photodegradation, CoMo nanoparticles.

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REMOVAL MECHANISM OF HEAVY METAL (Cr^{+3}) IN WASTEWATER USING MODIFIED ALGERIAN CLAY

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ABSTRACT

The necessity to remove pollutants from wastewater using different absorbents has attracted growing interest during the last decade. Clay minerals are a low-cost, abundantly available and non-toxic for environmental applications. Clays are often used as adsorbents, membranes and flocculates due to their high porosity and large surface area. Kaolinitic clays have an asymmetric structure due to the superposition of the tetrahedral and octahedral groups with a hydrogen bonds between the silica and alumina, which gives these crystals a high possibility of intercalation of ions or arganic compounds.

The present work examines the removal of chromium from an aqueous solution using natural clay from the region of Guelma (Algeria). The adsorbent was characterized by Fourier Transform Infrared spectroscopy (FTIR), X-ray diffraction (XRD) and Dynamic Light Scattering (DLS). The obtained results analyses confirm that the studied clay consists essentially of Halloysite and Ilite with traces of cristoballite with a high distribution of fine grains.

The kinetic experiments of the contaminant removal were performed by varying several operating parameters such as initial concentrations, temperature and adsorption time. The chromium removal efficiency from the water was followed by UV-Vis spectrophotometry. The results obtained show that the equilibrium is reached after 150 min of contact time for the low temperatures. The experimental data were analyzed according to the Freundlich and Langmuir equations. The results confirm that the natural Halloysite is ability to adsorb and remove about 90% of the chromium content in the wastewater.

KEYWORDS : Water treatment, heavy metals, Chromium, Halloysite, DRX, FTIR, UV-Vis.

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ORGANOBENTONITES FOR ANIONIC DYE REMOVAL APPLICATION TO REAL TEXTILE EFFLUENT

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ABSTRACT

Clays have been considered as potential alternative adsorbent due to their high adsorptive property, abundance and non toxic compounds. Adsorption of cationic dyes by natural clays have been studied and appreciable results have been reported, but few have been interested in anionic dyes, widely used by the textile industries, yet they are toxic, nonbiodegradable and hardly adsorbable on natural clay, modified clay have emerged as an alternative adsorbent such as organoclay. In this study, organobentonite was prepared with hexadecyltrimethylammonium bromide (HDTMA) at three cation exchange capacity (CEC) levels and used as adsorbents for the removal of, reactive blue II (RBII-); anionic dye used in Tunisian textile industry specialized on dyeing jeans. Obtained organobentonite labeled Hi-bent (I = 1, 2 and 3) were characterized by several techniques in order to study the effect of surfactant on texture and structure of the initial clay. H3-bent and purified bentonite (Na-bent) were then tested as adsorbents. The amount of dye removal by H3-bent (98 %) was found to be around 5 times higher than that of Na-bent (19 %). Adsorption process was well described by Freundlich, Dubinin-Radushkevic (D-R) and Elovich isotherms model. Kinetic data were fitted by both pseudo-second order and pseudo-first order models. The use of Na-bent, as adsorbent, for real textile effluent treatment was tested, and significant results were obtained related to two other clay minerals.

KEYWORDS : Bentonite; organobentonite; surfactant; anionic dye; adsorption isotherms; textile effluent, modeling.

Ti, HDTMA AND Al/Fe PILLARED BENTONITE FOR ANIONIC DYE AQUEOUS SOLUTION TREATMENT ESSAY TO REGENERATE THE ADSORBENT

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ABSTRACT

Removal of an anionic dye (Congo red) by a local bentonite before and after modification was studied. The modification of the bentonite was made by organophilisation using surfactant (HDTMA) and by pillaring process to obtain a bentonite with Ti pillars and with mixed pillars of Fe/Al. The various synthesized materials are characterized by different techniques such as DRX, MET, N_2 adsorption-desorption, Zeta potential measurement. Results show the development of the texture and the structure of the bentonite after modification. The various adsorbents synthesized show an increase in the adsorption capacity of Congo Red compared to the initial bentonite. Adsorption isotherms are described by the Langmuir model in all cases except that for Ti pillared bentonite, the Freundlich model is more suitable. Pseudo-second order is better for describing the adsorption process. Also, regeneration of the adsorbent is approached in this study by photochemical way and the results show a total regeneration of the adsorbent.

KEYWORDS : Bentonite; pillaring ; anionic dye ; adsorption; regeneration.

DETERMINATION OF HEAT AND MASS TRANSFER COEFFICIENTS IN A SPRAY HUMIDIFIER OF A HUMIDIFICATION-DEHUMIDIFICATION DESALINATION SYSTEM

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ABSTRACT

The availability of drinking water is reducing day by day; whereas the requirement of water use is increasing rapidly. One potential solution to tackle this issue is to develop reliable, efficient and cost effective de-centralized small-scale water desalination systems to make the clean water accessible. The humidification-dehumidification (HDH) desalination system is a carrier-gas based thermal technique that can be used for small-scale water desalination systems of high salinity water. The basic components of HDH system include a humidifier, a dehumidifier, a water or air heater, pumps and piping.

An innovative design approach is to use water spray humidifier to enhance the performance of the HDH water desalination system, where the hot water was sprayed from the top and the air was supplied from the bottom of the humidifier. In order to scale up a unit of this type, it is necessary to obtain sufficient information on the process of heat and mass transfer in the unit. A desalination unit prototype was developed and used in order to fulfill the main objective of this research which is evaluating the mass and the heat transfer coefficients in the humidifier. Likewise, the effect of saline water flow rate, the water temperature, the air flow rate and the position of water spray are examined in order to optimize the operating conditions. The experimental results obtained were used to correlate the influence of the different operating conditions on the mass and heat transfer coefficients.

HYDRO-CLIMATIC VARIABILITY OF THE MEDJERDA WATERSHED AND EXTREME CLIMATE EVENTS (TUNISIA)

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ABSTRACT

Climate change is one of a major global issue of our time with a direct impact on the hydrological system. It increases the frequency of extreme weather events, especially droughts and floods. 10 rainfall and hydrological stations, with continuous monthly precipitation and streamflow records over the period (1965–2017), were considered in the analysis to understand the hydrological variability (precipitation and streamflow) in Medjerdah's basin, one of the main river of Tunisia, as much by its length, the surface of its watershed as by the volume of water which it is carrying. This study also aims to examine the influence of the dominant climatic patterns in the hydrological system (North Atlantic 36 Oscillation (NAO), The Sea Surface Temperature (SST), Southern Oscillation Index (SOI), El Niño Southern Oscillation (ENSO) et Mediterranean Oscillation Indices (MOI)…). A "Bertin matrix" chronological graphical method and wavelet coherence analysis are also used to determine the different periods of dry and wet cycle change and to identify and describe variability in Medjerda streamflows.

The statistical treatments shows that the rainfall in the basin of Medjerda is very variable on the temporal scale but it follows the same variation in all the stations. This analysis shows also that the variation streamflow in rivers change over time and from upstream to downstream with a fairly fast and strong hydrological response upstream and medium to low with downstream disturbance. This phenomenon is affected by several conditional factors of the flow (lithology, vegetation, morphology …).

Bertin's matrix allowed us to determine three different cycles between 1965 and 2016: A variable cycle from 1965 to 1973, a second cycle that has a long dry period between 1974 and 1995 and the last has a long wet period between 1996 and 2015. The wavelet coherence analysis didn't show a coherence between NAO/streamflow and precipitation/NAO identified at the inter-annual scale in the basin of Medjerda. Therefore, we can conclude that we don't have the same phenomenon like in Algeria and Morocco.

KEYWORDS : Medjerdah, hydrological variability, precipitation, streamflow, climatic patterns (NAO…).

FACILITATED TRANSPORT OF TOXIC METALS BY MEMBRANAIRE PROCESS LIQUID MEMBRANE NON SUPPORTED CONTAINING DIFFERENT CARRIERS

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ABSTRACT

The micro mineral pollutants are discharged into nature thus involving risks of harmfulness with respect to the living organisms in the receptors. The discharge of toxic metals into environment is a serious problem facing numerous industries. So, the search for extraction techniques to remove those heavy metals are increasing interest. Liquid membranes have shown great potential in this way especially in cases where metal concentrations are relatively low and other techniques cannot be applied efficiently. The fundamental parameters influencing the transport of the chrome, copper and lead, through the liquid membrane containing different extractant: TOPO; HDEHP and TOA as carriers have been examined (the acidity, nature of the extractant and the time of transportation).

The study of chemical parameters have allowed us to obtain the variables giving the optimum extraction efficiency for diluted solutions of Cr(III), Cr(VI), Cu(II) and Pb(II) .

The chemical variable survey permitted us to determine optimum outputs, to understand the mechanisms of extraction were investigated and the phenomena of transfer put in game.

A chemical modelization has allowed to demonstrate the extraction mechanism and transport.

A physical modelling has permitted to identify the existence three phases of transfers that finds their origin on the one hand, in a gradient of potential chemical and, on the other hand, in the active transports bound to the processes

KEY WORDS : chrome, copper, lead, transport, membrane process, wastewater

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EVALUATION OF THE PHYSICOCHEMICAL QUALITY OF THEWATER USED IN THE MEDICAL INSTITUTIONS : CASE OF THE EHU AND CHO D'ORAN

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ABSTRACT

Water is an essential component in the operation of the health care institutions. At the hospital water exists under various types presenting of the physicochemical characteristics and microbiological well defined, it could be intended for uses is in direct contact or indirect with the patients what can be qualified as a source of serious infection which engages the vital prognosis of the patient.

To evaluate the quality of the water used in hospital medium we conducted a survey carrying into the physicochemical analysis of various types of water used with knowing water of hemodialysis, water conditioned sterile... in two medical institutions the EHUO and CHUO of the Wilaya of Oran according to the methods described in the Algerian official journal.

Among the 33 analyzed takingaway,17 samples met the standards fixed by the responsible authorities what represents a percentage of 57% of which 13% revealed nitrite high rates, 17% out of calcium. With regard to conditioned sterile water the regulation imposes standards and especially microbiological quality standards according to the European pharmacopeia.

This study remains restricted by report sampling carried out, it would be more interesting to supplement the study by others more pushed research for better assessing the situation of water and the quality of the latter within the hospital.

KEYWORD : water, physicochemical quality, health care institution, Wilaya of Oran

EVALUATION DE LA QUALITE PHYSICO-CHIMIQUE DES EAUX D'HEMODIALYSE : CAS DE STATION DE TRAITEMENT DE L'EHU D'ORAN

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ABSTRACT

L'eau pour hémodialyse est une substance médicamenteuse inscrite à la pharmacopée européenne, elle doit être sous la responsabilité du pharmacien, pour cela il convient de veiller à la validation du procédé de production d'eau pour hémodialyse avant sa mise en application, à la surveillance du fonctionnement en routine, ainsi qu'à l'entretien du matériel. La qualité de l'eau utilisée pour diluer les solutions concentrées de dialyse constitue un élément essentiel de l'efficacité et de la sécurité de cette thérapie. L'objectif de ce travail consiste à contrôler la qualité de l'eau d'hémodialyse station de traitement de l'EHU d'ORAN et d'évaluer les paramètres physico-chimiques reflétant la qualité de cette eau. L'étude a révélé que la majorité des éléments analysés (chlorures, nitrites, nitrates, matières organiques ...) étaient conforme aux normes de qualité établies par la pharmacopée sauf pour quelques prélèvements qui présentaient des taux dépassant légèrement les normes. En raison du mode de production en continu de l'eau pour hémodialyse et des risques toxiques et infectieuse, il est nécessaire de mettre en place, un système d'assurance qualité représente par un ensemble de dispositions préétablies et systématiques destinés à donner toute confiance dans la qualité du soluté utilisé.

MOTS CLES : Hémodialyse, Eau, Qualité, Oran, Risques, Assurance Qualité

REMOVAL OF METHYL ORANGE (MO) FROM AQUEOUS SOLUTION USING CATIONIC SURFACTANTS MODIFIED COFFEE WASTE (MCWs)

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ABSTRACT

Removal of toxic dyes from the environment is an important challenge. Ideally, a removal processes must be simple, effective and inexpensive. Conventional methods of dyes removal from wastewater have been used. These methods include biological and physico–chemical processes. The activated carbon with large surface area is effective and widely used as adsorbent, but its cost is quite high. Therefore, many researchers pay attention to the use of different types of low-cost materials from biomass products such as peanut husk, sugarcane bagasse, peanut hulls, and wheat straw as adsorbent. Commercial coffee waste can be used as an available adsorbent to remove cationic dyes from wastewater. The chemical composition of the insoluble coffee waste cell's wall is largely made up of lignin and some structural proteins that contain hydroxyl and carboxylic groups. However the capacity about anionic dyes was very low. To enhance the remove anionic ions pollutants, several researchers used cationic surfactant to modify agricultural products. But investigations using commercial coffee waste modified by surfactants for dyes adsorption were not, in our knowledge, reported in the literature. Therefore in the present study, two cationic surfactants cetyltrimethyl ammonium bromide (CTAB) and cetylpyridinium chloride (CPC) were used to modify the surface of CW to enhance its capacity toward anionic pollutants. Methyl orange (MO) is selected as anionic dye model. It is one of the well-known acidic/anionic dyes, and it has been widely used in textile, printing, paper, food, and pharmaceutical industries. Azo dyes are well known as carcinogenic organic substances. Like many other dyes of its class, MO don't inadvertently enter the body through ingestion, it is metabolizes into aromatic amines by intestinal microorganisms. The aim of this study is to improve the adsorption property of commercial coffee waste towards MO dye by using two cationic surfactants. Kinetic, thermodynamic and isotherms of MO removal on this novel materiel were investigated.

KEYWORDS : Methyl orange, modified coffee waste, surfactant, adsorption, kinetics, thermodynamics

ETUDE COMPARATIVE ENTRE LE TRAITEMENT BIOLOGIQUE DES EAUX USEES PAR LES BOUES ACTIVES ET LA BIO-FILTRATION (BISKRA-ALGERIE)

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RESUME

La pollution de l'eau est sans doute l'un des problèmes les plus gênant, surtout quand il s'agit de la dégradation de l'environnement naturel et donc de son équilibre.

La station d'épuration des eaux usées (STEP de Timgad) est située dans la ville de Timgad à Batna (Algérie). Cette dernière, en quelques années elle a réussi à réduire les diverses catégories de pollution urbaine et domestique, avec des performances et de purification conforme aux normes ISO. Le but de cette étude est de comparer et évaluer le rendement entre deux procédés de traitement des eaux usées, les boues activées, et la bio-filtration qui utilise des fibres de palmier dattier et les cailloux. Pour cela, l'analyse de DCO, DBO_5, pH, MES, , et sont utilisées pour mesurer la pollution des eaux ou d'effluents, suivi d'une analyse descriptive et statistique de la qualité des eaux usées traités par le procédé de la station (boues activées) et le procédé proposé (bio-filtration), durant une période de quatre semaines. Les résultats obtenus et la comparaison effectuée ont permis de conclure que le rendement épuratoire de bio-filtration (91,783 %) se rapproche de celui des boues activées (96,493 %).

MOTS-CLES : Eaux Usées ; Bio-filtration ; Biofiltre ; Boues Activées ; STEP de Timgad.

RECUPERATION DU NICKEL(II) EN MILIEU AQUEUSE PAR LE D2EHPA

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ABSTRACT

In the present work, the extraction of nickel(II) from sulfate media with di-(2-ethylhexyl) phosphoric acid (D2EHPA) in various polar and nonpolar solvents at 25°C, has been carried out. The stoichiometry of the extracted species in the organic phase have been found to be NiL22HL and NiL2 in nonpolar and polar solvents respectively. According to the nature of the solvent, the extraction of nickel(II) by D2EHPA decreased in the order: 1-octanol > cyclohexane > methyl isobuthyl ketone > carbon tetrachloride > dichloromethane > chloroform > toluene. Mots clés

KEYWORDS : Solvent extraction, Di-(2-ethylhexyl) phosphoric, Nickel(II), Diluant effect.

ETUDE ET MODELISATION STATISTIQUE DES COURBES DE PERCEES DE L'ADSORPTION DU PHENOL SUR CHARBON ACTIF

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RESUME

Dans cette étude, l'adsorption dynamique du phénol sur le charbon actif a été étudiée pour différentes conditions opératoires. Un plan d'expérience a été effectué pour évaluer les effets de trois variables sur six facteurs de réponse différents. Les trois variables étudiées sont la concentration initiale du phénol (C0), le débit d'injection (Q) et la hauteur de lit fixe (H). Les six facteurs de réponse sont le temps de percée (tb) (temps nécessaire pour atteindre 10% de la concentration initiale de phénol), le temps de séjour moyen (ts), le temps de la limite opératoire (te) (temps nécessaire pour atteindre 95% de la concentration initiale de phénol), la variance réduite (σ'2), la longueur de la zone de transfert de masse (ZTM) et la quantité retenue de phénol à l'équilibre (qe). Le but est de chercher à partir du plan d'expériences, le lien qui existe entre une grandeur d'intérêt, Y, et des variables, xi. Nous choisissons le modèle polynômial d'ordre deux complet, c'est-à-dire incluant aussi les effets dits quadratiques (modèle de surface de réponse). Les résultats obtenus par la modélisation statistique des modèles quadratiques proposés pour les six facteurs de réponse indiquent une bonne corrélation entre les réponses expérimentales et celles prédites. La valeur de probabilité (P-valeur) calculée est inférieure à 0.05 (niveau de confidence de 95%) pour tous les facteurs de réponse. Elle confirme la signification des modèles proposés dans le processus d'adsorption dynamique du phénol sur notre charbon actif.

MOTS CLES : courbe de percée ; adsorption dynamique; modélisation statistique; model quadratique.

H_3PO_4-ACTIVATED CARBON OF HIGH SURFACE AREA SYNTHESIZED FROM CORES NUTS OF SAPINDUS MUKOROSSI AS A HIGH-EFFICIENCY ADSORBENT FOR ENDOCRINE DISRUPTOR COMPOUND REMOVAL : KINETIC, ISOTHERM AND THERMODYNAMIC STUDIES

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ABSTRACT

Recently, endocrine disruptor compounds have been identified as Contaminants of Emerging Concern (CEC) in wastewater due to the potential hazards to human bodies, and various methods are being developed to remove CEC from wastewater and water bodies. This research reports the preparation of activated carbon from cores nuts of Sapindus Mukorossi (CNSM –AC), and its application on bisphenol A (BPA) removal from aqueous solution. CNSM-AC prepared via phosphoric acid activation showed the highest adsorption performance towards BPA. Characterizations on CNSM – AC revealed that acid treatment led to dehydration and chemical reactions in the biomass precursor. The maximum removal efficiency of BPA observed at the initial concentration of 50 mg/L, adsorbent dose of 1g/L, natural pH at 323 K and reaction time of 60 min. The adsorption data were well fitted to the Langmuir isotherm model and obeyed the pseudo-second order kinetics model. The adsorption capacity of CNSM – AC towards BPA was found to be 111.5 mg/g. The adsorption process is endothermic, feasible and spontaneous according to the thermodynamic evaluation. Overall, the results demonstrate the feasibility to convert one common biowaste to a value-added product that removes Bisphenol A from aqueous solution, thus it is necessary to investigate the potential of CNSM – AC in wastewater treatment application.

KEYWORDS : Bisphenol A, cores nuts of Sapindus Mukorossi, Activated Carbon, Adsorption.

NEW ION EXCHANGE MEMBRANE DERIVING FROM SULFOCHLORATED POLYETHER SULFONE FOR ELECTRODIALYSIS DESALINATION OF BRACKISH WATER

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ABSTRACT

In this research work, we present a new ion exchange membrane made from sulfochlorated polyethersulfone (Cl-PES) crosslinked by aminated polyethersulfone (NH2PES) crosslinking reagent for electrodialysis (ED) applications. This membrane has been obtained by reaction between Cl-PES with 1.3 SO_2Cl groups per monomer unit and 0.2 equivalent amount of NH2-PES. It is called ClNH2 membrane. ClNH2 membrane was characterized by contact angle (CA), transport number, intrinsic conductivity and water uptake as a function of temperature. The purpose of this work is the study of desalination of brackish water using this new ion exchange membrane. Electrodialysis performances were measured using an electrodialysis cell at laboratory scale. Efficiency of electrodialysis is evaluated by comparing demineralization rate, ionic flux transport and specific power consumption using commercial and newly synthesized membranes. All experiments were realized using synthetic brackish water solutions prepared from sodium chloride salts with different concentrations. Concentration of these solutions is varying from 0.5 to 5.0 g/L. The concentration of different water samples obtained is below than the amount recommended by world health organization (WHO) for drinking water.

KEYWORDS : Ion exchange membrane, Electrodialysis, Desalination, ClNH2 membrane, Demineralization rate, Conductivity, Ionic flux transport.

REFERENCE

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CLAY AND IRON BASED ADSORBENTS FOR METHYLENE BLUE REMOVAL

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ABSTRACT

The adsorption, one of the physical-chemical methods for treatment of wastewater, is the most simple and economical way to remove dyes from effluents. This study investigates the removal of a methylene blue (MB) textile dye in aqueous solution using the absorption methods assisted by a catalyst composed of iron and kaolinite clay. Fe adsorbent was obtained by green synthesis using coffee bean as a source of antioxidants, mixed with a solution of $FeCl_3$, $6H_2O$ to get stable iron nanoparticles.

Both raw and modified clay materials were characterized by XRD, particle size distribution and specific surface determination. Experiments were conducted to determine the discoloration rate using the Fe/clay adsorbent. Batch process experiments were conducted varying contact time, initial pH, initial dye concentration and adsorbent amount.

Adsorption test results show a maximum adsorption rate 88% reached after 60min with 25 ppm MB initial concentration and 0.1 g of Fe/clay in an alkaline solution (pH equal to 9).

With a small amount of clay (0.02 g), the adsorption rate reaches nearly 50% but with 0.1 g of both raw clay and catalyst it can reach 90%. This result shows the influence of masses to provide active sites on adsorbent surface. At a pH of 9, a high rate of discoloration is observed. This is caused by the formation of covalent bonds between surface of adsorbent atoms (OH groups) and the negatively charged dye molecules.

Langmuir type is the favorable adsorption isotherm showing that adsorption performs in monolayer. The pseudo-second order model is the most reliable for determining the adsorption kinetics of methylene blue by raw clay and catalyst.

All these results indicate that both raw clay and catalyst could be effective enough to remove a dye such as methylene blue in an aqueous solution using absorption as the most simple and economical way.

KEYWORDS : Methylene blue, adsorbent, iron nanoparticles, kaolinite, green synthesis.

TREATMENT WASTEWATER BY HYBRID METHOD : ELECTROCOAGULATION COMBINED WITH ADSORPTION USING BOX-BENHKEN DESIGN ON COD REMOVAL AND ENERGY CONSUMPTION

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ABSTRACT

In this study, the box benhken design (BBD) was used in the optimization of the oprerating parameters for the removal of the hexavalent chromium, because of its hazardous impact on human health and aquatic environment. This research experimentally investigates the treatement of wastewater to remove hexavalent chromium by adsorption modified clay adsorbant and electrocoagulation using aluminium electrodes. The as was applied to investigate the effects of major operating variables and optimization conditions of removal efficiency of COD and minimum cost. Response Surface Methodology (RSM) has important application in the improvement of existing design. It defines the effect of the independent variables alone or in combination and also it generates a mathematical model which describes the processes interaction. Hence this study focussed on optimization using Box Behnken design approach. The optimal operating conditions were determined and applied to the process. The influence of operating parameters such as current density, dose of adsorbant, initial p H were analyzed on the percentage COD removal along with power consumption for the treatment. Under optimal operating conditions such as 150 A/m^2 current density, p H =6,2g/l dose of activate clay, % COD removal, specific electrical energy consumed (EESC) were found to be 98%, 0,26 kW h/Kg respectively. These results reveal the alternative treatment method cleaning of wastewater.

KEYWORDS : Electrocoagulation, clay, COD, Cr (VI), Optimization

ELECTRICAL STUDY OF SCHOTTKY DIODE WITH AN INTERFACIAL POROUS SIC LAYER FOR GAS SENSORS

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ABSTRACT

In this work we study the influence of the porous structure of silicon carbide (psc) layers on the electrical properties of pt (pd) / sic-psi and pt (pd) / psc / sic-psi schottky diodes for gas sensors. this diodes was characterized in air ambient and in vacuum at pressure 8.10-2 mbar.the thin sic layer are realized on p-type silicon (si(100)) substrate by laser ablation method with krf laser (248 nm) using 6h-sic (purchased by goodfellow uk) as sputtered target and a thermal deposition of a thin metal layer (platinum (pt) and palladium (pd)). the electrical measurements were made at room temperature (295 k) in an air ambience using an oxford cryostat. the effect of the porous surface structure was investigated by evaluating electrical parameters. analysis of current-voltage (i–v) characteristics showed that the forward current might be described by classic thermal emission theory. the ideality factor of the i–v characteristics was found to be dependent and vary only on a modified surface such as psc (interfacial layer) and also vary with the nature of the metal (pt or pd) for electrical measurements in air and in vacuum, it notes that schottky diode without an interfacial layer (psc), all electrical parameters does not change when the measurements were taking in vacuum or in air ambient, a low value of ideality factor was found around 1.169 and 1.436 with a barrier height 0.746 ev and 0.804 ev for pt and pd schottky contact respectively. in contrast, in the presence of an interfacial layer (psc), the electrical properties of all the schottky contact change, in fact, the ideality factor increase 1.505 to 1.657 for the measurement carried out in vacumm (8. 10-2 mbar) by report of the one taking in the air (70 % n2 gas), this result confirmed in the two metals (pt and pd), also we register a decrease in barrier height and in series resistance for air measurements by report to vacuum measurements.

KEYWORDS : Porous Silicon Carbide, Schottky diodes,Platinum,Palladium

SALTING EFFECT ON LLE OF BINARY (WATER + MEK) SYSTEM AND ITS SIMULATION USING, MODIFIED EXTENDED-UNIQUAC AND ARTIFICIAL INTELLIGENT-BASED MODELS

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ABSTRACT

The influence of the cation (Li+, K+, and Na+) and the temperature on the LLE for the systems of {water + MEK} have been measured at 298.15 and 303.15 K. The results showed that the influence of lithium salt was higher than that of sodium and potassium salts with the same anion. The temperature effect on the phase behavior indicated that the mutual solubilities of both phases decreased with higher temperature in the presence of salt. Finally, an artificial neural network (ANN) and a modified extended-UNIQUAC model were used to estimate the phase behavior of LLE of ternary systems. The comparison of the both models showed that the prediction capabilities of the ANN model were better as compared to the activity coefficient model.

KEYWORDS : Liquid–liquid equilibrium; Salting effect; Artificial Neural Network; Modified extended-UNIQUAC.

NICKEL FOAM AS A NEW MATERIAL FOR CHLORTETRACYCLINE ELECTROCHEMICAL OXIDATION : BIODEGRADABILITY IMPROVEMENT AND BIOLOGICAL TREATMENT

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ABSTRACT

This project deals with the electrochemical oxidation coupled with biological treatment of biorecalcitrant antibiotic: chlortetracycline (CTC). This organochlorine compound releases from pharmaceutical industrial waste into the environmental water and usually causes suspected undesirable effects in aquatic organisms. The pre-treatment was performed in a home-made flow cell involving nickel foam as a working electrode at potential of 0.55 V/saturated calomel electrode (SCE). The electrolysis through the percolation cell led to a more than 99% conversion yield of chlortetracycline in oxidation in alkaline conditions. The evolution of the concentration during treatment was followed up by Ultra Performance Liquid Chromatography (UPLC). Cyclic voltammetry with a nickel electrode revealed a significant electrochemical activity of chlortetracycline. Total Organic Carbon (TOC) analyses of the electrolyzed solution revealed that the level of mineralization remained low, underlying the interest of a combined electrochemical and biological treatment. The biodegradability, based on the BOD_5 on COD ratio, was studied at the oxidation potential of 0.55 V/SCE. The electrolyzed solutions were biodegradable. Moreover, a simultaneous generation of chlorides was observed and intermediates were identified and monitored during 5h of electrolysis.

KEYWORDS : Chlortetracycline, biodegradability, electro-oxidation pretreatment, percolation cell.

DEGRADATION SONOCHIMIQUE DU FUROSEMIDE DANS L'EAU

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RESUME

L'eau est la base de toute vie, aucun animal, aucune plante, aucun être humain ne peut exister sans elle. L'eau symbolise aussi la santé et la joie de vivre, mais un danger menace ce bien si précieux, un danger insidieux et invisible à l'œil nu ; c'est la présence de divers polluants dits émergents. Les concentrations sont faibles mais la multiplicité de ces micropolluants peut créer un cocktail qui cause de sérieux problèmes sur la faune, la flore et surtout la santé humaine. Par conséquent, le traitement de cette source fragile n'est plus un choix, mais une obligation. Cependant, de nombreuses études réalisées à l'échelle laboratoire, pilote et industrielle ont clairement prouvé l'efficacité de nouveaux procédés pour la dépollution et l'assainissement des réserves d'eau potable, nommés : procédés d'oxydation avancés (POA). Ces technologies se basent sur la production des espèces hautement oxydantes capables de réagir rapidement et de manière non sélective sur la plupart des composés organiques. La sonochimie, basée sur le phénomène de cavitation acoustique, est l'un des procédés innovants d'oxydation qui représente le système le plus efficace et le plus facile d'automatisation par comparaison à d'autres POA.

Dans ce travail, une étude approfondie a été réalisée sur le traitement d'une molécule médicamenteuse, le furosémide, dans l'eau en utilisant un réacteur sonochimique multifréquences (585, 860 et 1140 kHz) opérant à différentes amplitudes. Des mesures expérimentales réalisées à l'aide d'une HPLC ont permis de déterminer les effets des différents paramètres opératoires sur la dégradation sonochimique du furosémide en solutions aqueuses tels que la concentration initiale du polluant, les gaz dissouts, le pH et certains piégeurs de radicaux libres.

MOTS CLES : Traitement de l'eau ; Procédés d'oxydation avancés ; Sonochimie ; Furosémide ; HPLC.

REMOVAL OF DYES BY A LOW-COST ADSORBENT: KINETIC AND EQUILIBRIUM MODELLING

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ABSTRACT

Cationic dyes are popular due to their brightness of colours, low cost and high tinctorial strength. Their discharge threats the environment and mainly the aquatic life even in trace quantities. Adsorption was proved to be potentially powerful method for color removal from aqueous solution. This study aims to describe the adsorption mechanisms of cationic dyes (basic red 2, BR2; and methyl violet, MV) by date pits as a low cost and available adsorbent. Different kinetic models as well as two and three-parameter equilibrium models were applied. Brouers-Stolongo kinetic model was the best fitted kinetic model compared to pseudo-first order, pseudo-second order and Elovich models. Moreover, intraparticle and film diffusion steps control simultaneously BR2 and MV adsorption processes and Biot numbers confirmed these results. On other hand, BR2 and MV equilibrium data were better fitted by the three-parameter models compared to the two parameter models. By comparing the six three-parameter models, Hill and Koble-Corrigan were the most adapted models for the fitting of BR2 adsorption isotherms. However, Toth, Khan and Redlich-Peterson models described well the MV equilibrium data. Thus, the present investigation showed that date pits had a considerable potential for the removal of cationic dyes from aqueous solution.

KEYWORDS : Adsorption, Cationic dyes, Date pits, Equilibrium, Kinetic.

EXTRACTION DU FUROSEMIDE EN MILIEU AQUEUX PAR MEMBRANE LIQUIDE EMULSIONNEE

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RESUME

Les établissements de soins sont considérés comme des points noirs en raison des quantités importantes contenant dans ses eaux usées tels que : des anti-infectieux, des produits de contraste, des anticancéreux et des produits diurétiques. Le furosémide appartient à la classe des médicaments appelés diurétique. Ce médicament est utilisé pour traiter l'œdème qui se produit lors d'une insuffisance cardiaque et de certains désordres du foie, des reins et des poumons. Il est toujours difficile de traiter les effluents chargés en FM par des méthodes conventionnelles. L'extraction par membrane liquide émulsionnée est un sujet d'actualité et elle s'est avérée comme une excellente technique de traitement des effluents aqueux. Elle est basée sur le transfert de matière à travers une membrane (phase organique liquide). Ce nouveau procédé est très efficient pour l'élimination, la récupération et la concentration de divers polluants ou solutés de valeur. Sa cinétique rapide, sa simplicité de conception et sa facilité d'emploi ainsi que la possibilité de recycler la membrane pour d'autres éliminations font que cette technique est une opération avancée de séparation.

Une émulsion E/H est préparée pour l'élimination de FM en phases aqueuses par une membrane composée d'un tensioatif (Span80), d'un diluant (Héxane) et du NaOH comme une phase interne. L'effet de la concentration de la phase interne sur l'enlèvement de FM, la stabilité de la membrane et la déséxtraction du FM est examiné pour des valeurs allant de 0.005 à 0.2N. Une émulsion métastable avec une meilleure efficacité d'élimination du Furosémide dans l'eau est obtenue pour une concentration de 0.01N en NaOH comme un agent de piégeage.

MOTS CLES : Furosémide ; Membrane liquide émulsionnée ; Transfert facilité.

DIAGNOSTIC ET AMÉLIORATION DES PERFORMANCES DU DIFFUSEUR DE LA STATION DE DESSALEMENT DE CAP DJINET - ALGERIE-Auteurs :

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RESUME

La station de CAP DJINET située dans la wilaya de Boumerdes a une capacité de production de 100000 m^3/j et un débit de rejet de saumure d'environ 124000 m^3/j. Ce dernier est rejeté directement dans le milieu marin à une profondeur de 7 m par un émissaire sous marin d'une longueur de 1200 m, doté d'un diffuseur de 100 m de longueur avec 40 ports de 0.1m de diamètre. L'objectif de notre travail est de faire un diagnostic de ce diffuseur et d'étudier son comportement par rapport aux variations climatiques tel que la vitesse du vent et vitesse du courant. Nous avons ensuite proposé des alternatives et solutions pour améliorer les performances de ce diffuseur, pour ce faire, nous avons simulé plusieurs scénarios de dispersion du rejet dans le milieu marin en utilisant le code CORMIX9.0GT (Cornell Mixing Expert System) (License ID N°75183932) commercialisé par la société MixZon, il s'agit d'un modèle servant à l'analyse, la prédiction et la conception de rejets de liquides contaminants ou non en milieux aquatiques.

MOTS CLES : Dessalement, Algérie, Saumure, Impacts, Environnement, Diffuseur, Mer, Cormix

ETUDE DU PROCESSUS D'ADSORPTION DU PRODUIT 2,4-D DANS UN SOL AGRICOLE ALGERIEN

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RESUME

L'objectif de ce travail est d'étudier le transport et la rétention de l'herbicide 2,4-D dans un sol agricole algérien et de déterminer les paramètres gouvernant la rétention et le transfert de cet herbicide. Le 2-4D a été choisi en raison de son usages fréquents en Algérie. Le transfert de ce pesticide a été étudié à travers des expériences dans des colonnes de sol reconstituées au laboratoire. Ces expériences sont basées sur la méthode de chromatographie éluto-frontale. La colonne est d'abord pré-conditionnée avec la solution de fond ($CaCl_2$ 10-2 M) pendant 18h et avec un débit constant égal à 0.3 ml puis avec une solution contenant le polluant (2,4-D) de concentration C0. Les différents modèles d'isotherme d'équilibre appliqués montrent globalement que les observations faites sur les courbes de percée permettent de conclure à des sorptions de type non linéaires et non réversible. Le PH et le débit ont été identifiés comme les paramètres majeurs gouvernant la rétention de pesticide étudié. L'adsorption du 2,4-D par un sol agricole montre que cet herbicide a une forte affinité vis-à-vis des constituants du sol.

MOTS CLÉS : Herbicide, 2 ,4-D, Adsorption en colonne, Sol, courbe de percée.

ADSORPTION OF FLUORIDE FROM AQUEOUS SOLUTION BY ACTIVATED CLAY

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ABSTRACT

The removal of fluoride from aqueous solution using modified sulfuric acid clay was studied in batch adsorption. Adsorption kinetics were used to identify the retention mechanisms. For kinetics study, perfectly stirred batch experiments were carried out after the adjustment of the parameters influencing the system, such as the pH, adsorbent dosage, initial fluoride ions concentration, and stirring speed. It appears that the rate of fluoride ions removal: (i) increased with the mass of adsorbent and the stirring speed, (ii) decreases with the initial fluoride ions concentration. Experimental results were modeled according to kinetic equations representing four external transport models. These transport models were used to calculate the external mass transfer coefficient, kf. The results showed that this coefficient is in the range of 10-5-10-4 ms-1.

KEYWORDS : Adsorption, Modified clay, Fluoride removal, Kinetics, External mass transport.

USE OF ADSORPTION USING ALOW-COST BENTONITE FOR THE ENHANCEMENT OF REMOVAL OF CHROMIUM FROM WASTEWATER BY ELECTROCOAGULATION

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ABSTRACT

The present work deals with removal of hexavalent chromium from synthetic effluents in a batch stirred electrocoagulation cell with aluminium electrode pair coupled with adsorption using activated bentonite. Several working parameters such as pH, current density, adsorbent concentration and operating time were studied in an attempt to achieve higher removal capacity. Results obtained with synthetic wastewater revealed that most effective removal capacities of chromium (VI) could be achieved when the initial pH was near 6. The removal of chromium (VI) during electrocoagulation, is due to the combined effect of chemical precipitation, coprecipitation, sweep coagulation and adsorption. In addition, increasing current density in a range of 25-150 A/m2 and operating time from 20 to 100 min enhanced the treatment rate to reduce metal ion concentration below admissible legal levels. The addition of bentonite active as adsorbent resulted in remarkable increase in the removal rate of chromium at lower current densities and operating time, than the conventional electrocoagulation process. The method was found to be highly efficient and relatively fast compared to existing conventional techniques.

KEYWORDS : Adsorption, Electrocoagulation, Chromium (VI), activated bentonite

EFFECT OF HYDROGENCARBONATE AND CALCIUM ON FLUORIDE REMOVAL BY ELECTROCOAGULATION

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ABSTRACT

Excessive concentrations of fluoride can be encountered in ground waters, in particular in sub-tropical areas, with concentrations reported up to 20 mg/L. Excess fluoride ions in drinking water occur in several regions of Tunisia, particularly in the south, close to the Gafsa phosphate mining, where fluoride concentration can reach 3.5 mg/L. At larger levels, fluoride induce a risk of dental fluorosis and progressively higher concentrations lead to several degradation of teeth and bones, together with ossification of tendons and ligaments. For these reasons, according to the World Health Organisation, the highest accepted fluoride concentration in drinking water must be below 1.5 mg/L. Fluoride can be removed from water by electrocoagulation with aluminium electrodes in a discontinuous system. The effects of hydrogencarbonate and calcium ions, often present in liquid waste and ground water, on the electrocoagulation process have been investigated.

The study has been occurred in synthetic water prepared by dissolving sodium fluoride in distillate water to have 10 mg F/L. Different concentrations of sodium hydrogencarbonate (6 and 15 mM) with or without calcium chloride (3 and 6 mM) are added to the solution. pH was adjusted to 6 by bubbling CO2 in the tank. To have the same concentration of chloride (17.11 mM) in the medium, the concentration of sodium chloride was varied accordingly. Hydrogencarbonate ions inhibit anode by formation of aluminium oxide hydroxide white deposit with lower aluminium dissolution and far less efficient treatment. The presence of calcium inhibit the chloride chemical corrosion at the cathode by formation of calcium carbonate deposit on the cathode area. Therefore, the amount of aluminium in the solution and in the sludge was largely reduced at the end of the treatment, which reduces the aluminium plate cost and the environmental issues induced by disposal of the sludge. In the one hand, hydrogencarbonate ions decrease fluoride removal by co-precipitation because of their reaction with hydroxide ions generated at the cathode. In the other hand, with calcium ions, hydrogencarbonate ions enhance fluoride removal. The most likely mechanism is the adsorption of fluoride on calcium carbonate precipitate at the cathode or released in the solution.

KEYWORDS : Electrocoagulation, fluoride, aluminium electrodes, hydrogencarbonate, calcium

POLYLACTIC ACID (PLA) MEMBRANES FOR AZEOTROPIC MeOH-MTBE MIXTURES SEPARATION BY PERVAPORATION

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Pervaporation is one of the most important membrane processes for the separation of organic / organic mixtures [1]. Among the large numbers of mixtures studied. MeOH / MTBE is one of the most studied.

Poly lactic acid (PLA), a natural source polymer were studied in a polar/non-polar case study. [2]

This work is part of the perspective and the development of processes that are more respectful of the environment. This includes the replacement of expensive processes such as distillation by pervaporation which represents an economical technology for the separation of azeotropic mixtures. PLA dense membranes were produced by solvent evaporation. The membranes have been used, in pervaporation (PV) separation of methanol (MeOH)- methyl tert-butyl ether (MTBE) mixtures. A complete optimization of the process was carried out by evaluating these membranes. the results show that the membrane of the acidic polylactic gives results successfully in the separation of the mixture MeOH / MTBE (14.3 / 85.7%). it has a permeation for methanol (MeOH) with good selectivity

KEYWORDS : Polylactic acid (PLA), Pervaporation, MeOH-MTBE separation.

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EXERGOECONOMIC AND EXERGOENVIRONMENTAL EVALUATION OF A SOLAR-ENERGY-INTEGRATED VACUUM MEMBRANE DISTILLATION SYSTEM FOR SEAWATER DESALINATION

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ABSTRACT

In this paper, an exergoeconomic and exergoenvironmental analysis of an autonomous solar vacuum membrane distillation (VMD) desalination system was performed in order to evaluate the cost of exergy destruction and the environmental impact of each relevant component of the desalination plant. The analysis permits identification and evaluation of inefficiencies in the plant as well as the determination of the most environmentally friendly process components and opportunities for deign improvements. The results showed that the solar collector has the highest cost rate of exergy destruction because of its low efficiency, and hence, it will be profitable to reduce exergy losses even by increasing the capital cost. Whereas, it would be advantageous to reduce capital costs in the heat exchanger, the membrane module and the condenser since they have a very high exergy performance of about 97%, 92% and 80%, respectively. Moreover, the cost of exergy destruction for the solar VMD plant could be significantly decreased by improving productivity and increasing the heat recovery in the discharges and condensation. Finally, the results revealed that the largest potential for reducing the overall environmental impact of the desalination system is associated with the solar collector, the membrane module, the condenser and the heat exchanger.

KEYWORDS : Seawater desalination; Vacuum membrane distillation; Solar energy ; Exergoeconomics ; exergoenvironmental analysis.

CARACTERISATION HYDROGEOLOGIQUE DES AQUIFERES ET APPORT DE L'OUTIL GEOCHIMIQUE ET ISOTOPIQUE A LA CONNAISSANCE DE L'ORIGINE DE LA SALINISATION ET AGE DES EAUX SOUTERRAINES : CAS DU BASSIN VERSANT DE OUED LABIOD – MASSIF DES AURES (NORD-EST ALGERIEN)

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RESUME

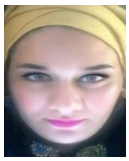
Le bassin versant de Oued de labiod est situé en zone montagneuse (massif des Aurès) a latitude 32N en bordure Nord du Sahara algérienne, cette zone est caractérise par un climat semi a aride avec des précipitation ne dépassant pas 450 mm/an sur la partie amant du bassin versant ou se situe le sommet de Chellia avec une altitude qui dépasse 2000 m le point le plus haut dans le massif des Aurès, alors que le minimum est de l'ordre de 100mm dans la sud. Cela se traduit par une très faible recharge des aquifères aussi bien de recouvrement que profond. Et par la modification et la détérioration de la qualité des eaux d'autant plus marqués que la région connaissant des changements climatiques matérialisés par des périodes de sècheresse plus étendue.

Les aquifères sont constitués de formations calcaires fissurés et de grès. Les ressources en eau souterraine sont souvent exploitées à la limite de leur disponibilité, elles enregistrent des baisses piézométriques considérables et une dégradation de leur qualité par salinisation ou par contamination, du fait d'une part d'une surexploitation pour satisfaire des besoins sans cesse croissants et d'autre part, en raison des changements climatiques notables ces dernières années et marqués par des périodes de sécheresse plus longues.

La composition chimique des eaux souterraines est influencée à la fois par les minéraux des roches évaporitiques et ceux des roches carbonatées. En effet, ces deux types de roches constituent l'essentiel des aquifères exploités dans la région. Le groupe évaporitique est dominant suite à la dissolution du gypse et de l'halite, suivi par le groupe des eaux carbonatées en liaison avec la dissolution des calcaires.

Les analyses isotopiques des eaux souterraines du bassin versant ont concerné le Deutérium(2H), l'Oxygène 18 (18O) et le Tritium (3H). Pour δ2H, les teneurs sont comprises entre -59.07 à -44.83 (‰), pour δ18O, elles varient entre -9.75et -7.38 (‰). La majorité des points d'eau analysés s'alignent sur la droite météorique mondiale, suggérant que l'alimentation des eaux des aquifères, surtout celle du l'Albien, s'effectue rapidement sans évaporation notable. Les résultats du Tritium montrent que les nappes de la partie Nord du bassin reçoivent de l'eau récente, probablement avec un effet de recharge en altitude.

MOTS CLES : Eaux Souterraines, Sécheresse, Minéralisation, Isotopes, Aurès.



EXTRACTION OF CERIUM IN AQUEOUS PHASE BY EMULSIFIED LIQUID MEMBRANE

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ABSTRACT

The emulsified liquid membrane extraction technique is used mainly for the recovery of rare ferrous and non-ferrous metals contained in aqueous solutions and for the concentration and selective separation of organic and inorganic pollutants.

The rare earth elements, although little known to the general public, are nevertheless present in a multitude of applications. Cerium is a rare earth element whose commercial applications are very numerous.

The main objective of this work is to develop an emulsified liquid membrane (MLE) system for the recovery and concentration of cerium from dilute aqueous solutions obtained after ore leaching. The prepared emulsions (W / O) are produced using Span 80, as hydrophobic surfactant, and di (2-ethylhexyl) phosphoric acid (D2EHPA), as extractant, in kerosene as diluent. The internal trapping phase is an aqueous solution of nitric acid. obtained show that the extraction of cerium by MLE is influenced by the operating conditions. The concentrations of the surfactant and the extractant are two paramount parameters of this process. The stirring speed plays a major role in the kinetics of extraction. The type of solvent has a significant effect on the extraction of cerium.

KEYWORDS : Extraction; Rare earth ; Cerium; Emulsified Liquid Membrane

SYNTHESIS AND CHARACTERIZATION OF POLYMER INCLUSION MEMBRANE (PIM): EFFECT OF THE CHEMICAL NATURE OF THE PLASTICIZER ON THE NICKEL IONS TRANSFER

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ABSTRACT

In this paper, a plasticizer polymer membrane (PPM) for nickel (II) separation is reported. The membranes were prepared by cellulose triacetate (CTA) as the base polymer, tris(2-butoxyethyl)phosphate (TBEP),2-Nitrophenyloctylether (2NPOE) or 2-Nitrophenylpentylether (NPPE) as plasticizers and di-(2-ethylhexyl)phosphoric acid (D2EHPA) as the carrier. With 0,1 M HNO_3 aqueous solution as the strip solution. The obtained film was characterized by the Fourier Transformed Infrared Spectroscopy FTIR, Scanning Electron Microscopy (SEM), thermo gravimetric analysis (TGA). Measurement of the contact angle gives information about the hydrophobicity and roughness of the membrane. The mechanical properties of the membrane are obtained by the measurement of the tensile strength. The effects of membrane composition such as the plasticizer type and the carrier amount were investigated on the transport of nickel ions. The transport flux and its efficiency depend on the chemical nature of the plasticizer. It can be perceived that the use 2NPPE as plasticizer and 35 % of carrier produce the highest PIM transport of ions. Further more PIM is effective for long-term separation processes.

KEYWORDS : Cellulose Triacetate, NPOE, NPPE, TBEP, D_2EHPA, nickel extraction

EXTRACTION DE PAR LA RESINE LEWATIT TP 214

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RESUME

En vue d'une meilleure gestion des déchets, notre étude vise à étudier l'extraction de l'ion uranyle (II) par la technique d'extraction Liquide-Solide en utilisant la résine Lewatit TP 214 qui contient un groupe thiourée sur une matrice polystyrène-divinylbenzène. Les conditions optimales d'extraction de l'UO2(II) ont été déterminées par l'étude de l'influence des paramètres : temps d'agitation (0-180mn) avec différentes masses de résine (0,015g, 0,03g, 0,1g), pH (2-6), concentration initiale en ion UO2(II) (10-5-10-3M), ajout de sel (CH3COONa, NaCl) et la température (293-323°K). Les résultats ont démontré l'existence d'une très grande affinité entre la résine et le cation uranyle. La valeur maximale d'absorption d'UO2 (II) était de 19,45 mg/g. Le rendement d'extraction augmente avec l'augmentation du pH de la solution, le meilleur rendement d'extraction de l'uranyle est atteint à pH initial de 3,2 et à température ambiante. L'ajout du sel NaCl influe négativement sur l'extraction tandis que CH3COONa n'influe guère. La cinétique d'extraction de l'uranyle (II) sur la Lewatit TP214 suit le modèle pseudo second ordre. Les résultats trouvés montrent que l'isotherme de Freundlich est adéquate comparée à l'isotherme de Langmuir. Les paramètres thermodynamiques relatifs à la sorption des cations de l'Uranyle (II) sur la résine Lewatit 214 indiquent que le processus est endothermique (ΔH° = + 9,748 KJ.mol-1). En outre, l'étude thermodynamique a également montré que ΔG° est positive, indiquant que le processus de sorption de l'uranyle (II) n'est pas spontané.

MOTS CLES : Extraction Liquide-Solide, Uranyle (II), Lewatit TP214, Paramètres thermodynamiques.

ELIMINATION DU METHYLE VIOLET DANS L'EAU PAR ULTRASONS : EFFET DE LA CONCENTRATION INITIALE ET DE LA PUISSANCE

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RESUME

Les colorants synthétiques représentent aujourd'hui un groupe relativement large de composés chimiques organiques rencontrés dans pratiquement toutes les sphères de notre vie quotidienne. Ce type de colorant et plus particulièrement les colorants azoïques et triphénylméthane ont posé de sérieux problèmes de pollution en provoquant un accroissement de leur persistance dans l'environnement.

La sonochimie est un procédé d'oxydation avancé qui est le résultat de l'action des ondes ultrasonores pour générer des radicaux hydroxyles (●OH), des entités très réactives, non sélectives et dotées d'un pouvoir oxydant très élevé.

Le méthyle violet est un composé organique de la famille des triphénylméthanes, principalement utilisés comme colorants textiles et en peinture. L'élimination du méthyle violet a été réalisée dans un réacteur ultrasonore opérant à une fréquence de 278 kHz. L'effet de puissance électrique et de la concentration initiale en colorant sur la dégradation sonolytique du substrat a été examiné.

MOTS-CLES : Traitement de l'eau ; Ultrasons ; Méthyle violet ; Dégradation ; Effet des conditions opératoires.

CERIUM EXTRACTION WITH NOVEL IONIC LIQUIDS BASED ON H-PHOSPHON ATE ANIONS FROM SULFURIC ACID MEDIUM

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ABSTRACT

A great deal of attention has focused on the development of sustainable technologies to extract, separate and recycle a wide range of high-value and critical metals such as lanthanides and certain actinides. The usual extraction-separation processes based on volatile organic solvents present numerous drawbacks including the environmental toxicity, low extraction efficiencies, poor selectivity and low purity. In addition, they are quite expensive because of the complexity of separation and purification processes [1]. In this context, novel ionic liquids are investigated as an alternative to conventional organic solvents commonly used for the liquid-liquid extraction process.

The removal and recovery of hazardous metals like cerium ions from aqueous matrices is critical importance. In this work, two H-phosphonate anion -based ionic liquids (ILs) denoted Pip1-10-DDP and TEA1-10-DDP were designed and synthesized. The choice of the H-phosphonate anion is justified by its formation via a simple synthetic route, the low cost of precursors, its abundance and non-fluorinated ligating structure. In such a case, it would be possible to control the cation and anion hydrophobicity by varying the nature of atoms constituting the alkyl chain. These green compounds play both the role of the solvent and the extracting agent of the extraction process. A complete optimization of the process has been realized. The results show that the distribution ratio (D) and the extraction Efficiency (%E) of the metal were found to be dependent on the acidity of the aqueous phase, the extraction time, the alkyl chain length in both ionic liquids, the concentration of the aqueous feed and molar quantity of ILs.

A distribution ratio higher than 600 and an extraction yield superior to 98% were obtained. This green process represents an efficient and ecological alternative, the usual separation and recovery techniques for critical metals.

KEYWORDS : Rare Earth, Ionic Liquid, Green Chemistry, Liquid-Liquid Extraction.

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PROPERTIES OF FUEL FROM AGRIFOOD BY-PRODUCTS

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ABSTRACT

Transport is one of the sectors that contribute most to energy consumption and the one that depends upon the use of fossil fuels. The continued burning of fossil fuels generates a significant greenhouse gas emission in the atmosphere. In the last years, the level of greenhouse gasses are increasing in atmosphere; causing global warming. These products still harmful to both the environment and human health.

This study consists of purifying hydrated bioethanol from agrifood by-products using two methods: fractional distillation and molecular sieves of A4 type. Moreover, the characterization of the fuels was carried out using the gasolines incorporated with 10% of biotehanol. The mixtures obtained were characterized in term of the ASTM distillation, density, the vapor Reid tension, Octane number, sulfur content, flash point. It has been found that the addition of bioethanol 10% to super gasoline allowed an improvement of the octane number of the gasoline from 98 to 100 with low sulfur amount 0.0023wt%.

KEYWORDS : Agrifood By-Products, Biofuel, Octane Number, Sulfur Content.

RESPONSE SURFACE METHODOLOGY FOR DYES REMOVAL BY ADSORPTION ONTO ALGINATE CALCIUM

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ABSTRACT

The removal of dyes from solution by adsorption onto alginate calcium beads has been studied. A methodology of surface response was used, this kind of designs estimate the coefficients of a quadratic polynomial mathematical model, whose essential interest is to be able to predict in any point of the experimental region, the values of the response. The effects of initial concentration, pH, adsorbent dose and temperature were investigated. A full factor design was performed to determine the effect of the main parameters and their mutual interaction for the adsorption process. Using the experimental results, a linear mathematical model representing the influence of the different parameters as well as their interactions was obtained; it shows that the temperature is the most significant parameter affecting the dyes removal. The effect various experimental parameters and optimal experimental conditions were ascertained by response surface methodology using Doehlert model.

KEYWORDS : Dyes, Adsorption, Alginate, Response Surface Methodology, Doehlert.

EXERGETIC ANALYSIS OF MULTI-EFFECT DISTILLATION WITH THERMAL VAPOR COMPRESSION (MED-TVC) SYSTEM

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ABSTRACT

In this study, an exergy analysis of a multi-effect distillation with thermal Vapor compression (MED-TVC) system was performed to clear main sources of exergy destruction. Second law efficiency and exergy losses of all main components in the desalination system were calculated based on present data. In addition, a parametric study was carried out to reveal the effect of different design and operating parameters such as the top-brine temperature, the number of effects, the entrainment ratio and the ambient temperature on the system performance. The exergy efficiency of the overall system is found to be 6.65%. Moreover, the analysis showed that thermo-compressor and the effects are the main sources of exergy destruction in the MED-TVC system. On the other hand, the first effect of this unit was found to be responsible for about 29.3% of the total effects exergy destruction.

KEYWORDS : Desalination, Multi-effect Distillation, Thermal Vapor Compression**,** Exergy analysis.

EXPERIMENTAL STUDY OF AN AIR GAP MEMBRANE DISTILLATION DESALINATION SYSTEM

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ABSTRACT

Membrane distillation (MD) is an emerging technology for desalination that separates liquids and solutes using a hydrophobic microporous membrane. Different configurations of MD process have been investigated at lab and pilot scale, among which air gap membrane distillation (AGMD). The paper deals with experimental investigations of the performance of an air gap membrane distillation performance for aqueous NaCl solution along with seawater. In order to enhance the performance of the AGMD desalination process, the effect of different operating parameters including feed temperature, coolant temperature and feed and coolant flow rates on the AGMD performance has been studied. Experimental results displayed that AGMD process could produce distillate water with a maximum permeate flux of 8,875 $kg.m^{-2}.h^{-1}$ achieved at a feed temperature of 90°C.

KEYWORDS : Desalination, Air gap membrane distillation, hydrophobic membrane, Experiment.

SYNTHESIS AND CHARACTERIZATION OF SODIUM ALGINATE/PVA/GRAPHENE OXIDE NANOCOMPOSITE MEMBRANE CROSSLINKED WITH CHLORIDE CALCIUM AND GLUTARDIALDEHYD

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ABSTRACT

Polymeric membranes composed of sodium alginate NaAlg and polyvinyl alcohol (NaAlg-PVA) were prepared using a casting solution technique. The association of incorporation method of graphene oxide (GO) at three different concentrations into (NaAlg-PVA) matrix with the use of multivalent cations crosslinker (Ca2+) put forward to synthesize novel nanocomposite membrane.

Four membrane solutions with different polymer concentration of Na-alginate were used to prepare the nanocomposite membranes. This study aimed to investigate the effects of polymer concentrations and membrane surface.

The obtained data shows that the permeability coefficient and flux decreased with increasing polymer concentration and the rejection of Bovine serum albumin (BSA) which rich 80 % increase with decreasing polymer concentration.

The results revealed that the GO sheets interlayer distance increased after assembling with Na-Alg-PVA. Ionic crosslinking significantly enhanced thermal and mechanical properties of NaAlg-PVA/GO nanocomposite membrane. In particular, Ca2+ led to NaAlg-PVA/GO nanocomposite membrane.

The resulting membranes were characterized by Fourier transform Infrared spectroscopy (FTIR), spectroscopy-ray diffraction (XRD), Scanning electron microscopy (SEM), Pores size, thickness etc.

KEYWORDS : Sodium alginate (NaAlg),Polyvinylalcohol (PVA),Graphenoxide (GO),Chloride calcium (CaCl2) and Glutardialdehyd (GA).

REMOVAL OF LANTHANUM (III) FROM AQUEOUS SOLUTIONS BY POLY(SODIUM 4-STYRENESULFONATE)

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ABSTRACT

The increased use of rare earth elements in variety commercial applications has led to the release of these elements into the environment. These rare earth elements have adverse effects on aquatic and terrestrial organisms as well as on humans.

Polyelectrolyte assisted ultrafiltration (PAUF) has been shown to be promising for removal of lanthanum. The principle of this process is based on the coupling of a complexation of lanthanide ions by a polyelectrolyte and a membrane.

In this work, particular attention has been given to the retention of Ln (III) in the presence of sodium poly (4-styrenesulfonate) (PSS) using a regenerated cellulose membrane with molecular weight cut-off of 10 kDa.

Several parameters have been optimized, such as transmembrane pressure, PSS concentration and pH solution to improve La (III) ions retention and permeation flux. Experimental results indicates that the retention of lanthanum ions increases respectively with applied pressure and polyelectrolyte concentration. A better retention was observed at 10^{-4} mol.L^{-1} PSS concentration and 2.5 bar transmembrane pressure. The study of pH effect on lanthanum ions revealed a maximum retention around 90% at pH 6.

KEYWORDS : Lanthanum(III), poly (4-styrenesulfonate de sodium) (PSS), Removal, Polyelectrolyte assisted ultrafiltration.

EVALUATION OF TRIAZOLE PESTICIDES IN SURFACE WATER FROM MADJERDA RIVER TUNISIA

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ABSTRACT

Water is an essential element of daily life for each and every one of us and a vital source of wealth. The Medjerda River is the most important river and the largest water resource in Tunisia. It is used for potable water supply and agriculture as well as an important aquatic life place. The objective of this work is to investigate the distribution of fifteen Triazole pesticides in water samples collected from Madjerda River. Extraction of water samples was performed by liquid-liquid extraction in tube with ethyl ether. Gas chromatography coupled to masse spectrum (GC-MS) was used to perform qualitative and quantitative determinations. The average concentrations of Triazole were 1.47 and 24.27 ngL-1. For Triticonazole the concentrations range between 0.05 and 6.80 ngL-1. The predominant Triazole pesticides in the surface water were tebuconazole (0.19-8.04 ngL-1) and fluquinconazole (0.97-6.96 ngL-1). Results shows that levels of Triazole pesticides obtained in this study pose no threat to human and aquatic living species. These concentrations are generally similar to the back ground levels from the Mediterranean Sea.

KEYWORDS : Triazole Pesticides, Distribution, Water, Madjerda River, GC-MS.

PHOTO-REDUCTION OF Cr (VI) IONS ONTO ALGERIAN CLAY / Fe_2O_3 CATALYSTS

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ABSTRACT

Natural Illite-Montmorillonite (IM) clay from Algeria was used in order to prepare heterogeneous catalyst containing semiconductor (Hematite Fe2O3) for the photo-reduction Cr(VI) ions. The preparation was made by clay impregnation with Fe2O3 by known nitrate method. The IM clay and heterogeneous catalysts were characterized by various techniques: X-Ray diffraction, Scanning Electronic and Energy dispersive spectroscopy. The BET analysis gives specific surfaces of about 92 and 150 m2.g-1 for IM clay and IM/Fe2O3 respectively. The photo-reduction of Cr(VI) ions on Hematite Fe2O3 catalyst was study. The physical parameters as initial concentration of Cr(VI) ions, temperature, catalyst dose an pH solution were also studied. A photo-reduction rate of 82% was obtained in our experiments using IM clay/Fe2O3 and in optimum conditions: initial Cr(VI) ions concentration: 50mg.L-1; temperature: 25°C; catalyst dose: 1 mg.mL-1 and pH solution: 2. The results of the kinetic study show that equilibrium is achieved after 3 h and it obeys to a first kinetic order rationalized by Langmuir-Hinshelwood Model with an apparent constant of 0.006 min-1.

KEYWORDS : Illite-Montmorillonite; clay; hematite Fe_2O_3; chrome (VI); adsorption; photo reduction

ADSORPTION OF BASIC YELLOW 28 DYE ONTO PLASTIC WASTES FROM AQUEOUS SOLUTIONS

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ABSTRACT

The removal of Basic Yellow 28 (BY28) from aqueous solutions by plastic wastes PMMA was investigated. The characteristics of plastic wastes PMMA were determined by SEM, FTIR and chemical composition analysis (CHNOS). The effects of solution *pH*, initial Basic Yellow 28 (BY28) concentration *C*, solid/liquid ratio *R* and temperature *T* were studied in batch experiments. The Freundlich and the Langmuir models have been applied and the adsorption and it was found that the equilibrium followed well Langmuir adsorption isotherm. A comparison of kinetic models applied to the adsorption of BY28 on the PMMA was evaluated for the pseudo first-order and the pseudo second-order kinetic models. It seems that these models were found to correlate the experimental data. Intra particle diffusion model was also used. The thermodynamic parameters namely the enthalpy ΔH°, entropy ΔS° and free energy ΔG° of adsorption of BY28 on PMMA were determined. As result the negative values of Gibbs free energy ΔG° indicated the spontaneity of the adsorption of BY28 by PMMA. The negative values of ΔH° revealed the exothermic nature of the process and the negative values of ΔS° suggest the stability of BY28 on the surface of SW PMMA.

KEYWORDS : Removal; Waste PMMA; BY28 dye; Equilibrium; kinetic study; thermodynamic study.

ADSORPTION OF Ni^{2+} IONS ONTO NEWSPAPER ADSORBENT FROM AQUEOUS SOLUTION

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ABSTRACT

Our work consists in valorizing wastepaper of newspaper in the setting of the water treatment that constitutes of paper of newspaper to throw in the nature. The retraining and the means to follow for valorize this garbage of way to save resources of wood.

We achieved experiences of Nickel adsorption on the paper of newspaper used after washing with water distilled for the homogeneity of our adsorbent and the elimination of the anchor. These experiences showed that pH, temperature and initial concentration of Ni^{2+} are important parameters in the metallic ion fixing on the surface of the adsorbent.

For the survey of output of Nickel adsorption on the paper of newspaper we noted that it increases according to the report. The survey of the effect of the temperature as thermodynamic parameter has showed that for increasing variation of 10 until 60 °C a considerable increase of the capacity and output of the adsorption of Ni^{2+} (7 mg/g). Otherwise, we note that the time of balance is about 3 h for the survey of the adsorption kinetics.

KEYWORDS: Removal; newspaper; Nickel; adsorption; kinetic study; thermodynamic study.

SYNTHESIS AND CHARACTERIZATION OF CONDUCTING POLYANILINE COMPOSITE CONTAINING SEAWEED ALGAE POWDER

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ABSTRACT

Algae type (ECL), has been used as reinforcement to synthesize a composite with polyaniline. The Polyaniline-ECL composite powder has been synthesized through oxidative polymerization of aniline with ammonium peroxide sulfate used as an oxidant in aqueous medium. Diverse amounts of ECL powder (5 and 10%wt) were used to study the influence on the characteristics of the synthesized materials. All samples were characterized by FTIR and XRD techniques. FTIR spectra have confirmed the presence of poly (aniline) in the form of conducting Emeraldine salt and suggest significant interaction of poly (aniline) with algae. XRD results exposed that the crystallinity of PANI was more noticeable after adding ECL powder. The electrical conductivity was measured using a four-probe method and it was found to be equal to 0.02 S/cm.

KEYWORDS : Polyaniline; ECL ; Composite; Conductivity; characterization.

BORON REMOVAL BY ADSORPTION INTO MODIFIED ACTIVATED CARBON

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ABSTRACT

The comparison of performances of three materials based on carbon, industrial activated carbon, oxidized activated carbon and activated carbon modified by D-mannitol, for boron removal from aqueous solution was achieved. For that, the materials were at first characterized by the determination of N2 adsorption–desorption measurements, X-ray diffraction, infrared and Raman spectroscopies, thermal analysis (TGA-DTA), “Boehm” titration and pH of the point zero charge. The tests of adsorption show that oxidized activated carbon modified by D-mannitol exhibits the highest boron adsorption compared with the industrial and the oxidized activated carbon. The surface chemistry particularly rich in carboxylic groups for the prepared carbon was responsible for the high boron adsorption. Based on the results of this study Langmuir is the best isotherm model describing adsorption of boron onto carbon-based materials, as it gave the maximum R2 value.

KEYWORDS : Activated carbon, oxidation, D-mannitol, boron, adsorption.

SONOCHEMICAL DEGRADATION OF BRIGHT RED SOLAR IN AQUEOUS SOLUTION

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ABSTRACT

Although water purification technologies have made significant progress, they still encounter certain molecules that are difficult to be degraded such as pesticides, dyes and other industrial or agricultural residues. These compounds are called refractory or recalcitrant. Synthetic dyes are widely used in various fields, are carcinogenic and very toxic especially to aquatic life.

Recently, advanced oxidation processes (AOPs) have become effective technologies for the degradation of refractory organic pollutants in textile effluents. These processes are based on the insitu production and use of highly reactive radicals, which react with organics with high reaction rates.

A new way of generating HO° radicals is the application of ultrasound in which important chemical effects can be observed. Application of ultrasound to aqueous solutions induces the formation of vapor and gaz-filled microbubbles that grow, undergo a series compression-expansion cycles and then adiabatically collapse causing temperatures of about 5000K and pressures in excess of 1000 atm therein.

In this work, the sonochemical degradation at a power of 60 W of the BRS dye in water was investigated. It has shown that ultrasound irradiation can be efficiently used to remove BRS from water. Changes in the UV-visible spectrumof the dye during sonolysis were analyzed and discussed.
The effect of the initial substrate concentration on dye removal was examined.

KEYWORDS : Sonochemistry, Bright Red Solar, degradation, hydroxyl radicals (HO°).

DEVELOPMENT AND STABILITY OF GELATIN CROSS-LINKED MEMBRANES FOR IRON REMOVAL USING POLYACRYLIC ACID ASSISTED ULTRAFILTRATION

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ABSTRACT

Iron removal from aqueous solution by polyelectrolyte enhanced ultrafiltration (PEUF) process was investigated. This technique combines a membrane filtration process (ultratfiltration) and a cation–polyectrolyte complexation technique. PEUF is shown to be an efficient technology for the removal of heavy metals from liquid effluents even at low concentrations. In this proposal, the removal of Iron from aqueous solutionsby PEUF process was investigated. The poly(acrylic acid) (PAA) was used as complexing agent. The ultrafiltration experiments were performed using a Frontal cell system equipped with a Gelatin membranes obtained from Pickering emulsions stabilized by h-BNNS. To improve the retention of the heavy metal ions, the effect of some operating parameters and solution characteristics were studied.

In the absence of PAA, rejection of free metal ions Fe (II) is low and they do not exceed 14%. The permeate flux increases with transmembrane pressure and decreases with the increase of polyelectrolyte concentrations. Insignificant polarization concentration phenomenon was observed. A best retention was observed at 1000ppm of PAA concentration and 3 bar transmembrane pressure. The pH effect on the Fe recovery revealed a maximum retention around 97%for pH 5 which favors the formation of macromolecular polymer–metal complexes, and subsequently an increase in metal rejection coefficients.

This new strategy opens a new route for the development of porous membranes with controllable pore size from hydrophilic polymers for filtration applications.

KEYWORDS : Iron, polyelectrolyte enhanced ultrafiltration, poly(acrylic acid), Gelatin, Pickering emulsions, h-BNNS.

POROUS GELATIN MEMBRANE OBTAINED FROM PICKERING EMULSIONS

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ABSTRACT

Polymer-based membranes play an important role in water filtration, in particular in the removal of particles, microorganisms and organic pollutants. Developing a reliable fabrication method for membranes presenting both high flux and good selectivity remains challenging. Gelatin is a biodegradable biopolymer obtained by the partial hydrolysis of collagen. A biopolymer such as gelatin is capable of adsorbing at an oil/water interface, resulting in decreased interfacial energy. Hence, gelatin is widely employed as an alternate for synthetic surfactants to stabilize emulsions in the food industry. In addition, as gelatin is highly water soluble, cross-linking reaction is needed but it affects the porous morphology.

A new strategy using mainly water as a solvent to produce porous membranes based on Gelatin has been developed using emulsion templating involving hexagonal boron nitride nano sheets (h-BNNS) as a stabilizer. Filtration tests were conducted on the membranes and the permeability results proved that the membranes fabricated by a Pickering emulsion are promising materials.

KEYWORDS : Gelatin, biopolymer, emulsions, cross-linking, hexagonal boron nitride nano sheets (h-BNNS)

EFFECT OF SUPPORT PORE SIZE AND MONOMER TYPE ON THE PERFORMANCE OF THIN-FILM COMPOSITE MEMBRANES FOR NANOFILTRATION

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ABSTRACT

Polyamide thin-film composite nanoflitration (TFC-NF) membranes were prepared by interfacial polymerization (IP) technique using cellulose acetate (CA) membranes as supports. In this work, the effect of cellulose acetate concentration (15-21 wt.%) on the pore size of the membrane supports was investigated. In the second part of this work, the effect of monomer type in polymerization was evaluated using the M-phenlenediamine (MPD), Piperazidine (PIP) and 1,3- Cyclohexannebis (methylamine) (CHMA) as monomers in water and the trimesoly chloride (TMC) were used as a monomer in hexane solution.

The membranes surface was characterized using the scanning electron microscopy (SEM), Fourier transform infrared (FTIR), contact angle (CAw), porosity and water content. The membranes performances were checked by water permeability and salts rejection (NaCl, Na_2SO_4).

KEYWORDS : Polyamide NF membrane, interfacial performances, cellulose acetate, support pore size, monomer type

PREPARATION OF POLYAMIDE COMPOSITE NANOFILTRATION MEMBRANE BY INTERFACIAL POLYMERIZATION WITH CYCLOHEXANE-1,3,5- TRICARBONYL CHLORIDE (HTC)

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ABSTRACT

A novel nanofiltration polyamide thin-film composite (NF-TFC) membrane was prepared by the interfacial polymerization technique of M-phenylenediamine and Cyclohexane-1,3,5-tricarbonyl chloride (HTC) on the Cellulose acetate (CA) supporting membrane. The active top surface of the membrane was characterized using FT-IR, SEM, contact angle and porosity. The performance of TFC membrane was optimized by studying the preparation parameter as concentration of monomers. The membrane performance was characterized in terms of permeate flux, and salt rejections. The pure water decreased from 29.54 to 9.87 L.h-1m-2.bar-1 it's depending on the HTC concentration.

The rejection of NaCl and Na_2SO_4 were varied from 0 to 50.19% and from 0 to 89.12% respectively where HTC concentration is between 0 to 2% (w/v). The antifouling performance was evaluated by humic acid. The thin film composite was used in the elimination of heavy metals as Cd^{2+}, pd^{2+}, Cu^{2+}, Ni^{2+}.

The heavy metals rejection is depending on experimental condition for attained the maximum rejection for

KEYWORDS : Polyamide NF membrane; preparation; characterization; interfacial polymerization, heavy metal.

SYNTHESIS AND CHARACTERIZATION OF MICROFILTRATION CERAMIC MEMBRANE

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ABSTRACT

Separation processes are widely used in industry since the chemical conversions are often incomplete. Membranes technique is one of the most attractive separation methods because of its low cost and high selectivity. Ceramic membranes have advantages in comparison with polymeric membranes. The chemical, mechanical and thermal stability of ceramic membranes are favorable compared to those of organic ones. These properties make ceramic membranes interesting candidates for separation [1-3]. Ceramic membranes normally have with an asymmetrical structure with porous support active membrane layer. The macro porous support ensures the mechanical resistance while the active layer functions separation ranging from MF, UF and even Nano-Filtration (NF). Several methods can be used to prepare porous supports from inorganic materials; the choice of method depends on the desired material and pore size. In this study, two different fabrication methods, dry-pressing and extrusion were used to produce porous flat and tubular ceramics supports using native raw materials.

Macro porous supports for membranes were prepared from natural materials. The characterization of the raw material and the effect of the sintering temperature on the morphology, pores size distribution and the mechanical properties of supports were studied. The membrane layer was prepared from calcium silicate (CaSiO3), using slip casting technique. The specimens were subsequently sintered at 1150°C. The microstructure and porosity as well as the permeability have been also studied.

KEYWORDS : Supports; Membrane; Microfiltration; Calcium silicate

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REDUCED GRAPHENE OXIDE INCORPORATED THIN FILM NANOCOMPOSITE (TFC) REVERSE OSMOSIS (RO) MEMBRANE FOR DESALINATION AND WATER PURIFICATION

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ABSTRACT

The main objective of the present study is to synthesize new based carbon material TFC/reduced graphene oxide (rGO) thin film nanocomposite membranes, suitable for operation in either reverse osmosis (RO) mode, using interfacial polymerization (IP) technique from mixed solutions, m-phenylenediamine (MPD) and 1,3,5-benzenetricarbonyl chloride (TMC) on the top surface of polysulfone (PS) membrane. Subsequently, during membrane fabrication, commercial reduced graphene oxide (rGO) was added into MPD aqueous solutions at different compositions ranging from 0 to 0.8 wt%. Incorporation of rGO in TFC membranes was confirmed by membrane morphology and surface properties such as FT-IR,SEM, contact angle analyzer, zeta potentiel (surface charge), young modulus (mechanical resistance), in addition to the pure water permeability.

The effect of addition of rGO on the membrane performance for desalination and treatment process of a synthetic solution of brakish water (2 g/L), in BSA (Bovine Serum Albumin) protein (200 mg/L) and a real raw textile wastewater, is proposed. The membrane efficiency were evaluated based on water permeability, salt rejection and fouling resistance.

Compared with the control TFC membrane, rGO-incorporated TFC membranes exhibit higher and improved water flux and reasonable solute rejection in the majority of studied parameters, better mechanical stability and lower fouling resistances of the membrane.

In terms of BSA rejection, experimental results showed a maximum increasing removal of 61.85% at an optimum composition of rGO equal to 0.08%. Fouling study was reversible for all studied compositions of rGO.

Concerning salt rejection for brakish water treatment, rGO nanocomposite membranes showed a maximum salt removal efficiency (17%) at a concentration of rGO equal to 0.04%.

Concerning real textile wastewater treatment, rGO was very efficient to enhance the removal of turbidity (almost 100% for a composition of 0.08%). For all used compositions of rGO, turbidy removal overpassed 95%. In terms of COD and TOC removals, 97-99% were obtained for all studied compositions of rGO. Similar results were observed in color removal (almost 100%).

As for conductivity rejection, for different compositions of rGO, the rejection varied between 24 and 37%. Major ions rejection show that for rGO membranes, major cations and anions reached important rejection percentages (60% Mg2+, 73% Ca^{2+}, 58% , 100% , 100% Br-). It seems that the synthesised membranes are “tight” nanofiltration membranes or “loose” reverse osmosis membranes.

As a result, rGO was very efficient for reverse osmosis membrane application in terms of permeability, turbidity, color, COD, TOC and major ions. However, TFC membrane without rGO resulted in better rejections, meanwhile TFC membrane with embedded rGO showed higher fluxes. Conspicuously, the ease of synthesis and the exceptional permeability and anti-fouling performance render that the low-dimensional carbon nanomaterial modification is an attractive way of designing future reverse osmosis membranes in both conventional fields and new emerging areas. Overall, this study suggests that rGO modification of membrane supports could be a promising technique to improve the performances of TFC-RO membranes.

KEYWORDS : reduced graphene oxide, interfacial polymerisation, reverse osmosis membrane, brakish water, Bovine Serum Albumin protein, real textile wastewater.

WATER TREATMENT BY COMBINED ACTION OF HETEROGENEOUS PHOTOCATALYSIS AND ADSORPTION

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ABSTRACT

The aim of this work is to reduce the impact of basic dyes such as methylene blue (MB) by a natural Tunisian clay by combined action of photocatalysis and adsorption TiO_2- clay containing composites

In order to recover the halloysite rich clay of Tamra mine in Tunisia and to achieve maximum discoloration with minimal cost, we have developed a method that takes into account the cost factor and product performance in discolouration of MB dye solution. In fact, we combined the two processes (Photocatalysis and clay adsorption). Preliminary studies have been done. These tests allowed us to set up the experimental protocol used, which consisted of adsorbing for about 60 minutes in the shade and then to make the solution fold under the UV light to ensure photodegradation. Tests of physical and chemical characterizations by different techniques, such as X-ray diffraction (XRD), X-ray fluorescence (XRF) and scanning electron microscopy (SEM) were performed: XRD patterns of raw clay showed halloysite as main phase (61%), with lower contents of kaolinite (39%). These raw clays presented relatively high quantities of SiO_2 (43.60%) and Al_2O_3 (39.20%) and relatively low contents of Na_2O and K_2O.

The experimental data of MB adsorption studies were mathematically fitted using Langmuir and Freundlich adsorption models. Indeed, the adsorption isotherms of methylene blue on the halloysite clay are described satisfactory by the Langmuir model. The combined effect of the phenomenon of adsorption and photocatalysis for MB resulted in very satisfactory performances (83% for Ti80), even for mixtures containing a relatively low TiO_2 catalyst. The results showed also, that optimal pH for the discoloration of BM solutions was found 3.0. At pH acidic (pH = 3) the decolouration efficiency for MB is reached the 98% for Ti80.

KEYWORDS : Tunisian clay, Titania, MB decolouring, Adsorption, Photocatalysis

EFFECT OF Ce^{4+} AND Eu^{3+} DOPED TiO_2 THIN FILMS COATED SILICON WAFERS ON AMIDO BLACK 10B PHOTODEGRADATION

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ABSTRACT

The present study reports on the structural properties and photocatalytic efficiency of Cerium and Europium-doped Titanium dioxide thin films (Ce and Eu-TiO_2) synthesized by sol gel spin-coating method coated on silicon wafers. Thin films have been prepared with different atomic weight percentage of Ce and Eu and annealed at 500°C. The structural and morphological properties of the layers were characterized by Scanning Electron Microscopy (SEM) –Energie Dispersive X-Ray Analysis (EDX), X-ray diffraction (XRD) and RAMAN spectroscopy analysis. The results show that pure TiO_2, Ce-TiO_2 and Eu-TiO_2 thin films exhibit (101) XRD peak corresponding to the anatase phase of TiO_2. The latter is consistent with the recorded Raman signal observed at 146 cm^{-1} (Eg mode) and 397 cm^{-1} (B1g mode), respectively. The morphology and surface structure of the films were studied by SEM, which reveals a nanoporous structure with certain degree of agglomeration. The phocatalytic activity of prepared doped TiO_2 was tested on the degradation of pollutant type (Amido Black 10B (AB)) under UV-C irradiation. The optimal Ce and Eu doping ions content and pH value for the AB degradation were 1% and 0.1% for Ce and Eu respectively, under acidic conditions (pH= 3.5). Under optimal conditions, the photodegradation efficiency of pure TiO_2 thin films was observed to be 93.2% after 3h of irradiation and could be fitted to apparent first-order kinetics. The results demonstrated that 1% Ce and 0.1% Eu – doped TiO_2 samples revealed higher activity than pure TiO2films.However Eu–TiO_2 catalyst showed the best photocatalytic performance than Ce- TiO2 for AB degradation under UV-C light, to reach 99.6% compared to 96.8% using Ce-TiO_2 catalyst after 3h of illumination

Besides, the apparent reaction rates of AB photodegradation showed a significant increase from 0.014min^{-1} for pure TiO_2 to 0.029min^{-1} for Eu (0.1Wt.%) compared to 0.019min^{-1} for Ce (1Wt.%).

KEYWORDS : TiO_2 ; Cerium ; Europium ; sol gel ; spin coating ; silicon ; photodegradation ; Amido Black.

SPECTROPHOTOMETRIC STUDY OF THE INTERACTION OF DYE WITH MONOLACUNARY POLYOXOMETALATES

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ABSTRACT

In the present work, the interaction between methylene blue and toluidine blue, cationic phenothiazine dyes, and the lacunary polyoxometalates PW11 were investigated spectrophotometrically. The obtained results reveal that metachromatic reaction was built for each dye and PW11 polyoxometalates. The large hypsochromic shift 77 nm for MB and 73 nm for TB were attributed to the formation of dye H-aggregates. The stability of the PW11-MB and the PW11-TB complexes were studied as a function of PW11, NaCl and surfactant concentrations as well as the pH of the solution and the temperature.

KEYWORDS : Polyoxometalates, Toluidine blue, Methylene blue, UV–visible spectroscopy.

SYNTHESIS OF NEW HYBRID MEMBRANES BASED ON CELLULOSE ACETATE: PREPARATION, CHARACTERIZATION AND APPLICATION TO HUMIC ACID RETENTION

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ABSTRACT

Ultrafiltration (UF) membranes have been extensively used for industrial process and generally for scientific research. In fact, they have largely applied in the elimination of various pollutants. The aim of this study is the modification of polymeric membranes in order to create a new membrane with enhanced retention and permeability. In this context, the hybrid membranes were prepared by the phase inversion method by dispersing PW11Fe in the CA casting solutions. Thereby, the impact of the added PW11Fe on the morphology and the stability of the hybrid CA/PW11Fe membranes were investigated by different methods such as thermal gravimetric analysis (TGA), scanning electron microscopy (SEM) and FTIR spectroscopy. The prepared ultrafiltration membranes exhibit high retention of humic acid.

KEYWORDS : Cellulose acetate (CA) ; PW11Fe polyoxometalate; hybrid membrane; phase inversion; Humic Acid removal.

WATER QUALITY INDEX FOR IRRIGATION PURPOSE CASE OF CHEFFIA DAM NE ALGERIA-

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ABSTRACT

The quality of water is in deterioration which makes us in need of continuous assessment of the water quality, one of the tools is water quality index which is a single number that summarize a whole quantity of complicated data. The purpose of the present study is to evaluate the quality of CHEFFIA Dam waters in El TAREF (ALGERIA) to assess their suitability for irrigation purposes. During nineteen (19) years, twelve (12) physicochemical parameters were assessed. The chosen method of calculation was meireles irrigation water quality index which is applied and modified. The final results showed that the waters are suitable for irrigation purposes.

KEYWORDS : CHAFFIA dam, irrigation, assessment, water quality index. Meireles irrigation water quality index.

APPLICATION OF MULTIVARIATE STATISTICAL ANALYSIS IN THE ASSESSMENT OF SURFACE WATER QUALITY IN AIN DALIA LAKE, ALGERIA

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ABSTRACT

Multivariate statistical methods are successfully used in many areas. Multivariate analysis was performed to decrease the number of parameters and sampling points for monitoring water quality in the Ain Dalia Dam. For this purpose, principal components and water quality index (WQI) techniques were used. Eleven water quality parameters were extracted during 06 years (2010–2015) and evaluated. The dataset was divided into periods low and high water to evaluate the effects of seasonal changes on the parameters. According to the results of Principal Component Analysis, three different groups of similarity between the sampling sites reflecting the different physicochemical characteristics and pollution levels of the studied water systems. Six latent factors were identified as responsible for the data structure explaining 79.513% of the total variance of the dataset and are conditionally named organic, nutrient, physicochemical. The WQI values ranged from 11.49 to 170.99 it reflected that the water samples were in the range of excellent quality to unsuitable for drinking rang.

KEYWORDS : Ain Dalia Lake ; Multivariate data analysis ; Quality of water ; Pollution ; WQI.

APPLICATION OF MULTIVARIATE ANALYSIS FOR SPRING WATER QUALITY ASSESSMENT OF THE MUNICIPALITY OF SERAIDI- NORTH EAST OF ALGERIA

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ABSTRACT

Spring water quality assessment of Seraidi area is determined using multivariate statistics with the aim of determining their suitability for drinking and irrigation. Chemical indices like percentage of sodium (Na%), sodium adsorption ratio (SAR), and permeability index (PI) indicate that the spring water in the study area are suitable for irrigation. Principal Component Analysis was also used as a complementary tool to help organize and interpret the chemical analysis. The interpretation of the analysis in principal components highlighted the scenario of the pollution of spring water of Study area by two types of pollution: an organic pollution resulting from the decomposition of the organic matter, pollution of geological type following the dissolution of the rock. Keeping in mind increasing urbanization and the pollution caused by urban waste, necessary measures should be taken to reduce the future costs of contamination from entering groundwater.

KEYWORDS : Seraidi · Principal Component Analysis (PCA) · Drinking water · Irrigation

REMOVAL OF EMERGING PHARMACEUTICAL POLLUTANTS BY ADSORPTION

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ABSTRACT

Each year, thousands of tons of pharmaceutical compounds are used in human and veterinary medicine to treat symptoms, diseases and infections. These molecules detected in ground and drinking water have a harmful effect on human health and environment. Thereby, they are considered as emerging pollutants. To face this worrying situation, many works are oriented for the elimination of these emerging pharmaceutical pollutants by several processes. In this context we will focus on the study of the elimination of this type of organic pollutants in water by adsorption using a low-cost bio-adsorbent from food waste, pomegranate peels. Structural and physicochemical characterizations of the prepared bio-adsorbent were carried out by different analytical techniques such as: IR spectroscopy, Zeta potential, Boehm titration, SEM… The adsorption study of the emerging pharmaceutical pollutant was initiated by a preliminary optimization of the experimental parameters (stirring speed, mass ratio of bio adsorbent / volume, pH effect ….) in order to determine the optimal conditions of adsorption. The isotherms, kinetics and thermodynamics studies were also investigated. This study has led to yielded encouraging results to eliminate this type of pollutants. The results of the present study clearly reveal that prepared adsorbent can be used beneficially in treating wastewater containing emerging pharmaceutical pollutants.

KEYWORDS : Adsorption, Emerging pharmaceutical pollutants, Pomegranate peels.

LOW COST BIOSORBENTS FROM FORESTRY WASTES FOR HEAVY METALS REMOVAL FROM WASTE WATER : ADSORPTION/DESORPTION STUDIES.

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ABSTRACT

Pine waste materials, e.g. cones and leaves, were used as an efficient and low cost adsorbent for copper (Cu) and chromium (Cr) from aqueous effluents. Adsorbent materials were characterized by Scanning Electron Microscope (SEM) combined with Energy Dispersive X-ray (EDX) spectroscopy, Fourier Transform Infra-red Spectroscopy (FTIR) and Brunauer-Emmett-Teller (BET) analysis. Adsorption tests determined the effect of pH, initial concentration, contact time, adsorbent dose and temperature in the adsorption of Cr and Cu in pine cones and leaves. The adsorption process was described by Langmuir model for both metals. Maximum biosorption capacities obtained with Langmuir model were 28.65 mg·g-1 for Cu and 79.37 mg g-1 for Cr. By modeling the kinetic data, it was found that the adsorption of copper and chromium followed the pseudo second order. The desorption of Cr and Cu with nitric acid 0.1 molL-1 permitted the recovery of the metals and the reuse of the adsorbent material. Thermodynamic study showed a spontaneous endothermic adsorption of Cu on pine cones (PC) and an exothermic adsorption of Cr on pine leaves (PL). It can be concluded that pine waste materials were potentially suitable for copper and chromium recovery from industrial effluents and wastewater.

KEYWORDS : Pine cone, pine leaves, chromium, copper, adsorption FTIR, SEM

OPTIMIZATION OF CHROMIUM REMOVAL BY ELECTRODIALYSIS FROM WATER USING RESPONSE SURFACE METHODOLOGY

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ABSTRACT

During the last decade, good quality of water is available in limited quantities because it has become very loaded with heavy metals such as chromium. So, it has become very imperative to treat Cr loaded from effluents. Among the most recent and promising separation methods are electromembrane separation processes “Electrodialysis” for the removal of these pollutants. The main aim of this work is to study the removal of chromium from water using electrodialysis. All experiments were performed with a laboratory scale electrodialysis cell on an industrial effluent. The response surface methodology was used first of all to determine the limiting current density and subsequently to model and optimize the chromium removal process by electrodialysis. The influence of the flow rate (FR), the pH, the number of compartments (NC) and the percentage of Ilim (%) was studied. The 4 factors studied have a significant effect on the efficiency of the process but the number of compartments has proven to be the most influential factor.

KEYWORDS : Electrodialysis, Chromium removal, Response surface methodology.

LA PHOTODEGRADATION DU BLEU DE METHYLENE PAR UN NOUVEAU PHOTOCATALYSEUR TiO_2/SAPO-34

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RESUME

Nous avons étudié la synthèse des matériaux nanocomposites, TiO_2 / SAPO-34, en utilisant la méthode sol-gel, qui consiste à préparer un mélange entre Zéolite SAPO-34 et le gel de TiO_2 avec la methode hydrothermale, l'introduction de la zéolithe synthétisée ou calcinée ; la cristallisation du mélange SAPO34/TiO_2 par la calcination à 400 ° C pour la formation de la phase anatase. Les caractéristiques structurelles et texturales des matériaux obtenus ont été déterminées par diverses techniques physico-chimiques. Les propriétés photocatalytiques du matériau SAPO-34/TiO_2 ont été testés pour l'élimination du colorant bleu de méthylène (MB).

MOTS CLES : TiO_2, TiO_2/zéolite, sol-gel. bleu de Methylène , Photocatalyse

CELLULOSE ACETATE (CA) ULTRAFILTRATION MEMBRANES MODIFIED BY POLY (ACRYLIC ACID): SYNTHESIS, CHARACTERIZATION AND SEPARATION PERFORMANCE.

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ABSTRACT

A series of cellulose acetate/Poly (acrylic acid) membranes were prepared by phase inversion protocol. Poly (acrylic acid) was used as a sustainable additive to improve selectivity and the antifouling properties of blend membranes. The prepared membranes were investigated in terms of structure, morphology, thermal behavior, hydrophilicity, pure water flux permeation, humic acid (HA) and cadmium rejection as well as the antifouling property. The DSC and FT-IR confirmed the good miscibility between CA and PAA via hydrogen interconnection. In addition, the SEM results showed that the membranes pores morphology was changed by varying the PAA amount. The reduction in water contact angle for the modified membranes reflects the amelioration of hydrophilicity. Moreover, CA/PAA membranes showed good water flux and better rejection for HA and Cd2+ compared to the neat membrane. The improvement of the antifouling property was proved by the increase of the flux recovery ratio (FRR) and the decrease of the total fouling ratio (Rt) by increasing the PAA in the casting solution.

KEYWORDS: ultrafiltration membrane, blend, antifouling, cellulose acetate, humic acid.

MODELLING OF THE LIMITING CURRENT DENSITY OF AN ELECTRODIALYSIS PROCESS BY RESPONSE SURFACE METHODOLOGY

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ABSTRACT

Electrodialysis (ED) is known to be a useful membrane process for desalination, concentration, separation, and purification in many fields. In this process, it is desirable to work at high current density in order to achieve fast desalination with the lowest possible effective membrane area. In practice, however, operating currents are restricted by the occurrence of concentration polarization phenomena. Many studies showed the occurrence of a limiting current density (LCD). The limiting current density in the electrodialysis process is an important parameter which determines the electrical resistance and the current utilization. Therefore, its reliable determination is required for designing an efficient electrodialysis plant.

The purpose of this study is the development of a predictive model of the limiting current density in an electrodialysis process using response surface methodology (RSM). A two-factor central composite design (CCD) of RSM was used to analyze the effect of operation conditions (the initial salt concentration (C) and the linear flow velocity of solution to be treated (u)) on the limiting current density and to establish a regression model. All experiments were carried out on synthetic brackish water solutions using a laboratory scale electrodialysis cell. The limiting current density for each experiment was determined using the Cowan-Brown method. A suitable regression model for predicting LCD within the ranges of variables used was developed based on experimental results. The proposed mathematical quadratic model was simple. Its quality was evaluated by regression analysis and by the Analysis of Variance, popularly known as the ANOVA.

KEYWORDS : electrodialysis; concentration polarization; limiting current density; response surface methodology; central composite design.

REMOVAL OF PHOSPHATES BY DONNAN DIALYSIS COUPLED TO ADSORPTION ONTO COMPOSITE ALGINATE BEADS

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ABSTRACT

The aim of this study is to test the efficiency of removal of phosphate by Donnan dialysis and by adsorption onto alginate calcium/activated charcoal beads separately and then together.

First, many parameters are realized: the choice of the counter-ion, the pH of the solution, the concentration of the counter-ion, the initial concentration of phosphates and the choice of membrane. Donnan dialysis was performed with three anion-exchange membranes AMX, AFN and ACS. Second, the adsorption onto alginate calcium/ activated charcoal beads is better than the adsorption onto alginate calcium beads. Finally, Donnan dialysis coupled to adsorption onto alginate calcium beads for the removal of phosphate was conducted. This combination is original and an effective solution to improve a large amount of phosphate removal

KEYWORDS : Donnan dialysis, Adsorption, Phosphate; Anion-exchange membrane; Alginate, activated charcoal.

SALINE SOIL FROM LAGOON BEN GHIADHA (MAHDIA, TUNISIA) AS A SOURCE OF STRAIN BACTERIAL PRODUCING BIOSURFACTANTS

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ABSTRACT

Biosurfactants are surfactants produced by various groups of microorganisms. They are generally biodegradable, non-toxic and able to solubilize many water micropollutants. In this study Three samples were collected from the sediments of Ben Ghiadha lagoon (Mahdia, Tunisia) (EC = 18.5) in sterile containers and stored at 4 ° C. Then we isolate a total of 16 different types of bacteria producing a biosurfactant. Of these, four are screened by culturing them in CTAB agar plates and their hemolytic activity was tested in blood agar plates. We analyzed four strains for their ability to produce an extracellular biosurfactant by the petroleum spreading technique and finally confirmed by a drop collapse test and a hydrophobicity test through a DNase activity test. The extracellular biosurfactant of the isolated strains were extracted in a conventional manner and were characterized by thin layer chromatography (TLC) and have been shown to be glycolipids (BSC, BSD2 and BSF2) and lipopeptides (BSA, BSB, BSD1and BSG1). The surface tension activities of the extracted biosurfactant were evaluated by the emulsification index (E 24), expressed as a percentage and classified by descending order as follows S12 (18.92) ≤ S1 (18.56) ≤ S6 (18.42) ≤ S8 (18.42) ≤ S9 (18.42) ≤ S7 (16.66) ≤ .S10 (16.66) ≤ S11 (16.66) ≤ S16 (16.66) ≤ S2 (16.21) ≤ S14 (16.2) ≤ S13 (15.79) ≤ S4 (14.86) ≤ S15 (14.28) ≤ S5 (13.89) ≤ S3 (12.16). Finally, the strains isolated by sequencing belong to Staphylococcus (BSF2, BSK, BSL1, BSL2), Strep ococcus (BSA, BSB, BSF1, BSH), Bacillus (BSC, BSD1E, BSG1, BSG2, BSG3, BSI) and Actinobacteria (BSD2).

KEYWORDS : Biosurfactants, thin layer chromatography (TLC), cetyltrimethyl-ammonium bromide (CTAB), hemolysis, emulsification index.

STATISTICAL MODELING AND OPTIMIZATION OF SIMULTANEOUS REJECTION OF PHENOL AND Cr (VI) FROM SYNTHETIC PHENOL - Cr (VI) BINARY WATER SYSTEM BY REVERSE OSMOSIS USING RESPONSE SURFACE METHODOLOGY (RSM)

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ABSTRACT

The current work focuses on the investigation and optimization of simultaneous rejection of phenol and Cr (VI) from synthetically binary water system by a reverse osmosis (RO) polyamide thin film composite membrane, in spiral wound configuration, using response surface methodology approach. A central composite design (CCD) was applied to find the optimum conditions for the simultaneous rejection of phenol and Cr (VI). The input variables were transmembrane pressure, pH of feed solution and recovery rate. The RO performance index, which is defined as the rejection rate of phenol and Cr (VI) has been considered as response. A significant pressure and pH effect on the retention of phenol and Cr (VI), respectively, were obtained. The analysis of variance ANOVA has been employed to test the validity of the regression models. The optimum conditions were: pH of feed solution of 8.5, transmembrane pressure of 11 bar and recovery rate of 50%. Under the optimum value of process parameters, retentions rates of 55.73% for phenol and of 99.94% for Cr (VI) were achieved experimentally. Moreover, simultaneous rejection of phenol and Cr (VI) ions from synthetic binary solution by a reverse osmosis membrane as a function of feed concentration and ionic strength was examined.

KEYWORDS : Phenol, Cr (VI) ions, RO membrane, Simultaneous rejection, Central composite design, Response methodology

OPTIMIZATION OF BATCH AND COLUMN ADSORPTION OF METRONIDAZOLE ON A NOVEL POROUS BIOCHAR - A FULL FACTORIAL DESIGN; EQUILIBRIUM AND KINETIC STUDIES

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ABSTRACT

In this research, Metronidazole (MNZ) removal by a novel biochar was investigated via batch and column process. The novel biochar was first synthesized and its physical and structural characteristics were analyzed using SEM, FTIR and BET techniques. The full factorial design was used for the batch and column process. Batch adsorption experiments were developed in order to determine the equilibrium time and the best isotherm model. Pseudo-second-order kinetic model described the adsorption process. Adsorption isotherm obtained was better fitted by Sips model compared to Langmuir and Freundlich models. The optimization of the factors to obtain maximum adsorption was carried out by incorporating analysis of variance (ANOVA), Pareto charts, surface plots, and contour plots. The results predicted using factorial regression model showed high values of regression coefficients indicating good agreement with experimental data. In addition, main and interacting effects of different process parameters on the response (% removal of MNZ) were found. Optimization of the process was carried out by using desirability (D) function by targeting the factors to desired levels for maximum removal of MNZ.

KEYWORDS : Adsorption; isotherm; kinetics; metronidazole; thermodynamics; experimental design

TRAITEMENT ET VALORISATION DES BOUES

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RESUME

Les boues d'épuration (urbaines ou industrielles) sont le principal déchet produit par une station d'épuration à partir des effluents liquides. Ces sédiments résiduaires sont surtout constitués de matière organique (bactéries mortes) de matière organique animale, végétale et minérale humide. Les boues doivent être considérées comme étant des déchets dangereux car il est impossible de définir la nature, le volume et les caractéristiques chimiques des divers produits chimiques qu'elles contiennent et dont elles sont imprégnées.

Le devenir des boues de stations d'épuration des eaux usées est un problème crucial posé aux pays industrialisés. Pour absorber ce volume croissant de production de boues différentes filières de traitement sont mise au point. L'objectif de ce traitement est non seulement d'éliminer les boues mais de les valoriser. La ré-utilisation ou la valorisation des boues se fait actuellement selon plusieurs filières principales ; agricole et énergitique.

Le développement d'une démarche de prévention efficace dans les réseaux d'assainissement permettrait par ailleurs de produire des boues moins polluées, donc plus faciles à traiter et à valoriser.

APPLICATON DE SIG DANS LA DEGRADATION DE LA COTE EST DE BIZERTE PAR EROSION ET SALINISATION SUITE A L'INTRUSION MARINE

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RÉSUMÉ

Les zones littorales sont caractérisées par l'apparition des intrusions marines qui peuvent être liées soit, à un changement climatique global et planétaire, régional et/ou local, soit à l'action anthropique tel que le cas de la région de Korba. Ce travail consiste à déterminer les dégâts causés par l'intrusion marine dans au niveau de la nappe de Ghar el Melh et ses environs immédiats. Pour se faire, l'approche utilisée est la méthode paramétrique combinée avec les techniques de SIG (méthode dite GALDIT).

La région de Ghar el Melh et ses environs se trouvent, au Nord-Est de la Tunisie (Cap-Bon). Ils sont caractérisés par leur climat méditerranéen à hiver modéré et été chaud. Ici, les séries géologiques affleurantes sont le plus souvent meubles (argiles et sables) d'âge Mio-Pliocène et Quaternaire.

La carte de vulnérabilité à l'intrusion marine de la nappe de Ghar el Meleh et l'indice GALDIT ont été obtenues grâce aux données analytiques du ministère de l'agriculture et ceux effectuées à l'INAT (laboratoire de pédologie). Ces données analytiques ont été traitées et cartographiés à l'aide du logiciel Arc Gis 10.1.

En déterminant les six paramètres sur lesquels est basée la méthode GALDIT on peut dire que :
1) le paramètre G, indique que la nappe de Ghar el Melh est semi captive

2) le paramètre A, montre que sa conductivité hydraulique est faible

3) le paramètre L, désigne sa hauteur par rapport au niveau de la mer. Cette hauteur est faible autour de la lagune de Ghar el Melh et à proximité d'Oued Mejerda ; elle est faible à moyenne à l'Est de la nappe et élevée à l'Ouest; 4) le paramètre D représente les distances 500, 750 et 1000 m par rapport au rivage; 5) le paramètre I concerne l'impact de l'état actuel de l'intrusion marine montre une conductivité électrique et une teneur en chlorure et un ratio Cl-/ (HCO3-1+CO32-) élevées, avec des zones négligeables de moyen et de faible ratio; 6) le paramètre T qui évalue l'épaisseur de la nappe montre qu'il s'agit d'un aquifère épais. L'indice GALDIT de la nappe de Ghar el Melh est égal à 6,1, correspondant à une vulnérabilité moyenne. En revanche, la carte de vulnérabilité montre d'importants dégâts tout le pourtour de la lagune de Ghar el Melh. En s'éloignant de la lagune, la vulnérabilité devient moyenne à proximité de l'Oued Mejerda et fable partout ailleurs.

TRAITEMENT DES POLLUANTS DES EAUX PLUVIALES ET URBAINES : CAS DE LA PLAINE OUEST D'ANNABA. NE ALGERIEN

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RESUME

La réduction de la pollution urbaine reste un sujet délicat à traiter, de nos jours plusieurs études s'intéressent à évaluer un milieu ambiant où la dégradation s'apprête le mieux. C'est dans ce contexte que s'inscrit le présent travail qui porte sur le traitement des paramètres (DBO_5, DCO, MES, O_2, , pH, T°, …), dans différents milieux : naturel et artificiel.

L'observation des données physico-chimiques et organiques a permis un traitement statistique par A.C.P en introduisant le coefficient de la cinétique de dégradation Kd

L'interprétation des résultats relève une sélectivité dans la dégradation de la pollution en fonction du milieu récepteur. Ainsi le milieu qui s'apprête le mieux à la dégradation des polluants est le site où l'optimisation des polluants est meilleure.

MOTS CLES : rejets urbains - matière organique - coefficient de dégradation Kd - ACP- Annaba.

GREEN SYNTHESIS OF COPPER OXIDE (CuO) NANOPARTICLES USING EUCALYPTUS GLOBULUS LEAF AQUEOUS EXTRACT: STUDY OF THEIR INTERACTION WITH ORGANIC DYE METHYL ORANGE (MO) IN AQUEOUS SOLUTION

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ABSTRACT

A biological extract of Eucalyptus globulus leaf was used for the synthesis of copper nanoparticles using copper sulphate as a precursor. In copper oxide formation, leaf extract acted as a reducing and capping agent. Fourier transform infrared spectroscopy (FT-IR) showed the presence of the functional groups characteristics of biological extract, i.e., triterpenes, phenolic, flavonoids, and other reducing agents. SEM analysis showed that the surface of the particles was spherical and rough. X-ray diffraction (XRD) pattern confirmed that the crystalline nature of the particles was affected by temperature. The average crystallite size was calculated to be about 85.2 nm. The adsorption characteristics of the nanoadsorbents were examined using methylene orange as adsorbate and the adsorption capacity reached 95 mg/g at room temperature. The values of B and bt, calculated from Temkin equation, increased with the increase in temperature (295–328K), indicating an endothermic adsorption and strong dye-nanoadsorbent interaction. The effects of different parameters such as nanoparticle dosage, contact time, pH, and initial dye concentrations on the capacity of the adsorption were studied. The MO adsorption isotherm follows Langmuir model and pseudo second-order kinetic model. In summary, the results obtained in this study deliver the design and the synthesis of new materials for removing pollutant.

KEYWORDS : Green synthesis, nanoparticles, CuO, Eucalyptus globulus, adsorption capacity, methyl orange (MO), isotherms model, kinetic study

REMOVAL OF CADMIUM FROM CONTAMINATED WATER USING TRICALCIUM PHOSPHATE NANOPARTICLES SINTERED AT DIFFERENT TEMPERATURES

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ABSTRACT

Heat treatment of materials has a great impact on their ability to fix heavy metals in aqueous systems. This study aimed to investigate the effect of this parameter of synthesis on Cd^{2+} sorption behavior of tricalcium phosphate (TCP).

TCP powders were synthetized according to fast precipitation process at room temperature. The experiment consists in pouring a solution of calcium nitrate into a solution of diammonium phosphate with a molar ratio of reactants Ca/P equal to 1.5. The pH of precipitation medium has been maintained close to 10 by addition of ammonia solution. The dried precipitates were subjected to heat treatments within the temperature range of 200-900°C. The prepared samples were tested as sorbents for cadmium in water through batch equilibrium technique. The adsorption experiments were carried out with 100 mg/L of Cd^{2+} solutions and 0.1g/L of TCP.

The results show that even the significant reduction of the specific surface area due to the ignition effect, the affinity of the material toward the metal ion showed a slight decrease. This later didn't exceed 1.8 % over the chosen broad range of the sintering temperature. Cadmium uptake was quantitatively evaluated using Langmuir, Freundlich and Dubinin-Kaganer-Radushkevich (DKR) models. The adsorption equilibrium fitted the Freundlich model very well and the maximum adsorption capacity (qe) determined through Langmuir model is 910 mg of Cd^{2+} per gram of TCP nanoparticles.

According to this study, the sorption mechanism is governed by ion-exchange rather than a physical adsorption. Besides, the neutralized amount of cadmium is significantly higher than that of activated carbon (57 mg/g)*, as one of the most commonly used material for filtrating heavy metal ions. Therefore, TCP nanoparticles treated at low temperatures might be of interest for effective immobilization of Cd^{2+} ions in wastewater.

KEYWORDS : TCP nanoparticles; heat treatments; Cd^{2+} immobilization; wastewater.

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WOMEN EMPOWERMENT TOWARD TREATED WASTE WATER REUSE : RECONNECT PRACTICAL AND STRATEGIC WOMAN NEEDS IN PALESTINIAN RURAL AREA

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ABSTRACT

Treated wastewater reuse is considered to be as one of the most important no-conventional water resources in Palestine. However it is still facing critical social obstacles and rejection. Women empowerment is expected to have a role on changing behaviors toward reuse depending on knowledge rising by training. This study aims to measure the impact of the women`s empowerment in the Palestinian rural areas on the acceptance of wastewater treatment reuse, and the impact of training on treated wastewater re-use issues to accept for reuse. Qualitative and quantitative approaches were used to achieve the objectives; 23 problem – centered interviews were conducted at institutional level and then 120 questionnaires were distributed to rural women in order to measure their empowerment and its impact on reuse acceptance. The study shows that wastewater sector is dominated by males and reflects patriarchal system. The study shows that 40% of targeted females are empowered with women`s empowerment in agriculture index (WEAI) equals 0.778 at same time: 47% of them accept the reuse. After training program; the reuse acceptance rate rises to 55% and WEAI to 0.797. Women empowerment impacts the acceptance of treated wastewater reuse as well as the linked of practical and strategic needs of gender and work to meet these needs in parallel

KEYWORDS : treated wastewater, reuse, empowerment, strategic gender needs, practical gender needs.

CERIUM EXTRACTION WITH NOVEL IONIC LIQUIDS BASED ON H-PHOSPHONATE ANIONS FROM SULFURIC ACID MEDIUM

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ABSTRACT

A great deal of attention has focused on the development of sustainable technologies to extract, separate and recycle a wide range of high-value and critical metals such as lanthanides and certain actinides. The usual extraction-separation processes based on volatile organic solvents present numerous drawbacks including the environmental toxicity, low extraction efficiencies, poor selectivity and low purity. In addition, they are quite expensive because of the complexity of separation and purification processes [1]. In this context, novel ionic liquids are investigated as an alternative to conventional organic solvents commonly used for the liquid-liquid extraction process.

The removal and recovery of hazardous metals like cerium ions from aqueous matrices is critical importance. In this work, two H-phosphonate anion -based ionic liquids (ILs) denoted Pip1-10-DDP and TEA1-10-DDP were designed and synthesized. The choice of the H-phosphonate anion is justified by its formation via a simple synthetic route, the low cost of precursors, its abundance and non-fluorinated ligating structure. In such a case, it would be possible to control the cation and anion hydrophobicity by varying the nature of atoms constituting the alkyl chain. These green compounds play both the role of the solvent and the extracting agent of the extraction process. A complete optimization of the process has been realized. The results show that the distribution ratio (D) and the extraction Efficiency (%E) of the metal were found to be dependent on the acidity of the aqueous phase, the extraction time, the alkyl chain length in both ionic liquids, the concentration of the aqueous feed and molar quantity of ILs. A distribution ratio higher than 600 and an extraction yield superior to 98% were obtained. This green process represents an efficient and ecological alternative, the usual separation and recovery techniques for critical metals.

KEYWORDS : Rare earth, ionic liquid, green chemistry, liquid-liquid extraction.

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REMOVAL OF DYE BY ADSORPTION ON ORANGE PEELS: ISOTHERM, KINETIC AND THERMODYNAMIC STUDIES

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ABSTRACT

Dyes in wastewater from various industries, such as textiles, printing, pulp mills, leather, food, dyestuffs, and plastics, is stable and resistant to biodegradation because of its complex aromatic molecular structure. As a result, the removal of dyes from waste effluents has become environmentally important. In this study, orange peels are used for the production of low cost and effective adsorbents in adsorption processes to remove a basic dye from water. Batch adsorption experiments were performed as a function of pH, contact time, solute concentration and adsorbent dose. Results were fitted to Langmuir, Freundlich and Temkin adsorption models, at different temperatures. Thermodynamic parameters were determined in the temperature range of 25 - 55°C. The adsorption kinetic was evaluated by pseudo-first–order, pseudo- second–order and Elovich models.

KEYWORDS : Basic dye; Orange peels; Adsorption isotherm; Adsorption kinetic; Thermodynamic.

LITHIUM EXTRACTION BY DIFFUSION DIALYSIS USING NOVEL COMPOSITE MEMBRANES

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ABSTRACT

Due to the rapid expansion of worldwide lithium ion batteries market, the procurement of this metal is becoming a matter of importance worldwide. Therefore, the selective separation, purification and recovery of Lithium from seawater and brine water generate great attention from scientists, engineers, and industrialists. The present work consists on the synthesis of novel lithium ion-selective membranes based on Lithium Ion Conductor as Lithium Ion Sieves embedded in a copolymerized matrix of an Anionic Polymer. A nonionic surfactant was also used to prevent the agglomeration of inorganic Lithium conductor in the polymer matrix. To optimize both the synthesis and the appropriate composition, several experiments have been carried out. The morphological and thermal properties of these prepared membranes were determined using SEM and TGA. Additionally, water uptake, contact angle and conductivities of these membranes were also determined. To test the performances and the selectivity of these membranes, Diffusion Dialysis experiments of Li and Na mixture solution were affected using a two compartments cell. Results confirm the homogeneity of as prepared membranes and their thermal stability up to 200°C. Conductivities of these membranes are more important in Li solution then in Na media. The performance of these composite membranes was confirmed in diffusion dialysis and a remarkable selectivity for Li+ was observed.

KEYWORDS : composite membranes, lithium conductor, lithium extraction and selectivity.

LEAD CARBONATE SPECIATION IN SEAWATER AND pH SCALE INVESTIGATIONS BY SPECTROPHOTOMETRIC OBSERVATIONS

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ABSTRACT

In this work the calculations of carbonate currently require measurements of two CO2 system parameters, such as pH and total dissolved carbon. Refined procedures were developed for directly determining carbonate ion concentrations in seawater through measurement of the ultraviolet absorbance of lead carbonate complex after addition of divalent lead (Pb(II)) to a seawater sample. Our model algorithm is based on carbonate ion concentrations calculated from measurements of pH and dissolved inorganic carbon (DIC) obtained on PANAREA seawater in Mediterranean Sea. These calculated carbonate concentrations, in conjunction with Pb(II) absorbance measurements for the same seawater. The precision of the spectrophotometric carbonate measurements is affected by the concentration of Pb(II) in the titrated seawater samples. Doubling the concentration of the titrant improved precision relative to previously published procedures. Minor changes in the new algorithm for the spectrophotometric method produced carbonate ion values (at 25 °C) in excellent agreement with values calculated from paired pH and DIC observations over a carbonate concentration range of 73–258 µmol.kg^{-1}. Spectrophotometric pH values obtained via measurements of absorbance ratios are directly grounded on indicator molecular properties: molar absorptivity ratios and protonation characteristics.

KEYWORDS : inorganic carbonate, lead, seawater, acidification, m-cresol and red cresol…

SYNTHESIS OF NOVEL ADSORBENT BY INTERCALATION OF BIOPOLYMER IN LDH FOR THE REMOVAL OF ARSENIC FROM SYNTHETIC AND NATURAL WATER

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ABSTRACT

This study focuses on the synthesis of nanocomposites named CCA and CZA that were prepared by the incorporation of cellulose (CL) in the Ca/Al and Zn/Al layered double hydroxide (LDH), respectively. These materials were then used for the uptake of As(III) and As(V) from aqueous medium. Characterization of both nanocomposites (CCA and CZA) was done using FTIR and Raman analysis to identify the functional groups, N2 adsorption-desorption isotherms to determine the specific surface area and pore geometry and XPS analysis to obtain the surface atomic composition. Some other characters were investigated using simultaneous TGA and DTA and elemental chemical analysis (CHNS/O). The crystallinity of the prepared nanocomposites was displayed by XRD patterns. Furthermore, the sheet-like structure of the LDHs and the irregularity of surface morphology with porous structure were observed by TEM and SEM microphotographs. Optimization of maximum adsorption capacity was adjusted using different parameters including pH, contact time and adsorbent dosage. The pseudo-second-order model was in good fitting with kinetics results. The adsorption isotherm results showed that CZA exhibits better adsorption capacity for As(V) than CCA and the Langmuir isotherm model described the data well for both nanocomposites. Thermodynamic studies illustrated the endothermic nature of CCA and exothermic nature on CZA, as well as the fact that the adsorption process is spontaneous. A real water sample collected from well located in Gabes (Southeastern Tunisia), has also been treated. The obtained experimental results were confirmed that these sorbents are efficient for the treatment of hazardous toxic species such as arsenic.

KEYWORDS : Layered double hydroxide; Adsorption; Arsenic removal; Kinetics; natural water treatment

REMOVAL OF CADMIUM FROM INDUSTRIAL EFFLUENT BY BIOADSORPTION USING A MARINE PLANT, POSIDONIA OCEANIC

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ABSTRACT

Water is one of the most affected environmental factors. It can be loaded with toxic substances, such as cadmium, due to several industrial sources. Therefore, this study intends to find some solutions to remove the excess of cadmium in synthetic solutions and wastewater from the battery industry, considering the technical and financial constraints. Series of biosorption experiments was studied for the elimination of cadmium Cd (II) using marine plant adsorbent Posidonia Oceanic. These experiments confirm the high adsorption capacity for the used biaoadsorbent. They show that the effectiveness of cadmium removal exceeds 90%. Characterization of this material was done using XRD, BET, XPS, EA, TGA/DTA, Raman and FTIR. Surface morphological studies was laid using SEM. Optimization of maximum adsorption capacity was adjusted using different parameters including pH, contact time and adsorbent dosage. The pseudo-second-order model was in good fitting with kinetics results. The adsorption isotherm results showed that Langmuir and Dubinin-Astakhov isotherms models described the data well. Thermodynamic studies illustrated the endothermic nature of CCA and exothermic nature on CZA, as well as the fact that the adsorption process is spontaneous. A real water sample collected from well located in Gabes (Southeastern Tunisia), has also been treated. The obtained experimental results were confirmed that this sorbent is efficient for the removal of Cd(II) from battery industry effluent.

KEYWORDS : Cadmium removal; Bioadsorbtion; aqueous effluent

CHARACTERIZATION AND PHYSICOCHEMICAL ASPECTS OF NOVEL CELLULOSE-BASED LAYERED DOUBLE HYDROXIDE NANOCOMPOSITE FOR REMOVAL OF ANTIMONY AND FLUORIDE FROM AQUEOUS SOLUTION

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ABSTRACT

A series of novel adsorbents composed of cellulose (CL) with Ca/Al layered double hydroxide (CCxA; where x represent the Ca/Al molar ratio) were prepared for the adsorption of antimony (Sb(V)) and fluoride (F-) ions from aqueous solutions. The CCxA was characterized by XRD, FTIR, BET, CHNS/O, TGA-DTA, zeta potential, XPS and SEM-EDX analysis. The effects of varying parameters such as dose, pH, contact time, temperature and initial concentration on the adsorption process were investigated. According to the obtained results, the adsorption processes were described by a pseudo-second-order kinetic model. Langmuir adsorption isotherm model provided the best fit for the experimental data and was used to describe isotherm constants. The maximum adsorption capacity was found to be 77.2 mg/g and 63.1 mg/g for Sb(V) and F-, respectively by CC3A. The CC3A nanocomposite was able to reduce the Sb(V) and F- ions concentration in synthetic solution to lower than 6 µg/L and 1.5 mg/L, respectively, which are maximum contaminant levels of these elements in drinking water according to WHO guidelines.

KEYWORDS : Layered double hydroxide, Adsorption, Antimony removal, Fluoride removal, Kinetics

PVDF-HFP FLAT SHEET MEMBRANES PREPARED BY Tamisolve® NxG SOLVENT FOR DIRECT CONTACT MEMBRANE DISTILLATION AND MEMBRANE CRYSTALLIZATION

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ABSTRACT

The impact of chemical products, more precisely the traditional solvent used to prepare membranes, on the environment is a subject that is increasingly debated. Many législations have been put in place to address these concerns and to encourage the introduction of new production methods that are economically and ecologically attractive. The replacement of these solvents with non-toxic equivalents attracts a great deal of attention in membrane preparation processes. In order to solve this issue, Poly(vinylidene fluoride-hexafluoropropylene) (PVDF-HFP) flat sheet membranes were prepared by non-solvent induced phase separation (NIPS) at different copolymer concentrations (15wt% and 18wt%) for aqueous membrane distillation (MD) and aqueous membrane crystallization (MCr) applications using Tamisolve® NxG as eco-friendly sustainable solvent. The prepared porous PVDF-HFP membranes were fully characterized in terms of their morphology observed by scanning electron microscopy (SEM), porosity, thickness, pore-size, contact angle, and pure water permeability (PWP). Moreover, preliminary DCMD and MCr tests were carried out and showed as the flat sheet membrane prepared whose the pore size comparable to that of a commercial PVDF membrane exhibited the great potential in terms of permeate flux and salt rejection at feed temperature of 40°C which opens up great perspectives in the sustainable membrane technology.

KEYWORDS : P(VDF-HFP) membranes, Tamisolve® NxG, Non-solvent Induced Phase Separation (NIPS), Direct Contact Membrane Distillation (DCMD), membrane crystallization (MCr).

METHOD FOR PREDICTING SCALING OF DRINKING WATER

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ABSTRACT

The present study is to improve the understanding of precipitation mechanisms in the context of the prediction and prevention of the scaling phenomenon in drinking water distribution circuits in the zone of Tabarka. The Physico-chemical analysis of water samples collected to show that it is of good quality. Examination of the modified Langelier saturation index (MLSI) allowed to conclude that water intended for human consumption is in calco-carbonic equilibrium. A study of the parameters acting on the calco-carbonic system was conducted. The critical pH method shows that water can become scaly when the pH reaches a value of 8.72 at room temperature. The degassing method at 25 ° C shows that the pH of the water increases to a pH of 8.3 and remains constant over time without breaking the Calco-carbonic equilibrium. at this temperature, the equilibrium moves towards the formation of tartar if a little quantity of calcite is present. The effect of temperature was studied, the degassing method was repeated by increasing the temperature to 35 °C, spontaneous germination was detected which shows that an increase in temperature can cause a deposit of scale.The presence of a calcite grain and in permanent contact with air or an increase in temperature can trigger scaling.

KEYWORDS : drinking water, Tabarka, scaling, calco-carbonic equilibrium, the modified Langelier saturation index

APPLICATION OF RESPONSE SURFACE METHODOLOGY FOR CHROMIUM REMOVAL BY ADSORPTION ON BIOCHAR

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ABSTRACT

Hexavalent chromium Cr(VI) has significant toxic effects on human and animals. The International Agency for Research on Cancer (IARC) identifies its compounds as human carcinogen. The World Health Organization defined an upper limit of 0.05 mg L^{-1} in drinking water. Different studies were carried out to determine the efficiency of biochars for pollutants removal. This work focuses on the efficiency of the response surface methodology to optimize the parameters affecting the chromium removal by adsorption on biochar using banana as precursor and zinc chloride as chemical modification agent. A Doehlert experimental design was applied to determine the optimum conditions. Three factors were chosen: the adsorbent amount, pH and the temperature.

The experimental results were analyzed by the ANOVA test and showed that the model regression is well fitted. The determination coefficient R2 was equal to 0.979 suggesting an excellent relationship between predicted and experimental responses. Graphic analysis of contour plots obtained from NEMROD software showed that the highest removal yield was obtained under the following conditions: an adsorbent amount of 1.10 g L^{-1}, a pH equal to 1.77 and a temperature of 31°C. The adsorption recovery reached 69.4 % under these conditions.

KEYWORDS : Biochar synthesis, Experimental design, Hexavalent chromium,

EXPERIMENTAL STUDY FOR PURIFYING POWER OF *PHRAGMITE AUSTRALIS* AND *TYPHA LATIFOLIA* IN ARID REGIONS.

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ABSTRACT

The urban waste can lead to pollution of the environment if discharged into the wild without prior treatment, especially because of their high organic load. In this paper the experimental driver is composed of three tanks, one planted with *Typha latifolia* another with *Phragmites australis*, and the third left without vegetation. The filling is done regularly with urban wastewater from the city of Biskra (rejecting Chetma) with a frequency of once every (5) five days. The study of purification performance of the system proves that it assures a significant removal of BOD 5 (75.69% to 71.60% *Phragmites australis* and *Typha for latofilia*), COD (66.75% for *Phragmites australis*, 79% for *Typha latifolia*) and a significantly reduced TSS (95% for *Phragmites australis* and *Typha latifolia* 92%). The results also show a significant decrease of NH4 + (68%), the PO_4^{3-} (59%) and NO_3^- (62%). It was also noted that the elimination of pathogenic microorganisms is important (98% à 100%).

KEYWORDS : constructed wetland, phyto-purification, wastewater, *Phragmites Australis. Typha Latifolia.*

AGRICULTURAL WASTE: A PROMISING RESOURCE FOR THE SELECTIVE RECOVERY OF TOXIC HEAVY METALS FROM WASTEWATER

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ABSTRACT

Pollution with heavy metals is one of the most severe environmental problems in the world due to its widespread applications in industrial processes such as metallurgy, tanning industries, refractories and foundries. Cadmium, Cobalt, Copper, Iron, Nickel, Lead and Zinc are harmful for environment and threatens the human health. Different studies were carried out on the efficiency of low-cost natural adsorbents for heavy metals removal. In this work, the batch adsorption of toxic heavy metals ions using two biowaste so common in Tunisia which are olive leaves Chemlali Tunis (OLCT) and peanut shell (PSh) were examined. The adsorbent was characterized by Fourier transform infrared spectroscopy (FTIR), BET, XRD, Elemental Analysis, SEM and EDS analyses. The effect of several parameters such as contact time, adsorbent dose, effect of pH, and initial concentration of metal ions on the adsorption process was estimated. The optimum adsorption was found to occur at pH 5.0, contact time 60 min, adsorbent dose 40 g/L, and initial concentration 50 mg/L. The isotherm adsorption data were satisfactorily found to be described by Langmuir. Besides, the thermodynamic studies revealed that the present adsorption process is a favorable, endothermic and spontaneous phenomenon.

KEYWORDS : Heavy metals, Adsorption, Olive leaves, Peanut shell, Optimization.

HYSICOCHEMICAL STUDY OF CHROMIUM ADSORPTION FROM AQUEOUS SOLUTION BY PEANUT SHELL ACTIVATED CARBON

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ABSTRACT

Preparation of economically and environmentally viable adsorbents out of biomass has achieved immense interest for the water treatment purposes. A low cost activated carbon was prepared from agricultural waste, peanut shells (PShAC), via two physical activation using simultaneous pyrolysis at 700 °C, 1 hour under nitrogen and CO2 atmosphere to remove highly toxic metal hexavalent chromium from wastewater. The obtained materials were characterized using XRD, elemental analysis, FTIR, SEM and EDS. BET surface area of PShAC is calculated to be 806,60 m2/g. An experimental design technique has been used to investigate the biosorption of chromium from water solutions. The four factors considered were pH, biosorbent dosage, temperature and initial concentration of chromium. Batch experiments were conducted to study the effects of pH (2–10), adsorbent dose (5–35 g L−1), temperature (10-40 °C) and initial concentration (10–190 mg L−1). The adsorption process is endothermic showing monolayer adsorption of Cr (VI), with a maximum adsorption of 52% at 40°C for an initial concentration of 100 mg L−1 and 0,0275 g of adsorbent at pH 2. Equilibrium study revealed that Langmuir isotherm model described best the experimental data. The kinetics of dye adsorption was found to conform to the pseudo-second-order kinetics with a correlation coefficient value of 0.991. Thermodynamic study revealed that the adsorption process was endothermic and spontaneous.

KEYWORDS : Chromium, Activated Carbon, Experiment Design, Isotherms, Kinetics, Thermodynamic.

RADIATION PROCESSING OF EMERGING PHARMACEUTICALS IN WASTEWATER

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ABSTRACT

Conventional wastewater treatment technologies are insufficient for removal of many pharmaceutical residues, characterized by low biodegradability and high chemical stability. Radiation technologies are promising and effective treatment processes for removing such relentless contaminants from wastewater as an alternative to conventional technologies. In this purpose, the degradation efficiency of several detected contaminants, non-steroidal anti-inflammatory drugs, was investigated using irradiation process. The primary advantage of radiation processing over alternatives is the generation in situ during radiolysis of powerful reactive species without addition of chemicals, able to destroy recalcitrant pollutants. The main irradiation process applied in treatment of aquatic organic pollutants (electron beam and Cobalt-60) will be illustrated. Many applications, highlighting the technology's strong points and operational conditions are described, with presentation of main advantages of this innovative process. In the aim to reach high degradation efficiency of treated pharmaceuticals, an optimization of the main parameters influencing this process, were investigated. Treated pharmaceuticals were irradiated with 0.5 to 15 kGy doses. Significant modifications attributed to main parameters appeared in the variation of degradation efficiency, COD removal, TOC values and concentration of radio-induced radicals, confirming them synergistic effect to attempt total mineralización. Moreover, the catalytic oxidation of these compounds by gamma irradiation was investigated with addition of optimal amounts of hydrogen peroxide as a convenient oxidant. This pairing application was efficient to improve the oxidative degradation and contribute to high performance of this process at very low doses (0.5 kGy). A sophisticated analytical study was released to detect and quantify generated radicals and intermediates (EPR spin-trapping, IC, FTIR, HPLC). All results showed the high performance of this process in degradation of pharmaceuticals due to strong oxidative properties of generated radicals.

KEYWORDS : pharmaceuticals, radiolysis, toxicity, IC, HPLC, FTIR, EPR.

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WASTEWATER TREATMENT BY NANOPARTICLES (TiO_2) ACTIVATED BY ULTRAVIOLET RAYS

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ABSTRACT

Titanium dioxide (TiO_2) is used for the photodegradation of organic contaminants in wastewater, killing bacteria and viruses. To photodegrade contaminants, the nanoparticles must first be photoactivated by ultraviolet rays, which, as loaded, catalyze the contaminants in solution around the particles.

NP-TiO_2 (1): Nano-TiO_2 was prepared from a commercial TiO_2 nanopowder (Sigma-Aldrich, USA). NP-TiO_2 (2) : Nano-TiO_2 was prepared from a commercial TiO_2 nanopowder (Daejung reagents chemicals, Korea).X-ray diffraction (XRD) was performed using a Philips X-ray diffractometer with Cu Ka radiation (l = 0.15406 nm). Fourier Transform Infrared spectra were recorded under identical conditions in the 400–4000 cm^{-1} region using a Fourier Transform Infrared Spectrometer (Shimadzhu). The morphology distribution was characterized using SEM (JEOL JSM 500-F). A model azo dye, Remazol Red Brilliant F3B (RR180) obtained from Dystar and used without further purification. It is clear from the SEM of the powder that the size of the samples NP-TiO_2 (1) and NP-TiO_2 (2) were less than 20 and 150 nm respectively. The SEM results revealed the presence of agglomerates of nanoparticles and showed that the morphology is replete with spheres. The direct band gap is determined by equation Eg =1240/χ. The band gap was 4.1eV and 3.6 eV of NP-TiO_2 (1) and NP-TiO_2 (2) respectively. TiO2 nanoparticle showed the highest photocatalytic activity. In addition, TiO2 nanopowders (size<20 nm) had the higher efficiency in photodegradation of dye RR180 under visible light irradiation for 60 min for up to one hour's duration but NP-TiO_2 (2) had the higher efficiency for up to two hours duration.

KEYWORDS : Titanium dioxide, wastewater, nanoparticles, RR180, photodegradation.

REMOVAL OF DYE BY A NOVEL CELLULOSE ACETATE (CA) MEMBRANE USING TiO_2 NANOPARTICLES

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ABSTRACT

With two sizes of titanium dioxide (TiO_2) nanoparticles as an additive, acetate cellulose (AC) membranes and a series of TiO_2/AC hybrid membranes were prepared by a phase-inversion method. TiO_2 NPs (D1) was prepared from a commercial TiO_2 nanopowder (Sigma-Aldrich, USA). TiO_2 NPs (D2) was prepared from a commercial TiO_2 nanopowder (Daejung reagents chemicals, Korea). Prepared membranes were analyzed for dye Remazol Red Brilliant F3B (RR180) rejection performance. NaCl decreased the retention rate of dye due to electrostatic interactions. The chloride ions compete with the anionic dye in complexation process. the retention rate decreased at basic pH due to interaction force between membrane surface and anion of the RR 180 which is negatively charged. An increase in permeate flux with the membrane-TiO_2 20 nm in contrast with membrane-TiO_2 83 nm, explained with a partial plugging of the pores of the membrane. The rate of dye degradation by TiO2 NPs 20 nm and 80 nm in suspension reaches 100% after 60 and 120 min, respectively. The constant speed for TiO_2 NPs 20 nm was twice higher than that of TiO_2 NPs 80 nm.

KEYWORDS : Cellulose acetate (CA). TiO_2 nanoparticle. Phase inversion. Hybrid membrane. Azo dye. Treatment

BIOREMEDIATION OF JEBEL CHAKIR LEACHATE USING BACTO-YEAST MIXED CULTURE, ISOLATED FROM TUNISIAN KEFIR PRODUCT

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ABSTRACT

The wastewater from the dumping site usually contains high pollutant levels and, since the importance of generated volume, the total pollutant load is also important. Biological process and chemical-physical treatments are among several technologies for wastewater. Using microorganisms in the treatment of landfill leachate is an emerging research issue. Furthermore, bioremediation is a feasible approach for pollutants removal from landfill leachate and it would provide an efficiently way to resolve the issue of landfill leachate. In this study, synergistic yeast and bacteria technology was applied for leachate treatment. Bacto-yeast mixed culture with 1% of inoculum size was demonstrated as the most efficient in the degradation of different contaminants. The overall abatement rate of chemical oxygen demand (COD), ammonium nitrogen (NH4+-N) and salinity were 75.8% and 85.9%, 75.13%, respectively. The bioremediation process resulted in up of 75% removal efficiency of Ni and Cd, and a 73.45, 68.53 and a 58.17% removal rates of Cu, Pb and Fe, respectively. The research findings indicate the bioremediation and detoxification potency of bacto-yeast mixed culture for LFL treatment.

KEYWORDS : Bioremediation, Landfill leachate, Microorganism, Ammonium nitrogen removal, organic materials removal.

COMPARATIVE STUDY ON THE DEGRADATION OF A MODEL PHARMACEUTICAL RESIDUE BY FERRATES, ELECTROCHEMICAL ADVANCED OXIDATION PROCESSES AND COMBINED PROCESSES

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ABSTRACT

Pharmaceutical residues as emerging pollutants have become an issue of growing concern owing to their continuous accumulation in the aquatic environment. The removal of such compounds requires developing new efficient technologies as well as better understanding degradation mechanisms. In this paper the degradation of paracetamol (PCT), as a model pharmaceutical compound, has been comparatively studied by ferrate (FeVIO42-), anodic oxidation (AO), electro-Fenton (EF) and combined processes. Results showed that the pre-treatment by ferrate followed by AO or EF was most effective than intermediate-ferrate treatment (i.e., ferrate addition after 5 or 20 min of AO) or anodic oxidation alone. The most promising treatment strategy appeared to be ferrate pre-treatment at pH 8.0 followed by electro-Fenton. In order to better understand the degradation pathway of PCT as regards to the process applied, main degradation by-products (aromatic intermediates and short-chain carboxylic acids) were identified and quantified. Acute toxicity tests (Microtox®) were also performed and correlated to the nature of degradation by-products generated.

PREDICTION OF THE INFLUENCE OF THE LIQUID TEMPERATURE EFFECT ON THE PUMPING OF GEOTHERMAL WATER BY AN AIR LIFT SYSTEM

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ABSTRACT

A new setup, consisting of a glass column packed with calibrated solid particles, has been designed, achieved and tested. It operates on the principle of an air lift pump. It was designed for the best contact between air and water. The fluid circulation in a granular medium is achieved by an air-lift pump. A unidimensional model, based on that of literature, has been developed. The effect of liquid temperature, on the hydrodynamic, has been considered in this model. The developed model is used to predict gas holdup, pressure drop, and liquid and gas flow rates at any liquid temperature. The results, obtained with the model, are found to agree with experimental data.

KEYWORDS : Airlift pump; Pumping; Geothermal water; Liquid temperature effect;

FLUORIDE REMOVAL FROM WATER USING SYNTHETIC HECTORITE CLAYS : LAPONITE

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ABSTRACT

Water treatment technology suggests that many of the issues involving water quality could be resolved or greatly ameliorated using clays as adsorbents [1,2]. The present survey highlights for the first time that synthetic Hectorite clay named Laponite can be used as adsorbents for the uptake of fluoride from natural water.

Batch experiments were carried out to determine optimum conditions for fluoride removal. The optimized parameters are: contact time, adsorbent dose, pH and temperature.

The optimum conditions for defluoridation of groundwater were found to be : 30min of contact time, 20 $g.L^{-1}$ adsorbent dose, natural pH (≈ 6.75) and 25°C as water temperature. The Laponite clay showed a great adsorption performance. We achieved 90% of fluoride removal with an initial fluoride concentration in water of 3.35 $mg.L^{-1}$.

The Laponite was characterized before and after adsorption by X-ray diffraction, X-ray fluorescence, FTIR and 19F solid state NMR spectroscopies. The experimental data showed that Langmuir adsorption isotherm (R2=0.98) fit better indicating a monolayer adsorption. Thermodynamic parameters such as the Gibbs free energy (ΔG°), enthalpy (ΔH°), and entropy (ΔS°) were calculated. These parameters indicated that the adsorption of fluoride onto Laponite clay was non spontaneous and endothermic in temperature range between 25 and 45°C.

KEYWORDS : Defluoridation, Adsorption, Laponite clay, Groundwater, Fluoride

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STRUCTURAL AND MORPHOLOGICAL INVESTIGATION OF POROUS NANOSTRUCTURED NICKEL-BASED COATINGS PREPARED BY ELECTRODEPOSITION

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ABSTRACT

Hydrogen is a promising energy for the future. Among the different methods of its production, the alkaline water electrolysis has attracted great attention because it is a sustainable and renewable chemical technology. Recently, there was a growing interest for the preparation of new cathode nanomaterials with high catalytic activity for hydrogen evolution reaction [1-3]. In this work, new composite Nickel coatings were prepared by electrodeposition from Nickel bath containing different amounts of Sulfur on FTO glasses. A detailed investigation of the chemical composition, surface morphology and crystalline structure of the deposits was carried out using EDX, SEM and XRD techniques respectively. The EDX results confirm the reduction of the Ni and S ions and the deposition of their corresponding atoms on the FTO substrate. The XRD patterns analysis reveals the presence of FTO peaks and the formation of NiS phase. The surface morphology shows that the deposits are porous and exhibit a cauliflower like morphology with spherical particles. The deposits thickness determined by the cross section technique is of about 5 µm depending on the S content in the bath. These results promote the use of these materials for water electrolysis.

KEYWORDS : Nanostructured materials, Ni thin films, Chemical composition, Structure, Morphology

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EQUILIBRIUM, KINETIC AND THERMODYNAMIC INVESTIGATIONS ON Pb(II) RETENTION ONTO AN ECOLOGICAL BIOSORBENT

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ABSTRACT

Lead cations Pb(II) removal from aqueous solution was studied under different experiential conditions using a cheap biosorbent (DCCP) prepared from cactus cladodes a natural, abundant and available material. It was found that Pb(II) biosorption is sensitive to solution pH, biosorbent dosage, lead ions initial concentration, contact time and temperature. The increase in these parameters enhanced Pb2+ retention. Among the pseudo-first and second-order kinetic models, the biosorption kinetics were well described by the pseudo second-order model implaying a chemisorption process. The equilibrium experimental data fitted very well to the Langmuir model assuming a monolayer and uniform Pb2+ biosorption.

Moreover, the thermodynamic parameters (ΔG°, ΔH°, ΔS°) determined from the temperature dependent isotherms, showed that lead ions retention onto DCCP was spontaneous, endothermic and feasible in the temperature range 293-333K. On the other hand, EDS and FTIR analysis showed the retention of Pb2+ by ion-exchnage, mainly with magnesium and potassium cations, and complexation involving primarily carboxyl and hydroxyl functional groups of DCCP. Through this study, it was shown that DCCP as low-cost and eco-friendly biosorbent may be a good alternative for lead cations removal from aqueous wastes.

KEYWORDS : Lead ions, Biosorption, Cheap biosorbent, Kinetics, Isotherm

SCREENING OF ADSORPTION PARAMETERS ON CLAY USING EXPERIMENTAL DESIGN METHODOLOGY

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ABSTRACT

Heavy metals are among the most dangerous pollutants found in water; Zinc is one of those heavy metals that are considered toxic if they exceed the acceptable threshold. Among the processes for the treatment of water, adsorption remains a relatively used technique and easy to implement.

In this study we have studied the screening of parameters influencing the adsorption of zinc ions obtained by dissolving the nanoaprticules of ZnO on an Algerian clay by application of Plackett Burman designe, a plan of 12 experiments to study the importance of 7 parameters (factors), pH, concentration, the amount of adsorbent, stirring speed, temperature, time and the type of clay), the results obtained shows that only 3 parameters have influence on this phenomenon (pH, Température and the amount of adsorbent).

OPTIMIZATION OF PARAMETERS FOR PREPARATION OF AN ADSORBENT USING EXPERIMENTAL DESIGN

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ABSTRACT

An experimental design has been drawn up to optimize the experimental conditions of the preparation of an adsorbent from sewage sludge. Seven adsorbent materials have been prepared by carbonization. A uniform shell design of Doehlret was applied to study the influence of carbonization temperature and time on the characteristic of the adsorbent including (burn-off, volatile matter, ash content, and solution pH). Four models were developed, and the multi-linear regression method was adopted to fit the relations between the characteristic parameters and influential factors. The models were used to calculate the optimum operating conditions for preparation of adsorbent providing a compromise between burn-off and ash content.

KEYWORDS : sewage sludge, adsorbent, carbonization, experimental design, Doehlert, modeling, optimization.

SIMULTANEOUS REMOVAL OF NICKEL, ALUMINUM AND CADMIUM USING CLOUD POINT EXTRACTION

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ABSTRACT

In this work, we optimized a simple, economic and efficient extraction protocol for Ni, Al and Cd removal from waste effluents using cloud point extraction. Triton X-114 is used as a surfactant and 1-(2-pyridylazo)-2-naphthol as complexing agent for the Ni^{2+}, Al^{3+} and Cd^{2+} removal from the aqueous phase to the rich one. The parameters influencing the extraction protocol (pH, surfactant concentration, temperature…) are optimized. The reliability of the method was checked by the analysis of standard solutions certified references materials in aqueous matrix before and after applying the extraction procedure using SAA-ET. The extraction recoveries exceeded 97 % for the studied elements. The method is repeatable and the relative standard deviations were < 5%. The result was a simple, inexpensive and sensitive method of Ni, Al and Cd removal from aqueous samples.

FACILE GREEN SYNTHESIS OF Fe_3O_4 NANOPARTICLES USING LYCIUM CHINENSE LEAF AQUEOUS EXTRACT AND THEIR APPLICATION IN DYE ADSORPTION IN AQUEOUS SOLUTION

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ABSTRACT

The aims of this work was synthesis of magnetite nanoparticles using Lycium chinense leaf extract as a stabilizing agent. The structural characterization of the Fe3O4 nanoparticles were carried out by scanning electron microscopy (SEM), X-ray diffraction, techniques. The application of Fe_3O_4 in adsorption was tested and showed high adsorption capacity (121 mg g−1) towards humic acid (HA), which is based on electrostatic interactions and size filter effect. The effects of different parameters such as nanoparticle dosage, contact time, pH, and initial dye concentrations on the capacity of the adsorption were studied. The HA adsorption isotherm follows Langmuir model and pseudo second-order kinetic model. The eco-friendly synthesis method, high adsorption capacity and stability of Fe_3O_4 nanoparticles make it an attractive candidate for application of HA removal from polluted environmental samples.

KEYWORDS : Green synthesis, nanoparticles, Fe_3O_4, Lycium chinense, adsorption capacity, isotherms model, kinetic study, humic acid.

CFD PREDICTION OF FLOW, HEAT AND MASS TRANSFER IN WOVEN SPACERS, OR THE STEADY-TO-TURBULENT REGIME

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ABSTRACT

Models of woven-spacer-filled channels were studied by Computational Fluid Dynamics (CFD) for the modelling of flow and heat/mass transfer in membrane distillation adopting spacer-filled channels in order to characterize the performance of (MD) modules. CFD simulations reached from steady state to turbulent conditions. The purpose of this study is to discuss some issues, which arise in heat or mass transfer in complex channels. Among the problems addressed are the consistent definition of local and mean heat or mass transfer coefficients; the influence of one-side versus two-side heat/mass transfer; the combined effects of the parameters that characterize the process (spacer pitch to channel height ratio P/H, flow attack angle γ and flow regime (from creeping to turbulent). A specific spacer aspect ratio (pitch-to-channel height ratio of 2, 3 and 4) and two different spacer orientations with respect to the main flow (0° and 45°) were considered. The finite volume code Ansys CFX 18 has been adopted to perform simulations. Predictions have shown that the existence of woven spacers in proximity of the membrane surface with the configuration P/H =2 and DEG =45° promises the best mixing conditions and heat transfer, thus contributing to the reduction of polarization phenomena.

KEYWORDS : Woven spacer ; Membrane Distillation ; Computational Fluid Dynamics ; Polarization phenomena.

EFFECT OF NANOPARTICLES TYPES IN THE PREPARATION OF NANOFILTRATION MEMBRANES USING PHASE INVERSION

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ABSTRACT

A new nanofiltration membranes containing different nanoparticles types (SiO_2, TiO_2, ZnO, Fe_2O_4) were prepared using cellulose acetate as polymer (22Wt%) via phase inversion technique. The FTIR, of SEM (surface and cross section), contact angle, porosity and water content analyzer were employed to characterize the surface morphology, physical and chemical properties membranes. Pure water flux and salts rejection (NaCl, Na_2SO_4) were determined for testing the membranes performances. The effect of nanoparticles in the membrane performance was investigated. The new nanofiltration membrane was used for retention of industrial model dye solution. The results indicated that new membranes could be successfully applied for the model dye removal.

OPTIMIZATION OF ELECTROCOAGULATION TREATMENT USING BOX-BENHKEN DESIGN ON SULFATE REMOVAL

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ABSTRACT

The main purpose of this work is to investigate sulfate removal from aqueous solutions by electrocoagulation (EC). The influence of electrolysis time, initial pH, and current density was carried out. The interaction of the several effects on removal efficiency was also studied. The Box-Behnken experimental design (BBD) in Response Surface Methodology (RSM) was applied in the development of statistical analysis, modelling, and interpretation of the resultant treatment data. The optimum conditions for highest removal ratio of sulfate from aqueous solution were: current density of 10 mA/cm^2, initial pH equal to 5 and electrolysis time of 60 min. Sulfate removal efficiency reach a maximum value of 98.76 % and the predicted value is 100 %. According to ANOVA results, the correlation coefficient (R2) value of 98 % proved that experimental data and model predictions agreed well. The R2adj and R2pred were also in a reasonable agreement (98 % and 95 % respectively). The mathematical model that describes the EC process was determined and proved that all variable had linear and quadratic significant effect on sulfate removal efficiency.

KEYWORDS : Sulfate removal, Electrocoagulation, optimization, Box-Behnken Design, Response Surface Methodology (RSM).

PERFORMANCE EVALUATION OF POLYMER INCLUSION MEMBRANES USING D2EHPA AS CARRIER

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ABSTRACT

In the present work, the separation of metal ions (Ni^{2+}, Pb^{2+}….) from aqueous solutions by synergistic extraction and transport through Polymer Inclusion Membranes (PIMs) has been investigated. PIM was prepared by casting solution containing cellulose triacetate (CTA) as polymer, di-(2-ethylhexyl) phosphoric acid (D2EHPA) as carrier, tris (2-butoxyethyl) phosphate (TBEP) as plasticizer and acetylated kraft lignin (AKL) as a filler. Lignin was incorporated into PIMs to evaluate the mechanical properties of CTA in acidic media. The PIM was characterized by several techniques, to obtain information on their composition and morphology, namely FTIR and SEM. Measurements of the contact angle are realized to have information on their hydrophobicity and roughness .The effect of membrane composition was investigated on the transport of metal ions The effect of metal ions concentration in feed phase and HNO3 concentration in strip phase were studied. The obtained results revealed that increasing the initial concentration of metal ions results in a saturation of the membrane and a decrease of the extraction efficiency. The best percentages of nickel and lead transported were obtained for PIMs containing CTA + D2HPA + plasticizer (TBEP). The addition of TBEP as plasticizer decreased the extraction time and improved the transport flow.

KEYWORDS : metal ions transport, Cellulose Triacetate, polymer inclusion membrane, D2EHPA, TBEP,

PAENIBACILLUS THERMALIS SP. NOV., A THERMOPHILIC, XYLANOLYIC AND CELLULOLYTIC BACTERIUM ISOLATED FROM HOT SPRING WATER IN TUNISIA

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ABSTRACT

Microbial xylanases have gained a constant interest in the last decades for many applications, such as enzyme-aided bleaching of paper (Paës et al., 2012), production of fuels or chemicals (Dodd and Cann 2009; Song et al., 2012) and food and animal feed industries (Collins et al., 2005; Dumon et al., 2012). Several bacteria within the genus Paenibacillus have been described as producers of diverse assortments of extracellular polysaccharide hydrolyzing enzymes, including xylanases (Rivas et al., 2003; Rivas et al., 2005a; Khianngam et al., 2009).

During a screening for xylanase-producing bacteria, strain HanTHS1T, was isolated from hot spring water in south Tunisia. The novel strain was thermophilic, facultatively anaerobic and Gram positive bacterium. Phylogenetic analyses based on 16S rDNA sequence revealed that the novel strain belongs to the genus Paenibacillus. It exhibited high 16S rDNA sequence similarity with its closest neighbor Paenibacillus phoenicis 3PO2SAT. The major cellular fatty acids were C16:0 (39.0 %), anteiso-C15:0 (27. 4 %) and iso-C16:0 (10. 5 %). The predominant quinone was menaquinone 7 (MK-7). The DNA G+C content was 54.5 mol %. Phenotypic , genotypic characteristics and DNA–DNA relatedness data indicate that strain HanTHS1T was distinguished from all the relative species of the genus Paenibacillus. Therefore, on the basis of the polyphasic taxonomic data presented, a new species Paenibacillus thermalis, with the type strain HanTHS1T (=DSM 18498T=LMG 23757 T) is proposed.

KEYWORDS : Tunisian water hot spring, thermophilic bacterium, xylanase, Paenibacillus thermalis sp nov

ANTIOXIDANT AND INSECTICIDAL ACTIVITY OF AQUEOUS EXTRACTS OF ARTEMISIA ABSINTHUIM AGAINST "APHIS FABAE" INSECT PEST OF THE BEAN

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ABSTRACT

The biochemical composition of Artemisia absinthuim leaves, the second is interested in characterizing the antioxidant and insecticidal activity of aqueous extracts of Artemisia absinthuim leaves against "Aphis fabae" bean pest insect. Analyses of the composition of total lipids, polyphenols and total flavonoids, organic matter, mineral matter and total tannins showed a significant variation in contents ($P<0.05$) according to the organ (leaf and stem). Indeed, lipid contents varied between 3.02±0.08% for the leaf and 1.89±0.2% for the stem. In addition, the maximum total phenol content was recorded in sheets 53.62±5.55 mg EAG/g. However, total phenol levels in the stems were 25.88±4.54 mg EAG/g dry matter only. For total flavonoids, the recorded levels were 25.61±6.57 mg EAG/g dry matter in leaves and 13.97±2.02 mg EAG/g MS in stems. Concerning the mineral and organic matter contents, the values varied between 11.94±0.25% and 88.06±0.25% in the leaves. For the rod, the contents varied between 7.6±0.46% and 92.38±0.46%. Finally, the total tannin content was 264.99±6.36 mg EAT/g dry matter for leaves and 159.08±18.67 mg EAT/g dry matter for stems. In addition, the evaluation of antioxidant activity revealed a good antioxidant efficiency of the extract from the stem part compared to the leaf part. Concerning insecticidal power, biological tests on insects of A. fabae have shown that the plant Artemisia absinthium has recorded a remarkable mortality rate that reaches 100% insect mortality. This study therefore showed that the aqueous extracts tested have an interesting bio-insecticidal activity. Overall, the results obtained are promising and open up new perspectives in the field of natural applications that can be a valid alternative to chemicals.

KEYWORDS : Artemisia Absinthium L., A. fabae L., Lipid, Polyphenols, Total Flavonoids

OPTIMIZATION TO PREPARE HIGH SURFACE AREA MICROPOROUS ACTIVATED FROM DATE PALM FIBER USING RESPONSE SURFACE METHODOLOGY ADOPTED WITH CENTRAL COMPOSITE DESIGN

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ABSTRACT

The aim of this study was to produce activated carbon derived from Date Palm Fiber with suitable characteristics as a good adsorbent. Central composite design and response surface methodology (RSM) were used for the optimization of the preparation conditions. The activation temperature, the activation time and the impregnation ratio were selected as the factors of the activation process to be optimized. The optimal conditions for preparing the biochar were 34 min, 432 °C and 1.41 for the activation time, activation temperature and the impregnation ratio, respectively. The experimental values of surface area and yield under these conditions correspond to the values of the expected optimized process. A large surface area (1720 m^2/g) was detected in the activated carbon produced, showing the great potential of Date Palm Fiber to be utilized as a raw material for the production of activated carbon with good adsorption properties. The best activated carbon samples were characterized with N2 adsorption desorption, SEM, FTIR and zeta potential.

KEYWORDS : Biomass, Activated carbon, Surface area, Response surface methodology, CCD, Optimization.

SEPARATION OF COPPER(II), CHROMIUM(III) AND NICKEL(II) USING A POLYMER INCLUSION MEMBRANE

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ABSTRACT

An experimental investigation of copper (II), chromium (III) and nickel (II) ions extraction and separation from nitric aqueous solutions by transport through polymer inclusion membrane (PIM) is presented. PIMs are formed by casting a solution containing a carrier (D2EHPA), a base polymer (CTA) and acetylated kraft lignin (AKL) as filler, to form a thin, flexible and stable film. The membrane was characterized to obtain information regarding its composition using FT-IR and SEM. Several important transport parameters such as D2EHPA amount, membrane thickness, stripping solution composition and feed phase pH are discussed. Cu(II) and Ni(II) ions were effectively removed from the source phase by transport through PIMs with D2EHPA into 1M HNO3 as receiving phase. In contrary, Cr(III) was not detected in the receiving phase. The best initial flux and permeability coefficient are obtained for D2EHPA average of 3.18 mg cm-2.

KEYWORDS : Polymer Inclusion Membrane; D2EHPA ; Acetylated kraft lignin ; Ions extraction and separation

OPTIMIZATION PROCESS OF BORON REMOVAL FROM WASTEWATER : COUPLING OF ELECTRODIALYSIS AND ADSORPTION

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ABSTRACT

A combination system electrodialysis/adsorption is investigated for the first time for the boron removal. The main purpose of this work is to study the removal of boron from brackish water. The Central Composite Design in combination with Response Surface Methodology was applied in the development of statistical analysis, modeling, and interpretation of the resultant treatment data of boron removal by ED-adsorption. The effect of factors affecting the hybrid process efficiency such as electrolyte concentration, pH of solution, electrodialysis time and adsorbent mass was studied. Analysis of Variance (ANOVA) showed that the quadratic model of boron removal is highly significant with a coefficient of determination R2 = 0.993. Pareto Chart indicated that pH and adsorbent have a significant effect on boron removal. Based on desirability function, the maximum value of the percentage removal of boron was predicted at 92.45 % and the optimum values of variables for the removal of boron by ED-adsorption are: an electrolyte concentration of 2.5 g/L, an adsorbent mass of 2.5 g and an electrodialysis time of 25 min.

KEYWORDS : adsorption, boron removal, electrodialysis, hybrid process, response surface methodology.

ELECTROCHEMICAL MINERALIZATION OF NANOFILTRATION CONCENTRATE OF LANDFILL LEACHATE USING TiOx ANODE AND Fe(II) Fe(III)-LDH MODIFIED CARBON FELT CATHODE

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ABSTRACT

The objective of this study was to implement electrochemical advanced oxidation processes (EAOPs) for mineralization enhancement of nanofiltration (NF) concentrate from landfill leachate initially pre-treated in a membrane bioreactor. For the first time, TiOx anode and FeIIFeIII layered double hydroxides-modified carbon felt (LDH-CF) cathode are used for treatment of a real effluent. Hierarchical FeIIFeIII-LDH was grown on CF as heterogeneous catalyst via solvothermal process. Electrochemical experiments were performed in open cylindrical batch reactor. Either a conventional carbon felt (CF, for homogeneous EF) or a FeIIFeIII-LDH/CF (for heterogeneous EF) cathode and either a Pt or a sub-stoichiometric titanium oxide (Ti4O7) anode was employed to carry out the treatment of a NF concentrate. Excellent mineralization of NF concentrate was achieved by heterogeneous EF with Pt anode after 8h of electrolysis, while homogenous EF with external addition of catalyst (Fe^{2+}) and adjustment of pH at 3 achieved lower mineralization rate. Combined electro-Fenton/anodic oxidation process using TiOx anode and LDH-CF cathode was the most suitable process for mineralization of organic pollutants with limited energy consumption.

ALGERIAN CLAY USED FOR WASTEWATER TREATMENTS

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ABSTRACT

Clay raw materials is used for the removal of several heavy metals present in wastewater.

The concentrations of several heavy metals were measured at entrance and exit of Bordj Bou Arreridj (BBA) Waste Water Treatment Plant (WWTP) in Algeria.

The WWTP removal results indicated that studied metals were removed with good efficiency in the treatment works, and concentration levels were below the safe limits allowed by the World Health Organization (WHO). However, in order to improve the elimination of these compounds from wastewater, Algerian raw kaolin was investigated. The sorption of these metals on Kaolin indicated a considerable removal percentage improvement for all elements, in particular Iron with 99.95%.

In addition to its higher removal efficiency performances for all elements, its low cost and its ease of use, the local Algerian kaolin could find potential applications as bed sorption step in WWTP.

KEYWORDS : Adsorption; Atomic absorption spectroscopy; Heavy metals; Removal; Wastewater.

VALORISATION DES EAUX USEES ISSUES DES REJETS FINS DES PHOSPHATES PAR COAGULATION-FLOCULATION

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ABSTRACT

Les phosphates naturels, de la zone minière du Bassin de Gafsa-Métlaoui au Sud de la Tunisie, enrichis par débourbage génèrent une large quantité d'eau boueuse nommée les rejets fins de lavage qui contiennent essentiellement des argiles. Ce travail consiste justement à déterminer les conditions optimales de clarification d'une eau argileuse préparée synthétiquement par addition à l'eau de robinet d'une quantité donnée de bentonite et d'heulendite pour une éventuelle utilisation industrielle.

L'optimisation et l'ajustement sur les paramètres physico-chimiques de l'eau traitée et des doses du coagulant et du floculant pour l'élimination des matières en suspensions (MES) et des matières colloïdales sur l'unité pilote ont contourné une solution pour les rejets fins industriels des phosphates. En effet, l'élimination optimale des MES et la déstabilisation des colloïdes par $Al_2(SO_4)_3$ et $FeCl_3$ est respectivement pour des pH entre 5,5 à 7,2 et 5,5 à 8,3 avec 58,5% et 82,9% d'élimination pour 14 mg/l et 9,4 mg/l respectivement. Au cours de la floculation, avec 2mg/l et 1.6mg/l en floculant FLOTINOR respectivement pour des solutions riche en $Al_2(SO_4)_3$ et de $FeCl_3$, on a remarqué que la turbidité a atteint des valeurs minimales de 0,72 NTU et 0,68 NTU pour des pourcentages d'élimination maximale des macro-flocs formés d'environ 98,69% et 98,76%.

DEVELOPMENT OF NOVEL MAGNETIC COMPOSITE Fe_3O_4/PINE WASTE GEL BEADS FOR HEAVY METAL REMOVAL: KINETIC AND ISOTHERM STUDIES OF BIOSORPTION PROCESS

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ABSTRACT

The use of magnetic biosorbents has gained a spread attention due to their eco-friendly characteristic, ease of separation and low cost. Herein, a novel biocomposite sorbent the magnetic pine cone beads (MPCBs) was synthetized and used to remove Cu (II) and Cr (VI) from wastewater. For comparison, three different types of beads: blanc beads, pine cones beads, Fe3O4 beads were also prepared. The structure and chemical properties of the prepared biosorbents were characterized by Scanning electron microscopy combined with energy dispersive X ray, Fourier transform infrared spectrometry (FTIR) and X ray diffraction (XRD) analysis. The influence of different parameters like contact time, pH, initial concentration on metal sorption was evaluated. The equilibrium data were fitted to Langmuir and Freundlich models and the results showed that the adsorption of Cu (II) and Cr (VI) was well described by Langmuir model indicating the possibility of monolayer sorption. Kinetic data showed good correlation with pseudo-second-order model. This study proves that the MPCBs hold great promise for using as effective biosorbent for heavy metals remediation.

ADSORPTION OF DYES ON ACTIVATED CARBONS : OPTIMIZATION AND INFLUENCE OF SURFACE CHEMICAL GROUPS

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ABSTRACT

The surface chemistry of a commercial activated carbon has been selectively modified, without changing significantly its textural properties, by means of chemical treatments, using HNO3, H2O2, NH3, and thermal treatments under a flow of H2 or N2. The resultant samples were characterized in terms of their surface chemistry and textural properties, and subsequently tested in the removal of different classes of dyes. It was shown that the surface chemistry of the activated carbon plays a key role in dye adsorption performance. The basic sample obtained by thermal treatment under H2 flow at 700 °C is the best material for the adsorption of most of the dyes tested. For anionic dyes (reactive, direct and acid) a close relationship between the surface basicity of the adsorbents and dye adsorption was shown, the interaction between the oxygen-free Lewis basic sites and the free electrons of the dye molecule being the main adsorption mechanism. For cationic dyes (basic) the acid oxygen-containing surface groups show a positive effect but thermally treated samples still present good performances, showing the existence of two parallel adsorption mechanisms involving electrostatic and dispersive interactions. The conclusions obtained for each dye individually were confirmed in the color removal from a real textile process effluent.

OPTIMIZATION OF THE ADSORPTION OF A FOOD DYE ONTO NANO-COAL USING A CENTRAL COMPOSITE DESIGN

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ABSTRACT

The main aim of this study was to evaluate the efficacy of nanoparticles of coal for the adsorption of E100 food dye from aqueous media. The experimental results were processed by response surface methodology based on a central composite design (CCD). The effect of four main variables, including initial E100 concentration, adsorbent dosage, reaction time, and temperature on the removal of E100 was evaluated by the model. The accuracy of the model and regression coefficients was appraised by employing analysis of variance. The results demonstrated a good agreement between the predicted values obtained by the model and the experimental values (R2 = 0.972). Accordingly, the maximum E100 removal of 97.32% was achieved with an initial E100 concentration of 60 mg/L, adsorbent dosage of 0.6 g/L, reaction time of 10 min, and initial temperature of 25°C. The results demonstrated the high efficiency of nano coal clay for the adsorption of E100 dye from aqueous solution based on the data processed by CCD approach. The adsorbent dosage was found to be the key factor that controlled dye adsorption. The adsorption kinetic and isotherm were also investigated. The rate of adsorption showed the best fit with the pseudo-second order model (R2 = 1). The results of the isotherm study fit the Freundlich model (R2 > 0.9). The physicochemical properties of the sample were determined by SEM and FT-IR.

STUDY OF CHROMIUM REMOVAL BY ADSORPTION ON ACTIVATED CHARBON SYNTHESIZED FROM BANANA PEELS

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ABSTRACT

Wastewater contamination by chromium becomes an important problem due to its widespread applications in industrial processes such as metallurgy, tanning industries, refractories and foundries. Chromium is harmful for environment and threatens the human health as it is a carcinogen element. The World Health Organization defined an upper limit of 0.05 mg L-1 in drinking water. Different studies were carried out on the efficiency of low cost natural adsorbents for heavy metals removal. This work focuses on the efficiency of chromium hexavalent removal by the biochar synthesis from banana peels by chemical modification with zinc chloride ZnCl2. Fourier transform infrared spectroscopy (FTIR), pH of zero charge, BET and Scanning Electron Microscopy (SEM) were used to characterize the biochar.

The characterization of the adsorbent revealed that the pH of zero charge is equal to 3.02, the specific area is about 1175 m2 g-1. A preliminary study of the influence of the various parameters on the elimination of chromium (VI) was carried out. The factors studied are: contact time, pH, adsorbent mass, and the initial concentration of hexavalent chromium. The results obtained show that equilibrium is reached after 120 minutes. The best elimination is obtained at pH equal to 2 and an adsorbent dose equal to 4 g L-1.

KEYWORDS : biochar, adsorption, banana peels, Chemical modification, Zinc chloride, Hexavalent chromium removal.

APPORACH TO A STUDY OF WASTEWATER FOR TREATMENT FOR RECYCLING

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ABSTRACT

The recycling of treated wastewater, with advanced treatment, will reduce the impact of liquid discharges on the environment.

Our study is part of this framework for the recycling of treated wastewater in an industrial process.

The study was done by carring out extensive treatment on an activated carbon- based material. This choice was studied on a matrix of treated wastewater. The results obtained are promising and the water quality produced corresponds to the water standards of the chosen process.

(It offers, moreover, on average, a corrosion rate, on the type of the material of the circuit and in the operating conditions of the installation of the process, of 0,055 mm/year.

KEYWORDS : environment, water recycling, adsoption, corrosion, water quality.

COMPARATIVE STUDY OF SEVEN SUPPORTS- ANIONIC TYPE : PREPARATIONS AND CHARACTERIZATIONS.

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ABSTRACT

This study is the synthesis of supports at different ratios, not calcined and calcined at 55O° C, to see the effect of the ratio on their physical properties, on their structure, their morphology and on the efficiency of their applications in the treatment by advanced oxidation process. The comparisons have been interpreted thanks to certain analyzes such as XRD, SEM-EDX, BET…

The effect of the acid-base properties of the supports on the degradation of a pollutant (as a model compound of recalcitrant wastewater molecules) was studied.

KEYWORDS : synthesis , nanocomposites, characterizations, waste water.

APPLICATION DE LA METHODOLOGIE DES PLANS D'EXPERIENCES POUR LA PREPARATION D'UN CHARBON ACTIF A PARTIR DES BRANCHES DU HENNE (LAWSONIA INERMIS)

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RESUME

Les charbons actifs occupent une place privilégiée dans la purification de l'eau, la décoloration des huiles, la fixation des colorants et le traitement des gaz à cause de leur grande capacité d'adsorption, liée à leur grande surface spécifique et au développement de leur porosité.

Dans le cadre de la valorisation de la biomasse, il nous a semblé opportun de préparer un charbon actif à partir d'un sous produit végétal (branches de Henné) en vue de son application comme adsorbant pour l'élimination des polyphénols et la fixation des colorants.

La préparation du « bio-charbon » comporte deux étapes essentielles :

- Une activation chimique avec l'acide phosphorique
- Une carbonisation à 600°C sous atmosphère de vapeur d'eau.

L'optimisation de trois paramètres de préparation (Concentration d'acide phosphorique utilisé pour l'activation chimique, Rapport H_3PO_4/matière végétale et temps de carbonisation) a été effectuée en faisant appel à la méthodologie de planification des expériences (plan de Doehlert).

Le bio-charbon obtenu dans les conditions optimales a présenté une surface spécifique de 954 m^2/g et des capacités d'adsorption de Catéchol et de Bleu de méthylène, respectivement, de 29,6 mg/g (pour une concentration initiale de 50 mg/l) et 17,2 mg/g (pour une concentration initiale de 30 mg/l).

MOTS CLES : Charbon actif, Branches de Henné, adsorption, Catéchol, plan d'expériences

TRAITEMENT DES EAUX USEES RICHES EN COLORANTS PAR ELECTROCOAGULATION/BIO-FLOCULATION : OPTIMISATION DES PARAMETRES DU PROCEDE DE TRAITEMENT PAR PLANIFICATION DES EXPERIENCES

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RESUME

L'électrocoagulation est un procédé électrochimique basé sur le principe des anodes solubles. Il consiste à générer, en imposant un courant continu entre des électrodes en fer ou en aluminium, des cations métalliques Al^{3+} ou Fe^{2+} qui jouent le rôle de coagulant permettant la déstabilisation des particules colloïdales en suspension dans l'eau. Cette technique a montré son efficacité pour le traitement de certains effluents liquides chargés en polluants solubles tels des métaux lourds, des matières organiques, ou des colorants.

D'autre part, de nouveaux travaux de recherche ont montré que certains floculants d'origines naturelles, nommés bio-floculants, peuvent être utilisés pour remplacer les floculants synthétiques avec l'avantage de biodégradabilité.

Le présent travail a pour but d'étudier les performances du couplage de l'électrocoagulation avec la bio-floculation pour le traitement d'un rejet hydrique issu de l'industrie de textile, contenant un colorant bleu à une concentration de l'ordre de 1g/L. En effet, un dispositif expérimental muni d'un générateur de courant continu variable et utilisant des anodes solubles en aluminium immergées dans une cuve contenant le rejet à traiter.

L'évaluation de la performance du procédé l'électrocoagulation/bio-floculation est évaluée via les réponses suivantes la matière en suspension (MES), la demande chimique en oxygène (DCO), la concentration résiduelle du rejet (CR)

Une étude préliminaire a permis de déterminer les principaux facteurs ayant une influence sur l'efficacité du traitement et leurs domaines d'études, à savoir le pH (1 à 9), la densité du courant (50 à 550 A/m^2) et le temps d'électrocoagulation (10 à 60 min).

Une optimisation de ces trois paramètres de fonctionnement, réalisée se basant sur la méthodologie des plans d'expériences (plan de Doehlert), a permis de déterminer les conditions optimales de fonctionnement du procédé, à savoir : pH=8, $J=471 A.m^{-2}$ et t = 39min. Avec ces paramètres de fonctionnement, les valeurs estimées des réponses sont MES = 17,00mg/L, DCO = 959mg de O_2/L et CR = 0,182mg/L.

MOTS CLES : Electrocoagulation, bio-floculation, plan d'expériences,

TREATMENT OF DAIRY WASTEWATER BY MACROPHYTES-WHEY RECOVERY BY COMPOSTING

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ABSTRUCT

The results of physico-chemical analyze of dairy waste water and whey reveal that these discharges are incompatible with the Tunisian standards of discharge into public connection. Therefore, they must be treated before being released into the natural environment. The proposed treatment system of sewage and whey is the artificial filter beds planted by macrophytes. That system is intended to protect the environment, safeguarding the components of natural wealth and specially to offer a possibility of reuse of treated wastewater in the agricultural domains.

Several water quality parameters including BOD5, COD, TSS, TKN and TP in raw and treated wastewaters were controlled during a macrophysic life cycle. This treatment system has proven its performance to reduce these parameters with a maximum whey concentration of 20%.

In addition, we measured environmental parameters such as pH, electrical conductivity, temperature, and dissolved oxygen to control the progress of the wastewater treatment process.

At the same time, the growth of the rooted plants, reeds, papyrus and vetiver was investigated through the measurement of the height and leaves number. The average influent characteristics were as follows: BOD (15100 mg/l), COD (25300 mg/l), TSS (15200 mg/l), TKN (395 mg/l), TP (161 mg/L). the main treatment performance results showed the following average removal rates: BOD (97%), COD (80%), TSS (99.6%), TKN (90.4%), TP (99.6%).

Analysis of the results reveals a temporal variation in the system's performance depending on the primary treatment operation and on the macrophytes growth rate and the quality of the treated wastewaters was evaluated according to Tunisian standards. The average effluent BOD, COD, TSS, TKN, and TP agreed with the standards.

The use of composting as a whey recovery method has been adopted, whose monitoring of the physicochemical parameters of the windrow has shown the good composting process using whey mixed with green waste and grain dust as compost.

The parameters of compost maturity ensure the good quality of the humus. Indeed, at the end of the composting, the C / N ratio, reached by the composts (OC3, OC2, and OC1), is near to 10. The results of the analyzes are conform to the Tunisian standards, which makes the three composts usable. By adding germination tests, it can be confirmed that humus from whey is the best choice to use.

CMTDE 2019

The 7th Maghreb Conference on Desalination and Water Treatment

Supported by

TUNISIAN REPUBLIC
MESRS

Ministry of Higher Education and Scientific Research

Laboratoire de Recherche "Dessalement et Traitement des Eaux"
LRDTE
Code : LR19ES01
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