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EFFECT OF DIFFERENT PARAMETER CLIMATIC IN SSD AND SSDHP

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The world demand for potable water is increasing every day with growing population. Desalination using solar energy is suitable for potable water production from brackish and seawater. In this paper, we present experimental study of solar distillation in tow configuration SSD and SSDHP a single basin under the open environmental conditions of Gabès (south Tunisia). The still has a base area of 1m² with a glass cover inclined at 30° in order to obtain extra solar energy. These parameters include system design char-acteristics and the climatic conditions. During the sunshine period, the layer is covered with glass layer where desiccant is regenerated and water vapor is condensed on the glass surface. Ambient temperature, bed temperature and temperature of glass surface are recorded. Also, the productivity of the system has been evaluated. The average solar radiation received is 800 W/m. The daily average efficiency of the still was found to be 45%. A 2.9 l/m²/d distillate yield is obtained with the SSD configuration and 12 l/m²/d for SSDHP.

WATER DEFLUORIDATION USING NANOFILTRATION-THIADIAYE (SENEGAL) THE FIRST WORLD UNIT

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The possibility of producing drinking water from brackish groundwater polluted with F^- using nanofiltration (NF) process was previously studied at pilot scale. Brackish groundwaters were taken from the south of Morocco (Tan Tan city) and from the center west of Senegal (Thiadiaye City). The performances of few commercialized NF spiral wound elements, low pressure reverse osmosis (LPRO) and reverse osmosis (RO) were compared to a large scale pilot experiments (membrane area 7.6 m^2). The following parameters were determined : hydraulic permeability, total salinity and Cl^-, F^- and SO_4^{2-} removals were compared under the influence of various experimental parameters such as flow yield ratio, transmembrane pressure, energy consumption and water compositions before and after treatment. This study shows that NF90 membrane provides specific advantages for fluoride removal as compared to LPRO and RO. Indeed, NF permits to reduce partially the total salinity and to reject selectively fluorides with a high flow yield ratio, at low pressure (lower than 10 bars) and therefore with a low energy consumption as compared to actual RO membranes [1]. Furthermore, this communication presents **the first NF plant in the world dedicated to water defluoridation by nanofiltration** and built recently in Thiadiaye (Senegal) (fresh water production 33 000 L/h for a rural drinkable water consumption).

Keywords : *Water Treatment, Desalination, Defluoridation, Nanofiltration, Reverse osmosis.*

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[1] M. Pontié, H. Dach, J. Leparc, M. Hafsi, A. Lhassani, Desalination 221 (2008) 174–191

VALORISATION OF ACTIVATED SLUDGE IN THE ELIMINATION OF DYES

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To appraise a new methodology for removal of blue methylene by materials produced by an activated sludge waste treatment plant, adsorption tests were performed according to a new approach developed at the University Laval which involves a use of a visible spectrophotometer / UV. The results showed that the procedure used eliminates the interpretation of the formation of the aureole, an error factor that was found with the filter paper method.

The dye adsorbs more easily with a contact time of 5 minutes. This gives a very high affinity compared to this support. The best process is represented by Langmuir. In addition the stirring time in the spectrophotometer method is the same (5 minutes); it allows a complete adsorption of the dye molecules.

The analysis of fine particles of the mud (< 80µm) subject to adsorption tests showed that the blue value is strongly influenced by the state of the grain surface (the state of damage to the grain) and the specific surface area. It was also noted that over the state of grain surface is damaged (long stirring time) plus the blue value will be.

BIOSORPTION OF COPPER (II) FROM AQUEOUS SOLUTION USING CELLULOSIC WASTE ORANGE PEEL

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This paper discusses about the adsorption of copper ion Cu^{2+} from aqueous solution by cellulosic waste orange peel (CWOP).The adsorption process depends on the solution pH, adsorbent dose, contact time, initial metal ion concentration and agitation speed. The adsorption kinetics was relatively fast and equilibrium was reached at 50min. The adsorption equilibrium follow Langmuir adsorption isotherm model. The maximum adsorption capacity value of the (CWOP) for copper ion was 40mg/g. The thermodynamic study shows the adsorption of copper ion onto (CWOP) was spontaneous and exothermic in nature. The external mass transfer kinetic model was applied to the experimental results and provided reasonable overall volumetric mass transfer coefficients.

NOUVELLE APPROCHE POUR L'ÉLIMINATION DES NITRATES

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The processes of adsorption which are the subject of this study tend to develop quickly and are mainly used for the elimination of polluting compounds. In practice,claysconstituted anatural barrier againstgroundwater pollution. Theycan function as afi1tre, which prevents the passageofcharge elements [Baskw and Hanshawb, 1965; Hassani, 1987].

Theexperiences do up to now show that theclay has, in the raw state, adsorbing propertiesopposite to various organic structures. [Degrémont, 1989; Essington, 1994; Ferrandon, 1998; M'leyeh, Srasra and Cheref, 2002; Seghairi, 1998 ; Achour, 2004 ; Marchaland Barret, 1995]

A representative sampleis collected in thevadose zoneand then groundand analyzed. So the adsorption isotherms nitrates by this clay for two states:enabledandgross, arestudied.

The maximum amountadsorbedisdetermined from thelevel ofthecorrespondingisotherm.it is is evaluating the ability ofionic adsorptionof fine particlesof materials,but not reallythe amount ofclay particlesresponsible forwater retention.

The best resultswere obtained foran activation timeof60 minutes for therawclay. Itsavessothat the bottom ofthe sabkhaisan unpolluted area.

DIFFUSION AND PERMEATION PROPERTIES OF LOW DENSITY POLYETHYLENE

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There is a direct relationship between the diffusion and relaxation of the polymer and on whether we place ourselves below (glassy state) or above (rubbery state) of the glass transition temperature Tg, the diffusion mechanisms are very different. On a fundamental level, the transition temperature (Tg) marks the transition from a cooperative mobility (T> Tg, rubbery state) to a localized mobility (T <T g, glassy state). Fickian diffusion in polymers is an idealized case of mass transport, corresponding to a free diffusion of permeant without interactions with the molecular conformation of the polymer and then with its structural relaxation.

There are two types of models to describe the variation of the diffusion coefficient D. In this contribution, we will review the different behaviors of the distribution function of the Tg and show us the Deborah number D⍰ defined as the ratio of characteristic times of diffusion and relaxation, to indicate the nature of dissemination and to apply the model. As a practical example we have studied the case of low density polyethylene manufactured and processed by the national Algerian plastic society ENPC

STUDY OF THE IMPACT OF LIQUID WASTE OF KAHRAMA PLANT ON THE MARINE ENVIRONMENT
STUDY THE QUALITY OF PRODUCED DRINKING WATER

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The assessment of water resources in Algeria reveals the problem of scarcity of drinking water, especially in the Oran region. The worrying situation confirms that the current and future needs of the region for water can only be covered if we turn to unconventional sources such as desalination of seawater.

Thanks to the ambitious program initiated in 2002, to build a total of 43 desalination plants by 2019, Algeria became the second Mediterranean country after Spain.

Thus, the first station of seawater desalination (factory Kahrama) for the production of drinking water with a capacity of 88 888 m^3/d, has started in the Oran region on the August 2^{nd} ,2005. The Kahrama plant occupies a strategic place in the drinking water production of Oran, currently contributing to the network water supply with a rate of 38% of water resource.

The aim of this study is to evaluate the impact of liquid waste of Kahrama plant on the marine environment, and study the quality of produced drinking water.

We have first evaluated the impact of liquid waste of Kahrama plant on the marine environment. The results of our study have allowed us to conclude that the effluents salinity and the used anti scale and anti foam agents have a low toxicity and are present in low concentrations not harmful to marine organisms. However, heavy metal due to corrosion and thermal pollution are characteristics of Kahrama effluents. These characteristics are kept below allowable limits.

Secondly, we have studied the quality of produced drinking water of kahrama plant. Drinking water produced by Kahrama plant has the characteristics of slightly soft mineralized water. High values of temperature and pH are detrimental factors which may affect the quality of water; however the low mineralization and the absence of undesirable substances are the strong points which allow the mixing of kahrama water with dam water and improve the drinking water for consumers.

***Keywords**: liquid waste, desalination, salinity, drinking water, thermal pollution*

L'évaluation des ressources hydriques en Algérie permet de constater la problématique de la rareté de l'eau potable, particulièrement dans la région oranaise. La situation préoccupante confirme que les besoins en eau actuels et futurs de cette région ne peuvent être couverts que si l'on se tourne vers des sources non conventionnelles comme le dessalement de l'eau de mer.

Grâce au programme audacieux initié en 2002 et qui prévoit au total, la construction de 43 stations de dessalement d'ici 2019, l'Algérie est passé au deuxième rang méditerranéen derrière l'Espagne.

Ainsi, le 2 aout 2005 la région oranaise s'est vu dotée de la première station de dessalement d'eau de mer (usine kahrama) pour la production d'eau potable avec une capacité de 88 888m^3/j. L'usine de Kahrama occupe une place stratégique dans l'alimentation en eau potable de la wilaya d'Oran avec un taux de 38 % des ressources en eau concourant actuellement à l'Alimentation du réseau AEP .

Dans le cadre de ce travail, nous avons évalué l'impacte des rejets liquides effectués par l'usine de Kahrama sur le milieu marin et étudié la qualité de l'eau potable produite et l'évolution de la qualité depuis le point de production jusqu'aux consommateurs.

Nous avons dans un premier temps, évalué les impacts dus aux rejets liquides de l'unité de dessalement Kahrama sur le milieu marin. Les résultats obtenus nous ont permis de conclure que la salinité des rejets liquides ainsi que les agents antitartre et anti mousse ont une faible toxicité et sont présents en concentrations qui ne nuisent pas aux organismes marins. En revanche, les métaux lourds dus à la corrosion et la pollution thermique sont des caractéristiques des rejets liquides de l'usine de Kahrama. Ces caractéristiques n'étant pas modifiées par la dilution et le mélange des courants d'effluents pouvant en renforcer les impacts, il est fait en sorte à ne pas dépasser les limites admissibles de rejet correspondantes.

Dans un deuxième temps, nous avons étudié la qualité de l'eau potable produite par l'usine de Kahrama qui a les caractéristiques d'une eau douce peu minéralisée. Les valeurs élevées de la température et du pH sont des facteurs défavorables qui peuvent nuire à la bonne qualité de l'eau potable, par contre la faible minéralisation ainsi que l'inexistence des substances indésirables sont les points forts qui permettent de mélanger l'eau de Kahrama avec l'eau de barrage de Gargar et d'améliorer la qualité de l'eau potable obtenue.

***Mots clés** : rejets liquides, dessalement, salinité, eau potable, pollution thermique.*

ENZYMATIQUE TRAITEMENT OF DIRECT YALLOW 106 BY PURIFUD PEROXIDASE OF CUCURBITA PEPO

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Treatment of synthetic dyes in waste water is a matter of great concern. Several physical and chemical methods have been employed for the removal of dyes. However, these procedures have not been widely used because they representing some disadvantages. Extensive research has been directed towards developing processes in which enzymes are employed to remove direct dyes from polluted water.

In this study, the objective is to shown the efficiency of a new C-peroxidase extracted from a local source of zucchini (cucurbita pepo) in treatment of direct yellow 106. The extracted peroxidase was partially purified using precipitation by acetone method and purified by size-exclusion chromatography G100 Sephadex. Activity of free and immobilized C-peroxidase was assessed by employing 4-aminoantipyrene method involving colorimetric estimation using phenol and hydrogen peroxide as substrates and 4-aminoantipyrene as chromogen.

The specific enzyme activity were 1.12 $IU.mg^{-1}$ and 2.01 $IU.mg^{-1}$ for purified and partially purified peroxidase respectively. The C-peroxidase used in treatment of direct dye was in two form: free and immobilized in beads of calcium alginate.

The optimal conditions for immobilization of C-peroxidase in Ca-alginate were identified. The immobilization was optimized at 2%(w/v) of sodium alginate and 0.2 M

of calcium chloride. The optimization of treatment parameters, indicate that at pH 2, dye concentration: 30 mg/L (for FCP) and 80 mg/L (for ICP), hydrogen peroxide dose: 10 mM (for FCP) and 5mM (for ICP) the decolourization by free and immobilized C-peroxidase were 97% and 37 % respectively. After optimization of parameters, contact time is reduced for free peroxidase from 30 min to 5 min and for immobilized form from 60 min to 15 min.

Also, the activity of C-peroxidase was tested in presence of organics and mineral reagents. The glucose, ethanol and the ascorbic acid were inhibitors and the iron (II) sulfate was an activator.

The degradation pathway and the metabolic products formed after the degradation were also predicted using UV–vis and FTIR spectroscopy analysis.

Key words: *C-peoxydase, purification, direct yellow 106, decolourization.*

EVALUATION DE L'IMPACT DE LA PARTICIPATION PAYSANNE DANS LES AMENAGEMENTS HYDRO AGRICOLES

(Cas des programmes de formation PMH Nord Marocain)

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En 1996, l'aménagement des périmètres irrigués de la Petite et Moyenne Hydraulique (PMH) des provinces du mord marocain, a connu plusieurs projets de réhabilitation intégrés dans le cycle de projet participatif. S'inscrivant dans une nouvelle approche, la Gestion Participative de l'Irrigation (GPI), la principale composante du projet d'aménagement était la mise en place des Associations des Usagers des Eaux Agricoles (AUEA) pouvant prendre en charge la gestion et l'exploitation de l'infrastructure et des équipements en place et s'impliquer d'une façon concrète dans les différentes phases du projet d'aménagement, allant de l'identification, la contribution dans les études, le contrôle des travaux et au mesures d'accompagnements à travers les formations et le suivi évaluation.

La présente communication essais de faire un diagnostic sur la participation des usagers dans ces projets, à travers, le diagnostic des Associations des usagers des eaux agricoles et leur fonctionnement, leur participation dans les différentes phases de réalisations pour en mettre les points sur les facteurs qui freinent cette dynamique participative dans les phases de ces projets pour en tirer les enseignements pour des projets similaires en irrigation.

Toutefois, on relève de multiples formes d'appropriation et des points forts de cette approche participative à travers l'instauration de nouveaux partenariats de travail entre Usagers, entreprises et administration, la formation de nouveaux leaders et la crédibilisation des interventions étatiques dans ces zones sensibles.

ANALYTICAL STUDY FOR WATER RESOURCES IN SABER MOUNTAIN, TAIZ, YEMEN

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The present research aimed to analytical study of the water resources in the area of study. The area of study receive significant amount of rain fall ranging between 500 - 1000 mm / year. The research deals the possibilities of water resources (surface and groundwater), and analysis of their geographical distribution in the area of study. In the present study, the estimation of the flow accumulation and the peak discharge during the maximum rainfall were computed and calculated using WMS8.1and ArcHydro9 programs. The accomplished results show that accumulated flow of parts of main wadis ranged between 10583 and 51142 m^3, while values of the expected total surface runoff during peak intensity in one day ranges between 336600 and 2143700 cubic meter per day. Through the study of groundwater and the status of water bearing formations, and their occurrence forms both in the form of the springs or wells, a map was constructed to show some places which will be subjected to depletion of groundwater aquifers possibilities. The presence and durability of surface water and groundwater is directly proportional to the amounts of rainfall, and due to these reasons, the citizens began to conserve the water to be use in the dry seasons for their needs as drinking and other domestic uses. GIS programs were be used in the various stages of the research, as well as machinery methods.

Key words*: Groundwater, Surface water, Water resources, Watersheds, Yemen.*

ESTIMATION DU FLUX DE MASSE ET DE CHALEUR D'UNE INSTALLATION DE DISTILLATION A DETENTES ETAGEES (MSF) COUPLEE A UN CAPTEUR CYLINDRO PARABOLIQUE POUR LE DESSALEMENT D'EAU DE MER

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Water and energy are two of the most important issues on the international environment and development. The modern social and economic health depends on the sustainable supply of energy and on water. Many areas around the world whichsuffer from shortages of potable water are increasingly dependent on desalination which is a very reliable source and unconventional production system of potable water. Thus, the market for desalination of seawater increased dramatically in recent decades and is expected to continue in the years to come. The water supply in Algeria today is based for a large part on desalination. In Algeria, the direct irradiation, used for concentrated solar thermal systems exceeds 2900kWh/m2 in some areas. The objective of this paper is to determine the amount of potable water produced in a desalination plant using the process Multi-Stage Fleche (MSF) equipped with a Parabolique -Through Collectors field (PTC). The results show that the rate of production per unit area is about 11.36 l/m^2 for Oran and 15.65 l/m^2 for Touggourt.

Keywords: *Sustainable water desalination, PTC, Solar flux.*

RESUME

L'eau et l'énergie sont des sujets les plus importants pour l'environnement international et le développement. La santé économique et sociale moderne dépend de l'approvisionnement durable en énergie et en eau. Beaucoup de zones à travers le monde qui souffrent de la pénurie d'eau douce sont de plus en plus dépendante du dessalement qui est une source très fiable et non conventionnelle de production d'eau douce. Ainsi, le marché du dessalement d'eau de mer a considérablement augmenté ces dernières décennies et devrait se poursuivre dans les années à venir. L'approvisionnement en eau aujourd'hui en Algérie repose en grand partie sur le dessalement. En Algérie, l'irradiation directe, utilisée pour les concentrateurs solaires thermiques dépasse les 2900kWh/m^2 dans certains régions. L'objectif de ce papier consiste à déterminer la quantité d'eau douce produite par une installation de dessalement utilisant les procédés Multi-Stage Flache (MSF) et équipée d'un champ solaire à Concentrateurs Cylindro-Paraboliques (CCP).Les résultats montrent que le taux de production par unité de surface est de l'ordre de 11,36 L/m2 pour le site d'Oran et 15,65 L/m2 pour le site de Touggourt.

Mots Clés : *Dessalement d'eau durable, CCP, flux solaire.*

SPECIFC SORPTION OF COMPLEX ORGANIC MIXTURES FROM RIVER WATERS ON LAYERED MONTMORILLONITES : AN ICR-FTMS INVESTIGATION ON A MOLECULAR LEVEL

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Aqueous solutions of natural organic materials (NOMs) from Suwannee River were contacted with clays materials to study their specific adsorption and/or possible alteration by combined high resolution ICR-FTMS (soluble NOMs) and FTIR (sorbed NOMs). The measured several tenths of thousands of exact masses allowed the calculation of sum formulas of soluble NOMs and their visualization in Van Krevelen diagrams. While clays retain aromatic molecules through an original mechanism, materials adsorb less bulky compounds, due to their shape selective properties. A 12 Tesla Apex-Q Fourier transform ion cyclotron mass spectrometer (Bruker, Bremen, Germany) using flow injection mode and electrospray (ESI) infusion ionizations, described in detail in[1], was used to analyze the probes. Aqueous NOM samples extracted by reverse osmosis from Suwannee river water collection standards (SRFA) provided by the International Humic Substances Society (IHSS), were stirred at ambient temperature for 48 h with layered aluminosilicates, to study structure-specific sorption phenomena. The clays used were montmorillonite 2 (Mont-2) from Mostaghanem region, Nord Ouest, Algeria ; The bentonite (bento) from the deposit of M'zila, (ENOF) Mostaghanem unity and the montmorillonite 1 (Mont-1) from Roussel Maghnia deposit, North West Algeria.

***Key Words** : Clays, Specific adsorption, Natural organic matter, Van Krevelen diagrams.*

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THE EFFECT OF HYDRODYNAMICS REGIMES OF BUBBLE ON THE INDUSTRIAL WASTEWATERS TREATMENT BY ELECTROFLOTATION PROCESS

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In this work, we propose to study the effect of liquid phase physicochemical parameters and current density applied at the electrodes of an electroflotation column on bubbles hydrodynamics regimes. The method of video recording and image processing was used to determine the diameter and the rise velocity of bubbles, and gas retention. This study has allowed us a better understanding of the transition from laminar to turbulent bubble regime. As a result, an optimization of the treatment of industrial effluent from paper industry was done. The treatment consists of maximizing the efficiency of removal of suspended solids contained in the wastewater. The optimization includes both batch and continuous modes.

Keywords: *Optimization - Treatment - electroflotation - hydrodynamic - Wastewater*

ETUDE DE L'EFFET DES REGIMES HYDRODYNAMIQUES DES BULLES SUR LE TRAITEMENT DES EAUX USEES INDUSTRIELLES PAR LE PROCEDE D'ELECTROFLOTTATION

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Dans ce travail, on se propose d'étudier l'effet des paramètres physicochimiques de la phase liquide, ainsi que la densité de courant appliquée au niveau des électrodes d'une colonne d'électroflottation sur les différents régimes hydrodynamiques des bulles générées. La méthode d'enregistrement vidéo et traitement d'images a été utilisée comme support pour déterminer le diamètre et la vitesse ascensionnelle des bulles générées, ainsi que la rétention gazeuse. Cette étude nous a permis une meilleure connaissance de la zone de transition du régime laminaire des bulles vers le régime turbulent. Ceci a permis en outre l'optimisation du traitement d'un effluent industriel issu d'une industrie de papeterie. Le traitement consiste à maximiser le rendement d'élimination des matières en suspension contenues dans cette eau usée. L'optimisation comporte les deux modes batch et continu.

Mots clés : *Optimisation – Traitement – Electroflottation – Hydrodynamique – Eaux usées*

ETUDE CINETIQUE ET MECANISME DE DEGRADATION EN MILIEU AQUEUX D'UN ACARICIDE : LE CARZOL

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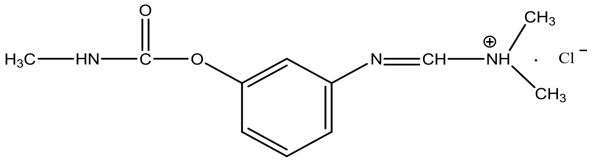
L'utilisation intensive des pesticides dans l'agriculture moderne a conduit à des problèmes sérieux au niveau de la qualité des eaux superficielles ou souterraines, ce qui conduit au développement de maladies et à la destruction de la faune et de la flore.

Le contrôle de cette pollution ainsi que l'élimination de ces composés en milieu aqueux devient impératif. Il est par conséquent important de porter un grand intérêt à leur capacité à subir une dégradation.

Le Carzol ou chlorhydrate de N-méthylcarbamate de(E)
3-diméthylaminométhylène- aminophényle est un composé bifonctionnel qui appartient aux familles chimiques carbamate et formamidine de formule semi-développée suivante :



Le Carzol est considéré comme un efficaceacaricide utilisé pour le traitement de certains fruits**(**le pamplemousse, le citron, la lime, l'orange, les pommes, les poires, les nectarines et les pêches) etdes semences. Il agit par inhibition de l'enzyme acétylcholinestérase comme tous les carbamates insecticides,et par inhibition de l'octopamine comme tous les formamidines acaricides. Vu son faible coefficient de partage octanol/eau (K_{ow} = 0,602) et sa pauvre adsorption par le sol, le Carzol est un contaminant à potentiel élevé des eaux de surface. L'OMS et la FAO classent cet acaricide parmi les produits fortement cancérogènes. D'après la littérature, il en ressort que les réactions d'hydrolyse et d'hydroxylation constituent les principales voies de dégradation des carbamates et des formamidines dans l'eau.

Dans ce travail nous nous sommes intéressées à l'étude cinétique par Spectrophotométrie UV de la réaction d'hydrolyse du Carzol, en milieu aqueux. La mise en évidence du N-méthylcarbamate de 3-aminophényle et du 3-aminophénol comme produits d'hydrolyse du Carzol, a montré la grande réactivité de la fonction formamidine par rapport à la fonction carbamate de l'acaricide. La valeur négative de la variation de l'entropie d'activation $\Delta S^{\#}$ obtenue pour la réaction d'hydrolyse du formamidine est en faveurd'un mécanisme $B_{AC}2$ impliquant une addition lente de l'ion hydroxyde sur le carbone de la fonction formamidine pour former un composé tétraédrique.

Alors que, l'hydrolyse de la fonction carbamate du Carzol peut mettre en jeu deux schémas réactionnels du type $B_{AC}2$ ou E1cB pour lequel il y a formation de l'isocyanate de méthyle. Du même type que celui mis en jeu dans la dégradation hydrolytique des carbamates N-monosubstitués tels que le Bendiocarb [1] et le Zectran [2], la mise en évidence de cet intermédiaire dans le milieu réactionnel est très difficile en raison de l'extrême fugacité de ce composé. La valeur positive de la variation de l'entropie d'activation $\Delta S^{\#}$ obtenue pour la réaction d'hydrolyse du Carzol et l'absence de catalyse basique générale sont en faveurd'un processus d'élimination unimoléculaire du type E1cB.

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[1] F. Boujelbane et N. Ben Hamida, Journal de la Société Chimique de Tunisie., 2007, 9, 121-132.

[2] F. Boujelbane et N. Ben Hamida, Journal de la Société Chimique de Tunisie., 2008, 10, 39-51.

EQUILIBRIUM, THERMODYNAMIC AND KINETIC INVESTIGATIONS ON BIOSORPTION OF ZINC FROM AQUEOUS SOLUTION BY DRIED ACTIVATED SLUDGE BIOMASS

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The biosorption characteristics of zinc (II) from aqueous solution using activated sludge biomass were investigated in terms of equilibrium, thermodynamics and kinetics. Optimum biosorption conditions were determined with respect to pH, biomass concentration, contact time, and temperature. Langmuir, Freundlich and Dubinin–Radushkevich (D–R) isotherm models were applied to the equilibrium data. The maximum Zn (II) sorption capacity of activated sludge was found to be 81.1 mg/g at pH 5, biomass concentration 4 g/L, contact time 30 min, and temperature 20 °C. The calculated mean biosorption energy (10.2 kJ/mol) using D–R model indicated that the biosorption of Zn (II) on the biomass was occurred by chemical ion exchange. The highest desorption efficiency (95%) was achieved using 0.5M HCl. The biosorption capacity of activated sludge slightly decreased about 10% after ten times of sorption–desorption process. The calculated thermodynamic parameters showed that the biosorption of Zn (II) onto activated sludge biomass was feasible, spontaneous and exothermic, respectively. The experimental data was also examined using the Lagergren's first-order and pseudo-second-order kinetic models. The results revealed that the pseudo-second-order kinetic model provided the best description of the equilibrium data.

Based on all results, it can be also concluded that the dried activated sludge biomass can be evaluated as an alternative biosorbent for the treatment of wastewater containing Zn(II) ions, due to its being low-cost biomass and having a considerable high sorption capacity.

Keywords: *Biosorption; Activated sludge; Zinc; Biosorption kinetic; thermodynamic parameters.*

INVESTIGATION OF 7-(DIOCTYLAMINO)METHYL)QUINOLINE-8-OLFOR UPTAKE AND REMOVAL OF BISMUTH IN WATER

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A new 8-hydroxyquinoline derivative extractant was synthesized via the Mannich reaction from a secondary amine. Various analytical techniques (^{1}H, ^{13}C NMR, FTIR, Mass spectroscopy) were used to characterize our product. The use of this new extractant for the uptake and removal of bismuth ions in aqueous solution was investigated. Conditions for an effective sorption were optimized with respect to different experimental parameters in batch process. The results showed that the extraction rate increases for solutions with a pH in the range [0.65-1.13]. The total sorption capacity was 105 ($mg.g^{-1}$) under optimum experimental conditions. The extraction of Bi(III) was found to be quantitative (100%) at initial bismuth concentration less than or equal to 41.59 mg/L . Thermodynamic parameters showed the adsorption of an endothermic process and a spontaneous nature, respectively.

Keywords : *solvent extraction, Mannich reaction, Bismuth, 8-hydroxyquinoline derivatives.*

SYNTHESISAND CHARACTERIZATION OFMESOPOROUS MATERIALSBASED ON SILICA

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Textile industry Effluents contains large quantities of synthetic organic dyes. Their release into the receiving environments without any treatment creates potential harm to the environment. Thus the reduction of pollutionat source, and the treatment of these effluents are proving an absolute necessity.

Mesoporous silica, since their discovery in the early 90s, have attracted the interestof many researchers.This interestis justified by a regular arrangement of their particular properties such channels, a pore size adjustable 2to 30 nm higher than the zeolites, and sometimes a high Specific surface exceeding 1000$m^2.g^{-1}$.

The physico-chemical characteristics of these material sallowa glimpse of their use in many and varied fields such as catalysis, adsorption, separation, chromatography, biochemistry as support for enzyme immobilization and drug release.

This work isfocusedon the synthesis ofmeso-porous materials.We under took to synthesize SBA-15 and MCM-41. We also studied the diatomite which was calcined at different temperatures and some samples were functionalized. The physico-chemical properties of diatomite were determined by the following techniques : surface area, structure using XRD, surface functions via IR and PTZ isoelectric point was determined by the ionic strength.

EXPERIMENTS ON DESIGN PARAMETERS OF A MULTI-STAGE WATER DESALINATION STILL

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The present work proposes a new multi-stage distillation system that was designed in UDES with the objective of increasing its productivity and improving its efficiency. The aim is to develop a simple and economic multi-stage solar still to produce fresh water for domestic and socio-economic uses from seawater and brackish waters that are abundant in many remote areas of the Sahara Algerian.

We study the effect of cooling water temperature and collected experimental data in order to optimize their influence on the yield of the multi-stage distillation process for the first four trays device. The preliminary results showed a significant improvement of the overall productivity. Effect of the boiler temperature T_b is presented for different values. Indeed, the total productivity of the distillator is affected by the increase of the cooling water flow rate on top of the tray. The experimental results of tests show that the first tray of the system produces about 23 liters of fresh water per day and the temperature of the evaporator efficiency is fixed at 96°C. The results that permit the determination of the output of each tray of the still are presented in this study. The analysis of the distilled water showed that its quality was within the international standards (World Health Organization guidelines).

Keywords*-Distillation, Desalination, Multi-Stage still, Solar, Energy.*

DEFLUORATION DES EAUX PAR RESINES ECHANGEUSES D'IONS

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La défluoration des eaux souterraines est une préoccupation majeure dans plusieurs endroits à travers le monde. Un excès d'ions fluorure dans l'eau potable a des effets néfastes sur la santé humaine. En effet, une concentration en F^- supérieure à 1,5 mg.L^{-1} favorise la fluorose dentaire. Une concentration supérieure à 5 mg.L^{-1} peut provoquer la fluorose osseuse caractérisée par une hypercalcification des os. Dans cette étude, nous avons procédé à la défluoration de solutions modèles de NaF d'une part et d'une eau souterraine tunisienne prélevée de la région de Gafsa (Sud Tunisien) d'autre part en utilisant une résine échangeuse d'ions A-520E. L'influence du temps de contact, de quantité de résine utilisée et de la concentration initiale en fluorure sur la rétention des ions fluorures a été évaluée. La défluoration de l'eau souterraine ($[F^-]$ initiale = 3,39 mg.L^{-1}) montre que l'eau traitée avec la résine présente une concentration résiduaire en fluorure de 1,09 mg.L^{-1}. Cette valeur est inférieure à la norme de potabilité fixée par l'Organisation mondiale de la Santé (OMS) à 1,5 mg.L^{-1} en fluorure.Les isothermes d'adsorption des ions fluorures vérifient les modèles de Freundlich et de Langmuir.

Mots Clés: *eaux saumâtres, défluoration, échange d'ion, isotherme d'adsorption*

TEMPERATURE EFFECT ON ION EXCHANGE REACTIONS OF CMX MEMBRANE WITH SODIUM, POTASSIUM AND CALCIUM IONS

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Ion exchange equilibrium in three systems involving monovalent and divalent ions has been investigated over the temperature using CMX cationic exchange membrane. All experiments were carried out at total constant concentrations 0.1 mol.L^{-1}. Ion exchange capacity and humidity percentage of the studied membrane were determined. Ion exchange isotherms for the binary systems (Na^+, K^+), (Na^+, Ca^{2+}) and (K^+, Ca^{2+}) were established at the different temperatures from 283to 313 K.

The obtained affinity order is: $Na^+ > K^+ > Ca^{2+}$. Selectivity coefficients $K_{Na^+}^{K^+}$, $K_{2Na^+}^{Ca^{2+}}$ and $K_{2K^+}^{Ca^{2+}}$ were determined. For the binary systems (Na^+, K^+), (Na^+, Ca^{2+}), the selectivity coefficients decrease with rise in temperature, while for the system (K^+, Ca^{2+}) increase with increasing of temperature. Thermodynamic equilibrium constant $K_i^{\circ j}$, standard free energy ΔG°**,** standard enthalpy change ΔH° and standard entropy change ΔS° were calculated. Ion exchange equilibrium at temperatures 283, 298 and 313 K were found to be exothermic process for the two binary systems (Na^+, K^+), (Na^+, Ca^{2+}) and endothermic for (K^+, Ca^{2+}).

Keywords: *CMX membrane, affinity order, binary isotherms, selectivity coefficients, thermodynamic parameters.*

A RESEARCH ON WATER DESALINATION USING MEMBRANE DISTILLATION

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This research work aims to investigate the desalination performance of direct contact membrane distillation (DCMD) unit under different conditions. A mathematical model was developed to evaluate the experimental values of the membrane water mass flux, heat transfer coefficients, the membrane/liquid interface temperatures, the temperature polarization coefficient and the evaporation efficiency. This model was solved numerically using MATLAB® software and its results were used to predict the actual performance of the membrane unit. Experimental tests were performed using 0.0572 m^2 of PTFE membrane manufactured by Membrane Solution (85% porosity, 45 µm thickness, 0.22 µm nominal pore size). Feed solutions were aqueous NaCl solutions, 1000-200,000 mg/L in concentration and its temperatures were 40-70°C; flow rate 2 l/min. The temperature and flow rate of permeate water were fixed around 20°C and 3 l/min, respectively. The experimental observation showed that the vapour mass flux through the membrane pores increased with feed temperature, but decreased with feed concentration. The membrane distillation coefficient was evaluated from the computer model data and was subsequently used to estimate water fluxes. It was found that the predicted mass fluxes agreed reasonably with the experimental data, except at high feed concentration. The temperature polarisation coefficients increased with concentration, and decreased with increasing temperature. The membrane mass transfer coefficient and the permeate flux was shown and discussed.

Keywords : *Water Desalination, Membrane Distillation, Water Treatment, Membrane Mass flux, Membrane distillation coefficient.*

MODELING ANDOPTIMIZATIONOFLEACHATE TREATMENT

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Demographic, urban and economic increases are causing various sources of pollution. The urban waste managementis currently one of the major problems encountered int he more developed countries. In Algeria the annual waste production ranged from 0.35 kgin 1968 to 1 kg in 2008 per person, andaccording to the Ministry of Environment it could reach about12.5 Mtin 2025.

Land fill leachate is a difficult effluent to be treated and for which emission standards are imposed. The leachate formation involvesa wide range ofphenomena, mainly resulting from the operating mode of the waste disposal (height, waste type and composition, seasonal weather variation, and the age of the landfill... etc).

Previous studies haveshown that the landfill leachate coming from thesite of Ouled Fayet isc haracterized by a very high organic and inorganic pollutant load. This has led several studies on a laboratory scale to develop treatments reducing some physicochemical parameters indicators of pollution.

Treatment with fixed cultures on an inert support although it has been applied to an intermediate leachate iseffective, aeration leach ate improves the efficiency of abatement for all parameters tested and achieves a reduction greater than70%.

Modeling results collected was used to determine the removal ratio for COD, BOD and SM: 83%, 54%, and 61% respectively, with an optimum contact time: 15 days, 3 hours, 38 minand35 seconds. Thus, the duration of treatment can lead to optimize pollution reducing some physico-chemical parameters and increase others. A compromise must befound to reducethe maximum pollutant and each treatment should be tailored to the nature of the treated leachate.

Keywords: *pollution, leachate treatment, modeling, optimization.*

MODÉLISATION ET OPTIMISATION DU TRAITEMENT DES LIXIVIATS.

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Les accroissements démographiques, urbains et économiques sont à l'origine de différentes sources de pollution. La gestion des déchets urbains est actuellement l'un des problèmes majeurs rencontré surtout dans les pays en développement. En Algérie la quantité d'ordures ménagères rejetées est passée de 0,35 kg/hab/j en 1968 à 1 kg/hab/j en 2008, et d'après la Ministère de l'environnement, en Algérie, la production annuelle de déchets pourrait atteindre environ 12,5 Mt en 2025.

Le lixiviat est un effluent difficile à traiter et pour lequel des normes de rejet sont imposées. La formation des lixiviats met en jeu une grande diversité de phénomènes, résultant essentiellement du mode d'exploitation du centre de stockage (hauteur des déchets, nature et qualité des déchets, surface exploitée, âge des déchets …etc).

Des études antérieures ont démontré que le lixiviat provenant du CET d'Ouled Fayet est caractérisé par une charge polluante organique et minérale très élevée. Ceci a conduit différentes études à l'échelle laboratoire visant à mettre au point des traitements réduisant certains paramètres physico-chimiques indicateurs de pollution.

Le traitement par cultures fixées sur support inerte bien qu'il ait été appliqué pour un lixiviat intermédiaire est efficace, l'aération du lixiviat améliore le rendement de dépollution pour tous les paramètres analysés et permet d'atteindre un abattement supérieur 70%.

La modélisation des résultats collectés a permis de déterminer des rendements importants de dépollution de l'ordre de 83% pour la DCO, 61% (MES), 54% (DBO_5) avec une durée de contact de: 15 jours, 3heures, 38min et 35 seconds. Ainsi la durée de traitement peut amener à optimiser la dépollution en réduisant certains paramètres physico-chimiques et à en augmenter d'autres. Un compromis doit être trouvé pour réduire un maximum de polluants et chaque traitement doit être adapté à la nature du lixiviat traité.

Mots clés : *pollution, lixiviat, traitement, modélisation, optimisation.*

WASTEWATER TREATMENT WITH Ag/TiO_2 DOPED CATALYST UNDER SOLAR IRRADIATION

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Heterogeneous semi conductor photocatalysisis considered a promising strategy for the use of solar energy for the decomposition of organic contaminants in water.Titanium dioxide(TiO_2) is now the most widely used photocatalyst. However, it is a semi conductor characterized by its bandgap of approximately 3.1 eV and a peak light absorption situated in the ultraviolet range ($\lambda<386$). Soit does not absorbvisible light.The addition of a metal precursor with TiO_2 can solve this problem to increase the activity under visible light.

This work was done in the field of wastewaters treatment by the use of advanced oxidation processes, especially heterogeneous photocatalysis. New catalysts based on titanium dioxideTiO_2 doped with silver (Ag) at various percentages were synthesized by the impregnation method. The photocatalytic efficiency was tested by degradation of the spiramycin, an antibiotic pollutant, under solar irradiation using two experimental designs (Batch and Helical reactors). The influence of some operating parameters such as the percentage of silver, the pH of the solution, the initial pollutant concentration and the amount of catalyst were evaluated.The catalyst synthesized showed satisfactory photo degradation efficiency in the presence of visible light.

Keywords: *Photocatalysis oxidization, Doped catalyst, Ag/TiO_2, Spiramycin, pharmaceutical pollutants, Water treatment, reuse of waste water.*

MODIFICATION OF BENTONITE WITH BIS-IMIDAZOLIUM CATIONS : AN ADSORPTION STUDY OF TEXTILE DYE TELON

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Clay ion-exchange using bismidazolium salts (MMBI) could provide organophilic clays materials that allow effective retention of polluting dyes. The present investigations deal with bentonite (Bt) modification using (ortho, meta, and para) bismidazolium salts and attempts to remove a synthetic textile dyes, such as (Telon-Orange, Telon-Red and Telon-Blue) by adsorption, from aqueous solutions. The surface modification of MMBI-Bt was examined using Fourier transform infrared spectroscopy (FTIR), powder X-ray diffraction analysis (PXRD) and thermogravimetric analysis (TGA). Adsorption tests applied to Telon dyes revealed a significant increase of the maximum adsorption capacity from ca. 11-26 to 88-108 mg.g^{-1} after intercalation. The highest adsorption level was noticed for Telon-orange dye on the p.MMBI-Bt, presumably due higher interlayer space and better diffusion. The pseudo first-order rate equation was able to provide the best description of adsorption kinetics data for all three dyestuffs, but the process kinetics appeared to change over time. The Langmuir and Freundlich adsorption models were applied to describe the equilibrium isotherms and the isotherm constants were also determined. The results show that MMBI-bentonite could be employed as low-cost material for the removal of Telon dyes from effluents.

Keywords : *Bentonite; Organoclay; Bis-imidazolium salts; Dye; Isotherms; Adsorption*

KINETIC MODELING FOR REMOVAL TOXIC CRYSTAL VIOLET FROM AQUEOUS SOLUTION ON OKOUME SAWDUST

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Synthetic dyes are widely used for textile dyeing, paper printing, leather dyeing, colour photography and as additives in petroleum products. Unlike pigments, these dyes are absorbed to a certain extent by the material to which they are applied. They exhibit a wide range of different chemical structures, primarily based on substituted aromatic and heterocyclic groups. Many synthetic dyes are toxic to some organisms and may cause direct destruction of creatures in water Due to these reasons; these dyes must be removed from effluent. But synthetic dyes are highly soluble in water, and their removal from effluent is difficult by conventional physicochemical and biological treatment methods. In this study, Okoume sawdust was used as a biosorbent material to test its suitability for removal of a toxic crystal violet (basic violet 3) from aqueous solution. The influence of operating conditions such as initial concentration of the dye, the dose of biosorbent material, ionic strength, pH and solution temperature on dye removal is discussed. The results show that the increase of initial concentration, dose of biosorbent material, pH and temperature has a positive impact on the sorption of dye. In contrast, the ionic strength has a negative effect to the remove of dye. The kinetics of sorption of the dye obtained at different concentrations was analyzed by linear method using pseudo-first order, pseudo-second order Intraparticle diffusion, and Elovich models. It was found that the pseudo-second order kinetic model was the best applicable model to describe the sorption kinetic data.The experimental data were analyzed by sorption isotherms the Langmuir and Freundlich models. Equilibrium data fitted well to the Langmuir model with a maximum sorption capacity of Okoume sawdust was 123, 63 mg g^{-1} at 25 °C. These results demonstrate thattheOkoume sawdust is a suitable biosorbent for the removal of crystal violet from aqueous solution in terms of low cost, natural and abundant availability.

***Keywords**: Removal, Crystal violet, Okoume sawdust, Kinetics, Modeling.*

GRAVITY FORCE DRIVEN DESALINATION UNIT: A SUSTAINABLE ENERGY SUBSTITUTE OF HIGH PRESSURE PUMPS

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Water shortage is a worldwide serious issue and of great priority. Efforts are being spent to solve this issue and propose alternatives especially in arid and semi arid countries. Along with wastewater reclamation and reuse, desalination has been adopted as a non-conventional water supply alternative in water scarce regions. Estimates report that reliance on desalinated water is expected to grow in coming decades. However, desalination requires significant amount share of generated electricity. For the time being, most of desalination plants in Middle East are operated using non-renewable and non-environmental friendly energy options. Hence, investigations to develop effective desalination processes powered by various Sustainable Energies are prioritized. Thus, a low (energy) cost seawater desalination system and methods, that operates using gravity force is proposed. In this unit, the conventional high-pressure pumps are substituted by a heavy mass (water tank) to generate the pressure needed for seawater filtration (desalination using reverse osmosis -RO- membranes) resulting in a massive reduction in the energy needed (about 90%) for this process, consequently, a remarkable lowering in the cost.

SMALL SCALE DISTILLATION SYSTEMS FOR HOUSEHOLD USE IN KINGDOM OF SAUDI ARABIA

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The growing concern of freshwater scarcity, especially in arid and semi-arid regions, is promoting the use of desalination technology as a means of alternative freshwater source. The Gulf countries utilise thermal desalination technology for freshwater production. These systems are less efficient and energy intensive as compared to the membrane technology. The high Total Dissolve Solid (TDS) of over 45,000 ppm in the seawater around the Gulf countries made membrane technology not attractive except for brackish water treatment. The need to develop desalination mechanism with less energy use and high overall efficiency is desirable. Saudi Arabia is one of the leaders in desalination technology, especially in fossil driven desalination technologies. These technologies are energy intensive and require expensive materials for construction and pipe layout. This work will investigate the feasibility of a small/medium scale decentralized desalination systems capable of producing potable water using brackish water for communities and/or household in Kingdom of Saudi Arabia. In this study a potable distillation system is propose for use in residential buildings. In addition, the feasibility of using small-scale solar distillation system in households was carried out. This work also review trends and developments in small scales solar desalination systems.

Keywords: *Solar Distillation System, Total Dissolve Solid, Energy, Saudi, Desalination*

RETENTION OF SAMARIUM IONS FROM AQUEOUS SOLUTIONS BY POLY(ACRYLIC ACID) ENHANCED-ULTRAFILTRATION

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Lanthanides (REE) are considered as one of the main contaminants groups due to their toxicity. The extensive use of lanthanides in chemical industries and in various commercial products has resulted in increased public exposure to them. Recent studies have shown that the toxicity of lanthanides as a group is similar to the toxicity of heavy metals.

Polymer enhanced ultrafiltration (PEUF) process has been shown to be promising for removal of trace metals from aqueous streams by the addition of water soluble polymers in the wastewaters.

Samarium removal from aqueous solution by polyelectrolyte enhanced ultrafiltration (PEUF) process was investigated using poly(acrylic acid) (PAA) with average molecular weight 100.000 Da. The ultrafiltration studies were carried out using a tangential cell system equipped with 5.000 MWCO polyethersulfone. Several parameters, such as transmembrane pressure, PAA concentration, pH and ionic strength, have been optimized to improve the retention of the Sm (III). Results shows that the permeate flux increases linearly with increasing pressure.It can be seen that with the increase of the concentration of PAA, the Sm (III) retention also increases until reaching 80 %. A better retention was observed at 2 10^{-4} mol L^{-1} PAA concentration and 3 bar transmembrane pressure. The study of ionic strength effect demonstrates that it decreases the retention of samarium ions and increases the permeate flux.This result can be explained by a conformational change on the polymer chains, a competitive adsorption between Na^+ and Sm^{3+} on negatively charged polymer.

***Keywords**: Samarium (III), polyacrylic acid (PAA), retention, polyelectrolyte enhanced ultrafiltration.*

DISCOLORATION OFMETHYLORANGEIN AQUEOUS MEDIUMBYOXIDATIONCATALYSIS ANDRECOVERY OF HETEROPOLYANIONIC CATALYST OF DAWSON TYPE

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The wastewater from the textile industries are a major source of water pollution because they are highly concentrated dyes sometimes not readily degradable or non-degradable, making biological treatment impractical. So it is necessary to find techniques of high efficiency. These techniques include the process of advanced oxidation.

In our case we are interested in the treatment of water polluted with methyl orange (MO). This treatment is based on the oxidation of the dye in aqueous solution by potassium permanganate ($KMnO_4$) using a heteropolyanion of Dawson type ($\alpha_2P_2W_{17}Ni$) as catalyst. The parameters controlling the oxidation reaction are: pH of the initial aqueous solution concentration of $KMnO_4$, MO concentration, catalyst mass ($\alpha_2P_2W_{17}Ni$). The optimum conditions were found as follows: pH = 5,75; C = 0,1 mM $KMnO_4$; C_{MO} = 10ppm; M = 0,3 g.

These conditions can achieve an efficiency of 90.75% discoloration.

Then a recovery study of this catalyst after chemical reaction was performed. This recovery has proved successful after the analysis and testing of the recovered catalyst.

Keywords : *oxidation catalysis, potassium permanganate, methyl orange, heteropolyanion Dawson type of water pollution.*

MODELISATION DES ECHANGES DE CHALEUR ET DE MASSE AU SEIN D'UN EVAPORATEUR SOLAIRE

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Dans ce travail, nous avons modélisé les échanges de chaleur et de masse au sein d'un évaporateur solaire.
L'étude a porté tout d'abord sur la détermination des profils de la température, de la concentration, et de la vitesse dans la phase liquide et gazeuse. Ensuite, on s'est intéressé à l'étude de l'interface en déterminant son comportement thermique et massique.
Enfin, nous avons étudié l'influence des différents paramètres opératoires en vue d'optimiser le problème en question et de mieux comprendre les phénomènes physiques qui y sont reliés.

***Mots-clés** : Evaporation, transfert thermique et massique.*

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SALTS EFFECTS AND THEIR INTERACTIONS WITH CLAYS IN AQUEOUS ENVIRONMENT

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Macromolecules or colloidal particles suspended in the water can carry loads if dissociable functional groups are present on the chain of macromolecules or on their surface. If the ions are separated from the particle or macromolecule, a potential flow can be observed.To elucidate the mechanism of interaction between clay particles and various cationic ions in aqueous medium, the effects of various symmetric and asymmetric electrolytes (NaCl, KCl, $CaCl_2$and$BaCl_2$) on the surface chargeoftwo montmorillonites have been investigated by measuring thestreaming potential. In addition, the adsorption of acation icsurfactant(CTAC) in an aqueousmedium on the surfaceofclayswas followed bymeasurementof the flowin orderto deduce thepotentialsurface areaclays. Theresults arecomparable to those obtainedby the BET method.The streaming potentialdecreasesin absolutevalue when thesalt concentrationincreasesin the electrolyticsolutionfor bothmontmorillonites, indicating a higher affinityof the cationexchanged forthe surface, whichthencompensatesthenegative chargemore effectively.For bothmontmorillonites, a cationic exchange with a cation of high ervalence further decreases the absolute value of the streaming potential, and can goup toreversethe charge. When clay sarepackaged in an indifferent electrolyte same valence as compensating cations, the potential flow is weak lymodified.

Keywords: *Interactions, Surface charge, PIE, Salts effects, Streaming potential.*

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MESURE DES PROPRIETES DE SURFACE DES MINERAUX PAR POTENTIEL D’ECOULEMENT

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Les macromolécules ou particules en suspension colloïdales dans l’eau peuvent porter des charges si des groupes fonctionnels dissociables sont présents sur la chaîne macromolécules ou sur la surface. Si les contre-ions sont séparés de la particule ou de la macromolécule, un potentiel d’écoulement peut être observé.

Afin d’élucider le mécanisme d’interaction entre les particules d’argiles et les divers ions cationiques en milieu aqueux, les effets de divers électrolytes symétriques et dissymétriques (NaCl, KCl, $CaCl_2$ et $BaCl_2$) sur la charge de surface de deux montmorillonites ont été étudiés par mesure du potentiel

d’écoulement. Également, l’adsorption d’un surfactant cationique (CTAC) en milieu aqueux sur la surface des argiles à été suivi par mesure du potentiel d’écoulement afin de déduire la surface spécifique des argiles. Les résultats sont avérés comparables à ceux obtenus par la méthode BET. L’augmentation de la concentration en sel diminue la charge de surface de l’argile jusqu’à ce qu’elles s’égalisent.

Le potentiel d’écoulement diminue en valeur absolue lorsque la concentration en sel augmente dans la solution électrolytique pour les deux montmorillonites, signe d'une affinité plus forte du cation échangé pour la surface, qui compense donc plus efficacement les charges négatives. Pour les deux montmorillonites, un échange cationique avec un cation de valence plus élevée diminue encore la valeur absolue du potentiel d’écoulement, et peut aller jusqu'à inverser la charge. Lorsque les argiles sont conditionnées dans un électrolyte indifférent de même valence que les cations compensateurs, le potentiel d’écoulement est très faiblement modifié.

***Mots clés** : colloïdes, charge de surface, PIE, Sels, Potentiel d’écoulement.*

SYNTHESIS AND CHARACTERIZATION OF MODIFIED MEMBRANE REACHED BY BATIO3 NANOPARTICLES FOR IMPROVING GROUND WATER QUALITY

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This paper deals with the synthesis and the characterization of reverse osmosis membranes reached by barium titanium oxide nanoparticles. A composite membrane containing $BaTiO_3$ nanoparticles (NPs) was prepared by the in situ interfacial polymerization (IP) process on porous polysulfone supports. Aqueous m-phenyl diamine (MPD) and organic trimesoyl chloride (TMC)-MPs mixture solutions were used in the IP process. $BaTiO_3$ NPs with a size between100-200 nm were used as the fillers to fabricate nanocomposite membranes at concentrations ranging from 0.001% to 0.009% wt%. The membranes were characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM), atomic force microscope (AFM) and contact angle technique. Their performances were evaluated based on the water permeability and salt rejection. Results indicated that the $BaTiO_3$ nanoparticles are well dispersed in polyamide (PA) layer and improved membrane performance under optimal concentrations. By changing the content of filler, hydrophilicity and roughness of the composite membranes were increased. Notably, the permeate water flux increased from 26to 42 L/m^2h at $BaTiO_3$ concentration of 0.009% with the maintaining of NaCl high salt rejection of 90%. These results were obtained with initial NaCl concentration of 2000 ppm and under pressure of 225 psi. For the hydrophilicity, the contact angle was decreased from 94^0 to 24^0.

ETUDE DE LA PRECIPITATION DU SULFATE DE BARYUM : EFFET DE LA CONCENTRATION, EFFET DE LA TEMPERATURE ET EFFET DU PAROI.

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The study of the effect of ion ratio (R = $[Ba^{2+}]/[SO_4^{2-}]$), the temperature, and the nature of the materials on the kinetics of precipitation of barium sulfate was investigated using a Barium specific electrode and a conductivity cell. The study of the variation of temperature in the range [15°C, 35°C] shows that the solubility of barium has a minimum at 20°C. Similarly it was found that the addition of barium ($BaCl_2$) and sulfate (Na_2SO_4) increases the solubility of barium. Finally, it was found that the polyethylene is more nucleogenic as stainless steel and glass.

INHIBITION OF BARIUM SULFATE SCALE IN THE PRESENCE OF SODIUM TRIPOLYPHOSPHATE INHIBITOR

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The precipitation of barium sulphate from aqueous supersaturated solutions is a well-known problem in the oil industry often referred to as ‘scaling’. The formation and growth of barite on surfaces during the oil extraction process can result in malfunctions within the oil facilities and serious damage to the equipment. The effect of STPP which is commercial Tunisian inhibitors for calcium carbonate was examined for barium sulphate. The in situ conductivity and FTIR measurements allowed the identification of barium sulphate precipitation and the deposited barite in the presence of the inhibitor at various temperatures (25, 50°C).

THE EFFECT OF COVER TILT ANGLE OF DOUBLE SOLAR STILL ON ITS PRODUCTIVITY IN SUMMER AND WINTER SEASON

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Algeria is interested in using solar still for a sufficient potable water supply from brackish water, since it receives a high solar radiation, especially in the summer. In this study a computer program has been developed to simulate the effect of the cover tilt angle on the performance of double slope solar stillwith the objective to obtain the optimum design parameters**,** under the climatic conditions of Constantine (eastern of Algeria), using meteorological data recorded during the last decade (2002–2012). 1st August 2005 and 28th February 2010 are the two selected hottest days for summer and winter respectively.

The obtained results show that 10° and 45° are the optimum angles of inclination that permit to receive a maximum solar radiation for this type solar still in the two seasons by increasing the evaporation-condensation phenomenon. However, in summer, a tilt of 10° gives higher daily productivity in comparison with 45° and with an increase of about 24,45%. In contrast, in winter, the largest angle (45°) gives higher daily productivity when compared to the smallest one (10°) and with an increase of about 34, 28%. Therefore, tilt angle is an important factor to be considered for solar still design.

Keywords : *Solar still, Tilt angle, Performance, Hottest day, Constantine.*

WASTEWATER DISINFECTION BY THE USE OF UVA, UVC AND SOLAR RADIATION

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Water availability and quality represent a major challenge facing water scarcity and pollution. The United Nations Organization provides that 44% of the world population will live a severe water scarcity, in 2050. Countries located in semi-arid and arid regions of the world will be especially concerned by this water problematic.

To anticipate water shortage, Algeria has elaborated a new water management policy. The reuse of treated wastewater is among the recommended solutions. In 2014, 25 wastewater treatment plants, managed by the National Office of Sanitation, will contribute to the wastewater reuse for agriculture. Yearly, 200 million m^3 of treated wastewater should be produced to irrigate more than 18 000 hectares. However, it must be noted that the treatment processes applied are deficient because they do not include the disinfection and the recalcitrant organic pollutants treatments.

The aim of this study is to propose the disinfection treatment by irradiation as a complement wastewater treatment for a safe microbial quality reuse. The experimentations were conducted to disinfect treated wastewater by the UVA, UVC and solar radiation. The UVA and UVC disinfection treatments were conducted by an experimental bench composed by three flat-bottom flasks and three Erlenmeyers of 2 liters each one. The solar disinfection treatment was experimented by 40 liters-tubular photoreactor in stationary and dynamic flow. Obtained results indicate that 6 hours of solar exposure allowed a disinfection rate of 100% for fecal coliforms, 96% for fungi and 8% for staphylococci. The disinfection efficiency was performed by the use of UV radiation which induced, after 2 hours irradiation, a disinfection rate of 100% for sulphite-reducing spores, 98% for fecal coliforms and 84% for staphylococci.

Keywords : *Water scarcity, wastewater reuse, UV disinfection, solar disinfection, sustainable wastewater treatments.*

FABRICATION OF POLYAMIDE MEMBRANE REACHED BY MGTIO$_3$ PARTICLES FOR GROUND WATER PURIFICATION

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Here, we report the fabrication of mixed matrix reverse osmosis membranes by interfacial polymerization of nanocomposite (NC) on porous polysulfone supports. NC elaborated for this study comprise magnesium titanium oxide ($MgTiO_3$) nanoparticles (NPs) dispersed in polyamide host matrix synthesized by the in situ interfacial polymerization (IP) process on porous polysulfone commercial supports. Aqueous m-phenyl diamine (MPD) and organic trimesoyl chloride (TMC)-NPs mixture solutions were used in the IP process. NPs of $MgTiO_3$ with a size of about 100 nm were used as the fillers for the fabrication of the NC membranes with a concentrations varying from 0.001% to 0.009% wt%. The samples were characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM), atomic force microscopy (AFM) and contact angle set-up. Their performances were evaluated based on the water permeability and salt rejection. Results indicated that the NPs are well dispersed in the host matrix of PA layer and improved membrane performance under optimal NP content. By changing the concentration of the filler, hydrophilicity and roughness of the NC membranes were increased. Notably, the permeate water flux increased from 26to 45 L/m^2.h at NPs concentration of 0.001% with the maintaining of high salt rejection of 98%. These results were obtained with initial NaCl concentration of 2000 ppm and under pressure of 225 psi. Also better hydrophilicity was obtained; the contact angle was decreased from 94^0 to 32^0.

PERFORMANCE OF POLYAMIDE MEMBRANE REACHED BY ZNO NANOPARICLES FOR GROUND WATER PURIFICATION

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We report in this study the synthesis of mixed matrix reverse osmosis membranes by interfacial polymerization of thin film nanocomposite (TFNC) on porous polysulfone supports. TFNC elaborated for this work comprise zinc oxide (ZnO) nanoparticles (NPs) aerogel dispersed in polyamide host matrix synthesized by the in situ interfacial polymerization (IP) process on porous polysulfone commercial supports. Aqueous m-phenyl diamine (MPD) and organic trimesoyl chloride (TMC)-NPs mixture solutions were used in the IP process. NPs of ZnO with a size of about 25 nm were used for the fabrication of the TFNC membranes with a concentrations varying from 0.001% to 0.009% wt%. The samples were characterized by different techniques such as X-ray diffraction (XRD), scanning electron microscopy (SEM), atomic force microscopy (AFM) and contact angle set-up. Their performances were evaluated based on the water permeability and salt rejection. Results indicated that the NPs improved membrane performance under optimal NP concentration. By changing the content of the filler, better hydrophilicity was obtained; the contact angle was decreased from 94^0 to 21^0. Also, with initial NaCl concentration of 2000 ppm and under pressure of 225 psi, the permeate water flux increased from 26to 49 L/m^2.h at NPs concentration of 0.001% with the maintaining of high salt rejection of 99%.

ELECTROCHEMICAL REMOVAL OF COPPER AND ZINC: EFFECT OF SURFACTANT MOLECULES

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The effect of the presence of copper and surfactants on the deposition of zinc was studied on a graphite electrode in an acidic solution of zinc sulphate. Cyclic voltammetry, chronoamperometry of electrochemical impedance spectroscopy techniques were used to characterize the kinetics of nucleation and the electro-deposition of zinc.

The effect of the scan rate of the potential and the concentration of zinc show that the electroplating is an irreversible process and it was controlled by diffusion and charge transfer.

The coefficient of the zinc diffusion was calculated. The addition of zinc in solution causes a negative shift in the potential of reduction and a positive shift in the potential of the oxidation with proportionality between the current intensity and the concentration of zinc.

The voltammograms performed in the presence of copper ions (Cu^{2+}) with the presence of different nitration of surfactant was indicate the acceleration of the electro-deposition process.

ELIMINATION DU ZINC ET DU CUIVRE PAR VOIE ELECTROCHIMIQUE : EFFET DE MOLECULES TENSIO-ACTIVES

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L'effet de la présence du cuivre et de tensioactifs sur la déposition du zinc a été étudié sur une électrode en graphite dans une solution acide de sulfate de zinc. Les techniques de Voltampérométrie cyclique, de chronoampérometrie de spectroscopie d'impédance électrochimique ont été utilisées pour caractériser la cinétique de l'électrodéposition et de la nucléation des dépôts de zinc. L'effet de la vitesse de balayage du potentiel et la concentration en zinc montrent que l'électrodéposition est un processus irréversible contrôlé par la diffusion et par le transfert de charge.

Le coefficient de diffusion de zinc a été calculé. L'ajout du zinc en solution provoque un décalage négatif dans le potentiel de réduction et un décalage positif dans le potentiel d'oxydation avec une proportionnalité entre l'intensité de courant et la concentration en zinc.

L'analyse des voltamperogrammes réalisées en présence des ions de cuivre (Cu^{2+}) à différentes concentrations de tensioactif a montré l'accélération du processus de l'électrodéposition.

Les mesures de chronoampérométrie et d'impédance électrochimique au potentiel de -1300 mV/ECS ont provoqué une augmentation importante dans l'intensité du courant, en présence du cuivre à 0,01M et du tensioactif à 40 ppm.

IMPROVEMENT ADSORPTION CAPACITY OF METHYLENE BLUE OF TAMAZERT KAOLIN

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This investigation was divided into two parts, in the first one, KT kaolin issued from the Tamazert region, located in east Algeria was subjected to a series of treatment, in a first time KT kaolin was calcined at 800C° for 5h, the aim of this thermal treatment was to obtain metkaolinite, which is more reactive than the parent kaolinite, then the obtained product was subjected to an acid attack using HCl to increase specific surface area, but the acid activated metakaolinite had a similar adsorption capacity of MB in comparison with KT kaolin, this result lead to treat it with NaOH to increase cationic exchange capacity (CEC), results showed that with this last treatment adsorption capacity of KT kaolin was strongly increased, it was 2 times better than once of KT kaolin, the obtained adsorbent was characterized by powder X ray diffraction, FT-IR spectroscopy, BET surface area, and scanning electron microscopy (SEM). In the seconde part the effects of initial dye concentration, contact time, adsorbent dose, stirring speed, pH, salt concentration and temperature were studied. The experimental isotherms were analyzed using Langmuir and Freundlich models, also thermodynamics parameters were calculated. This study showed that this new adsorbent can be a good candidate for some activated charcoal.

Keywords : *Tamazert Kaolin, Acid activation, Adsorption Methylene blue, isotherms*

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STUDY OF IBUPROFEN REMOVAL BY PAC-CERAMIC MEMBRANE PROCESS

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During the recent decades, pharmaceutical and personal care products (PPCPs) has become increasingly compelling for its potential harmful effects to environment and health. Thus, removal of PPCPs in water is considered important and urgent. The activated carbon (AC) adsorption had been verified as an effective method for removing PPCPs in water by previous researcher, but there was a difficulty in recycling of AC what hampered its application, and the adsorption capacity of the AC tend to not been fully utilized, due to the constraint of hydraulic retention time in practice. Ceramic membranes (CM) are well known for its higher mechanical stability, higher chemical stability and higher hydrophilicity, which resulting in high fluxes and lower fouling. In this study, ibuprofen was selected as a model of PPCPs (concentration of 0.4 mg/L), and the pilot scale AC (concentration of 10 mg/L) adsorption combined with CM filtration system was investigated as a new method for PPCPs removal in water. Furthermore, BSA, SA and HA have been selected as several model of natural organic matter (NOM) been respectively added in the raw water (DOC concentration of 5 mgC/L) to evaluate the effects of high concentration of NOM. The results of adsorption tests demonstrated that activated carbon adsorption is still an effective method for removing ibuprofen in water with high concentration of NOM, but the retention efficiency of NOM was relatively low. The results of pilot scale adsorption combined with filtration tests shown a significant increase of retention efficiency of NOM (as shown in Fig. 1), and provided a potential to increase the retention efficiency of ibuprofen. These advantages were particularly remarkable when the NOM in water were hydrophilic substance (SA). Furthermore, the irreversible fouling of CM was very little. Therefore, this combined system is potentially very useful for ibuprofen (PPCPs) removal in water with high concentration of NOM.

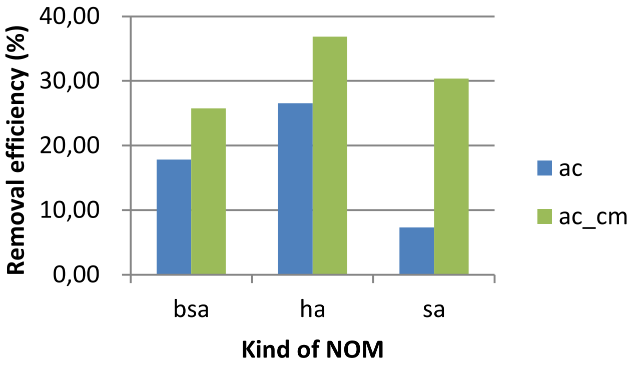

Fig. 1 Removal efficiency of NOMs indicated by NPOC in tests

STUDY OF FORWARD OSMOSIS MEMBRANE FOULING WITH DIFFERENT ORGANIC MATTER

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In recent years, the forward osmosis has gained increasing popularity for waste water reuse and seawater desalination. In this study, the membrane flux variation, organic rejection and absorption evolution was investigated by a cross-flow flat-sheet forward osmosis membrane system. Alginic acid, bovine serum albumin, humic acid and tannic acid were used as model organic matters in feed solution, and the concentration was adjusted to 100mg/L in the experiments. Sodiumchloridesolution (2mol/L) was employed to provide trans-membrane pressure in the draw solution. Blank test was performed with deionized water used as feed solution. Measures such as fluorescence excitation-emission matrices (EEMs), temperature, weight and conductivity were operated in feed and draw solution. The flux decreased in all experiments, including the blank, which was mainly attributed to the dilution of draw solution. Besides, it was noted that the alginic acid caused maximum decrease, and the average flux was 6.98 L/(m2·h), while the value of blank was 8.05 L/(m2·h). However, the rejection efficiency of organics was quite remarkable; no obvious peaks could be found in the EEMs spectrum of draw solution. In addition, Fourier Transform Infrared Spectroscopy (FTIR) was used to characterize the chemical composition of the FO membrane surface, and significant fouling was identified from the location and intensity of peaks of the FTIR detection. Furthermore, we had ultrasonic oscillated the fouled membranes in ultrapure water, and the substance absorbed on membranes were wiped off completely, except for the bovine serum albumin, the symbolic peaks at 1635 and 1543cm-1 were still distinguishable on the spectrum after oscillation.

Typical fluorescence excitation-emission matrices (EEMs) observed after ultrasonic oscillation cleaning of the forward osmosis membranes were shown in Fig.1. The peaks at Ex/Em 230/300 and 270/300nm in Figure.1 (a) indicated that membrane structure may be damaged slightly. Besides, organics were detected in the other solution(c and d).

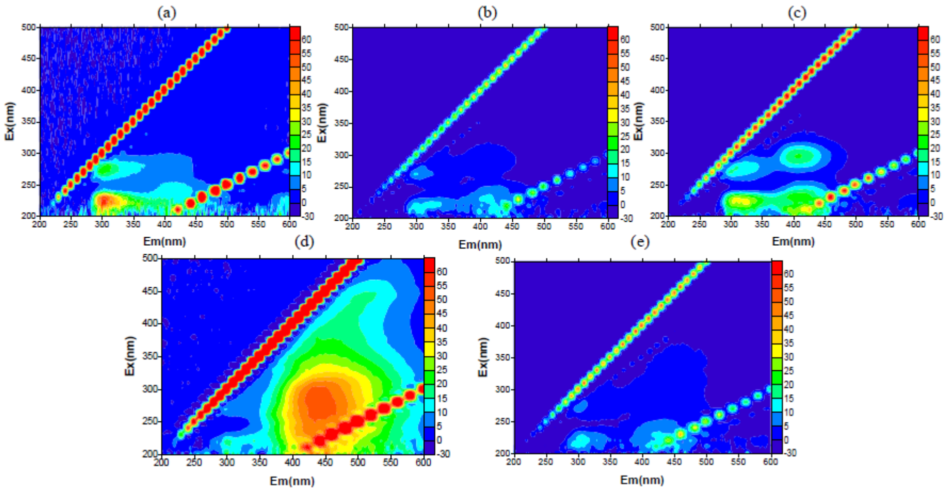

Fig.1. Fluorescence EEMs of solution after membrane ultrasonicoscillation
(a) Clean membrane; (b)Alginic acid; (c) Boving serum albumin;
(d)Humic acid; (e) Tannic acid.

DIAZABENZO CROWNS GRAFTED ON POLYSTYRENE AND APPLICATION TO EXTRACTION OF METAL CATIONS

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We carried on recovered polystyrene (PS) two structural change methods. The first is to mix directly crown ethers with PS in varying amounts (from 5 to 20% by weight of polymer) in chloroform. This leads to polymers M1, M2, M3 and M4 when mixing PS with benzo-15-crown-5 (B15C5). Then mixing PS with dibenzo-18-crown-6 (DB18C6) in varying amounts gives polymers named P1, P2, P3 and P4. The second step is to graft these crown ethers on the backbone of amino polystyrene. But before grafting, the PS had been chemically modified by nitration using a mixture of (HNO_3/H_2SO_4) in chloroform, that yielded the nitro polystyrene (resin **1**). The aminated polystyrene (Resin **2**) was obtained by reduction of nitro groups by (Sn-HCl). The amine functions undergoe diazotization followed by condensation firstly with B15C5 to achieve resin **3** and secondly with DB18C6 to yield resin **4**. Obtained polymeric structureswereconfirmed byvariousanalytical techniquesnamelyIR, DSC, DTA /TGA,andX-ray diffraction. The graftedor ungraftedpolymersbycrown ethershad been testedfor their ability toextractmetal cations contained inan aqueous phase (Li^+, K^+, Mg^{2+}, Ca^{2+}, Cr^{3+}, Fe^{3+}, Co^{2+}, Ni^{2+}, Cd^{2+} and Pb^{2+}). Extraction percentage reached 30% for K^+ and 65% for Fe^{3+} by resin **3** but reached 75% for Li^+ and 79% for Ni^{2+} by resin **4**. The extraction wascontrolled bythe conductivity of thesolution metal using apparatus for measuring pH and conductivity VWR / CO 3000L.

Keywords : *Recovered polystyrene, Diazabenzocrowns, Metal cations extraction.*

REMOVAL OF HEAVY METALS FROM AQUEOUS SOLUTIONS USING TUNISIAN SMECTITIC CLAY INTERCALING CROWNS ETHERS

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The solid-liquid extraction is one of the most methods used for the protection against environmental pollution caused by heavy metals. In this work the solid phase was a Tunisian clay saturated by Na^+ cation and intercalated by the following crowns ethers: dibenzo-14-Crown-4 $(NO2)_2$ (**1**), dibenzo-14-Crown-4$(NO2)_2(Br)_2$ (**2**), dibenzo-14-Crown-4$(Br)_4$ (**3**) and dibenzo-14-Crown-4$(COOH)_2$ (**4**). The new obtained materials are subsequently used in the extraction study of heavy metals (Fe, Hg, Cu, Ni, Cd, Zn, Ba, Mn and Co). Interestingly, the metals extraction capacity of our modified Tunisian clay upward in the following range $Fe^{2+} \approx Hg^+ \geq Ba^{2+} > Ni^{2+} \approx Cu^{2+} > Co^{2+} \geq Mn^{2+} > Cd^{2+} \approx Zn^{2+}$. The intercalation of crowns ethers in our Tunisian clay was then confirmed by micro-elemental analysis, DSC and TG-DTA analysis, X-ray diffraction, and IR spectroscopy.

Key words : *Tunisian clay, Intercalation, Crowns ethers, Extraction, Heavy metals.*

KINETIC AND THERMODYNAMIC STUDY OF CESIUM BIOSORPTION BY AN INVASIVE GREEN ALGA

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The biosorption of cesium, from aqueous solution onto an invasive green alga was carried out to evaluate the parameters of cesium uptake by using the adsorption technique in batch. The cesium sorption behavior from aqueous solutions indicates that the Cs^+ removal is realizable in ranges of pH 4~8.5. The results showed that the Cs^+ uptake is fast where equilibrium is reached at the end of 10 minutes; hence the extension by this time up to 120 min didn't lead to an improvement of the uptake percentage and the kinetics is better adapted for the model pseudo second order (R^2=0.99)than for the pseudo first order(R^2=0.92). Obtained yields were 40, 87, and 97% related to adsorbents doses of 0.4, 2, and 10 g L^{-1} respectively. The study of the standard thermodynamic parameters revealed that this adsorption process is a spontaneous phenomenon with a raised affinity for Cs^+ ($\Delta G^0<0$ and $\Delta S^0>0$), exothermic ($\Delta H^0<0$) and that it takes place by physical adsorption process (E_a<18 kJ/mol).

Keywords: Cesium; Biosorption; Kinetics; Thermodynamics

ETUDE CINETIQUE ET THERMODYNAMIQUE DE LA BIOSORPTION DU CESIUM SUR UNE INVASIVE ALGUE VERTE

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La biosorption du césium, en milieu aqueux sur une invasive algue verte a été réalisée pour évaluer les paramètres importants de la fixation du césium en utilisant la technique d'adsorption en batch. Le comportement de sorption du césium à partir des solutions aqueuses indique que la rétention du Cs^+ est réalisable dans des gammes de pH 4 ~ 8,5. Les résultats ont montré que l'absorption de Cs^+ est rapide, où l'équilibre est atteint au bout de 10 minutes, et la prolongation de cette période jusqu'à 120 min n'a pas conduit à une amélioration du pourcentage d'adsorption et la cinétique est mieux adapté pour le modèle du pseudo second ordre (R^2 = 0,99) que pour le pseudo premier ordre (R^2 = 0,92). Les rendements obtenus sont 40, 87, et 97% relatifs aux concentrations d'adsorbant de 0,4, 2 et 10 g L^{-1} respectivement. L'étude des paramètres thermodynamiques standards a révélé que ce processus d'adsorption est un phénomène spontané avec une affinité élevé pour Cs^+ ($\Delta G^0<0$ et $\Delta S^0>$ 0), exothermique ($\Delta H^0<0$) et qu'elle a lieu par procédé d'adsorption physique (E_a<18 kJ / mol).

***Mots-clés**: Césium; Biosorption; Cinétique; Thermodynamique*

ADSORPTION OF DYES TEXTILE FROM AQUEOUS SOLUTIONS BY ALGERIAN CLAYS

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The present work deals with adsorption of three acidic colorings (yellow bezanyl, red bezanyl and green nalomine) on Algerian clays: bentonite of Maghnia, kaolin of Mila and Djabel Debbagh clay from Ain Berbar. The acidic colorings were chosen as model pollutants of textile industry effluents in Tlemcen. From the three clays, bentonite showed the highest adsorption capacity of the coloring molecules under study. In a second step, a pillared bentonite was prepared using hexadecyltrimethylammonium bromide and an acidic treatment. This modified bentonite showed an enhanced adsorption capacity. At the end, all bentonites were tested in adsorption of “real” textile industry effluents. Results evidenced clearly the interest to use clays in the depollution of coloring waste waters.

***Keywords**: adsorption, clay, bentonite, acid dyes, kinetics.*

ADSORPTION DES COLORANTS TEXTILES EN SOLUTION AQUEUSE PAR DES ARGILES ALGERIENNES

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Actuellement, les rejets de l’industrie du textile sont lourdement chargés en colorants. Ces derniers sont souvent utilisés en excès pour améliorer la teinture ; de ce fait les eaux de rejet se trouvent fortement concentrées en colorants dont la faible biodégradabilité rend les différents traitements difficilement applicables, ce qui constitue une source de dégradation de l’environnement. Pour le grand public, un effluent coloré est obligatoirement pollué et dangereux. Chaque année et d’après notre Ministère de l’Environnement plus de 100 millions de m^3 d’eaux usées contenant des colorants ont été rejetés en Algérie.

La Wilaya de Tlemcen possède trois complexes de textiles (Tlemcen, Nédroma et Sebdou), leurs rejets colorés constituent d’énormes nuisances pour la santé humaine. L’élimination des colorants à partir des rejets industriels est très souvent réalisée par des traitements chimiques classiques tels que : la décantation, coagulation-floculation, oxydation,... Les eaux résiduaires traitées par ce procédé contiennent encore des colorants et sont chargées du fait du nombre de réactifs ajoutés. Dans la plupart des cas, ces procédés sont très onéreux.Il est nécessaire de réfléchir à des techniques d’efficacité importante et de coût moins élevé. Les recherches se sont alors orientées vers des procédés de traitement faisant appel à des matériaux naturels moins coûteux.

Depuis un demi-siècle, de nombreux laboratoires de différents horizons s’intéressent à la recherche de nouveaux adsorbants à base de matériaux naturels; parmi ces adsorbants, figure les argiles utilisées dans le domaine de traitement des eaux colorées.

C'est dans ce contexte que nous nous sommes proposés de tester des adsorbants compétitifs au charbon actif à base d'argiles disponibles en grande quantité dans notre pays du fait de son exploitation facile et peu coûteuse.

Le présent travail a pour but de :

Tester trois argiles de différentes régions de l'Algérie : la bentonite de Maghnia, le kaolin de Mila et l'argile de Djabel Debbagh de Ain Berbar dans le cadre d'éliminer trois colorants acides : le Jaune Bezanyl, le Rouge Bezanyl et le Vert Nylomine qui sont souvent rencontrés dans les effluents de l'industrie textile de Tlemcen.

L'objectif de cette étude consiste à :

- Simplifier le mode de traitement des eaux colorées avec un coût moins élevé,
- Améliorer la qualité et le rendement du traitement des eaux de rejet,
- Sauvegarder l'environnement des effets néfastes des colorants.

Les cinétiques d'adsorption des colorants sur la bentonite, le kaolin et l'argile de Djabel Debbagh montrent que ces argiles sont de bons adsorbants des colorants en solution aqueuse. Ces cinétiques sont influencées par les paramètres étudiés le pH de la solution, la température et la vitesse d'agitation.

***Mots clés** : adsorption, colorants textiles, bentonite, kaolin, argile Djabel Debbagh*

EMULSION SEPARATION USING HYDROPHOBIC GRAFTED CERAMIC MEMBRANES BY AIR GAP MEMBRANE DISTILLATION PROCESS

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Novel fluorosilanes grafted ceramic membranes were prepared and characterized in the air-gap membrane distillation (AGMD) process. The hydrophobic active layer was created by grafting 1H,1H,2H,2H-perfluorodecyltriethoxysilane (C_8 compound) on the ceramic membrane (mud of hydrocyclone laundries of phosphates/zirconia), to change their hydrophilic character into hydrophobic one. The efficiency of the grafting process was characterized by Scanning Electron Microscopy (SEM). The determination of the contact angle on the grafted membrane surface proved the hydrophobic character since it increases from 25° beforegraftingto values exceeding 160°aftergrafting. The membrane permeability varies from 720L/h.m^2 before grafting to 7 L/h.m^2 after grafting. The new hydrophobic membrane seems to be promising in the field of membrane distillation. High salt and oil retention higher than 99% were obtained using modified MF ceramic membrane.

Keywords : *Ceramic membrane, surface modification, Fluoroalkylsilanes, Air Gap Membrane Distillation, Emulsion Separation.*

EVALUATION OF THE ENERGY CONSUMPTION OF A HYBRID PROCESS OF DESALINATION OF SEA WATER COMBINING FREEZING AND REVERSE OSMOSIS.

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Throughout the world, water scarcity is being recognized as a present or future threat to human activity and as a consequence, a definite trend to develop alternative water resources such as desalination can be observed.

This work is part of an innovative approach aimed at improving the cost of desalination of sea water through the development of a new method more efficient than the membrane and thermal desalination processes in use. Benchmarking study and a literature analysis helped in orientating research study towards the development of a hybrid method coupling freezing and reverse osmosis (RO).

The freezing process is proposed as a method of pretreatment of the seawater upstream of the RO membranes. The freezing plant consists of three basic steps: the crystallization of ice in a scraped surface heat exchanger, the separation of ice crystals from the brine in a separation column and the melting of the ice formed.

The evaluation of the energy consumption of the proposed method shows an energy savings of approximately 36% compared to conventional RO desalination. This evaluation was conducted on the basis of mass and energy balances of the pretreatment process by freezing and simulation of RO desalination process using commercial software.

***Keywords**: hybrid desaliniation, freezing, reverses osmosis, ice crystallization.*

EVALUATION DE LA CONSOMMATION ENERGETIQUE D'UN PROCEDE HYBRIDE DE DESSALEMENT DE L'EAU DE MER COMBINANT LA CONGELATION ET L'OSMOSE INVERSE.

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Actuellement, les pays en situation de stress hydrique sont de plus en plus nombreux, tandis que les besoins en eau ne cessent de croitre. Face à cette pénurie, les recherches se sont orientées vers le développement de solutions techniques utilisant les eaux non conventionnelles. Le dessalement de l'eau de mer représente l'un des principaux axes.

Le présent travail s'inscrit dans une approche innovante d'amélioration du coût de dessalement de l'eau de mer ; et ce, par le développement d'un nouveau procédé plus performant que les procédés de dessalement existants. Une étude de benchmarking, et une analyse bibliographique approfondie, ont permis d’orienter la voie de recherche du travail vers le développement d’un procédé hybride couplant la congélation et l’osmose inverse(OI).

Le procédé de congélation proposé comme méthode de prétraitement de l’eau de mer en amont des membranes d’OI. L’installation de congélation comprend trois étapes essentielles: la cristallisation de la glace dans un échangeur de chaleur à surface raclée, la separation des cristaux de glace de la saumure dans une colonne de separation et la fusion de la glace formée.

L’évaluation de la consommation énergétique du procédé proposé montre un gain énergétique d’environ 36% par rapport au procédé de dessalement par OI conventionnel. Cette évaluation a été effectuée sur la base des bilans de matières et d’énergie du procédé de prétraitement par congélation et par simulation du procédé de dessalement par OI à l’aide d’un logiciel commercial.

Mots-clés : *dessalement hybride, congélation, osmose inverse, prétraitement.*

COMPARATIVE PERFORMANCE OF SODIUM-TRIPOLYPHOSPHATE AND SODIUM POLYACRYLATE ON SCALING INHIBITION BY FAST CONTROLLED PRECIPITATION METHOD.

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Calcium carbonate, $CaCO_3$, is an abundant substance that can be created in several mineral forms by the reaction of dissolved carbon dioxide in water with calcium ions. It is one of the most common scale components that affects daily life, industry, and technology. Therefore, chemical water treatment using inhibitors are applying to retard the formation of precipitates in the natural waters exploitation systems. Sodium-Tripolyphosphate (STPP) and Sodium Polyacrylate (RPI2000) are known to be efficient scaling inhibitors. The anti-scaling performance of STPP and RPI2000 was compared using the FCP (Fast Controlled Precipitation) method. Using this method, the precipitation occurs following a pH increase, by dissolved CO_2 degasification, after contact air/water. Some modifications were made to the FCP method to control the CO_2 degasification rate. During the scaling tests, resistivity, pH and calcium content were recorded. Studied solutions were calco-carbonic waters prepared by dissolving pure $CaCO_3$ in distilled water under CO_2 bubbling.

A comparative performance of the two inhibitors, concerning the time of nucleation and the scale inhibition efficiency , is developed. Results treatment give important information on the effect of CO_2 degasification rate on the nucleation threshold and on the quantity of inhibitors used.

APPLICATION OF DIRECT CONTACT MEMBRANE DISTILLATION FOR CADMIUM REMOVAL

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The removal of cadmium heavy metal contaminant from wastewater is one of most important issues of environmental remediation. In this work, an experimental investigation on the removal of cadmium ions from aqueous solutions was conducted by direct contact membrane distillation (DCMD) using polypropylene (PP) hydrophobic membrane. The DCMD process study describes the effect of feed temperature, feed flow rate, and initial cadmium concentration on permeate flux and cadmium removal efficiency. Experimental results show that cadmium removal was less dependent on different operating conditions. High value, nearly 99.98%, of rejection was observed for all experimental runs. The decontaminated water flux increases with increasing feed temperature and feed flow rate, and he effect of initial cadmium concentration could be neglected. The results indicated that PP membrane had the best permeate flux when a feed temperature of 80°C under feed flow rate of 20 L/h. All the experimental results indicated that DCMD using PP membrane could efficiency used for cadmium removal from aqueous solution.

Keywords: *DCMD; Cadmium removal; Permeate flux; Cadmium rejection; PP membrane;*

FLUORIDE REMOVAL FROM AQUEOUS SOLUTION BY DIRECT CONTACT MEMBRANE DISTILLATION

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Direct contact membrane distillation (DCMD) process was applied for fluoride removal from aqueous solution using a flat sheet polypropylene (PP) hydrophobic membrane with low pore size. The effect of relevant operating parameters such as feed temperature, feed flow rate, initial fluoride concentration on DCMD performance has been investigated. The obtained results indicates that DCMD process had rejection rate high than 99.8% and the product water was below maximum permissible level. The permeate flux increased with the increase of feed temperature and feed flow rate; and no effect was found as increased initial fluoride concentration. Using PP hydrophobic membrane, the maximum permeate flux was 4.35 L/m^{2}h at feed temperature of 80°C and feed flow rate of 20 L/h.

***Keywords**: DCMD; fluoride removal; Permeate flux; Nitrate rejection; PP membrane.*

REMOVAL OF PHENOL FROM AQUEOUS SOLUTIONS BY ADSORPTION ONTO SEWAGE SLUDGE BASED ADSORBENT

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The aim of this work is to evaluate the adsorption performances of sewage sludge based adsorbent (SSBA) for the removal of Phenol from aqueous solutions.

The SSBA was prepared by chemical activation with H_2SO_4 in a mass ratio of 1:1, followed by a pyrolysis at 650°C for 1 h under inert atmosphere. The produced adsorbent was characterized in terms of the specific surface area, the pH at zero charge point (pH_{PZC}) and the surface functional groups.

Batch adsorption experiments were carried out under different conditions including the adsorbent dose, the contact time, the initial concentration, the solution pH and temperature, in order to investigate their effects on the retention capacity of the solid support.

The Langmuir, Freundlich and Redlich-Peterson isotherm models were tested to examine the adsorption behaviour. The equilibrium data were well fitted by the Freundlich model. The maximum monolayer adsorption capacity of SSBA was found to be 26.16 $mg.g^{-1}$ at 293 K.

Finally the kinetic studies indicated that adsorption process followed the pseudo second-order model.

In conclusion the SSBA showed quite good capabilities in removing phenol from aqueous solutions.

Key words: *Sewage sludge; Phenol; Adsorption; Isotherms; Kinetics.*

INDUSTRIAL PHOSPHORIC ACID PURIFICATION USING NANOFILTRATION

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Phosphoric acid production is of major importance to the Tunisian economy. However, the quality produced is not suitable for other than agriculural use due to mineral and organic impurities. In this study, the purification of industrial phosphoric acid with a maximum of different P_2O_5 25% was achieved by nanofiltration. Six solutions differing by the concentration of P_2O_5 were used. The removal of some ions such as magnesium, iron, chrome, zinc, cadmium and vanadium had been studied.

The performances of the NF membrane (Nadir NP 30) were determined in terms of retention of $P_2O_{5,}$ impurities and permeate flux taking into account the effect of transmembrane pressure and membrane prea-treatment with purified phosphoric acid solution.

The results obtained in this work show that NF is highly efficient to purify industrial phosphoric acid solutions. Besides is the best choice because it is possible to treat solutions with high H3PO4 concentrations with a good global performance.

***Keywords**: Industrial phosphoric acid, 25% P_2O_5, purification, heavy metals, Nanofiltration*

CARACTERISATION DES BOUES ET DES EAUX EPUREES DE LA VILLE DE MEDEA EN VUE D'UNE REUTILISATION AGRICOLE

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La rationalisation de l'usage des ressources en eau conventionnelle est devenue une gestion impérative. En ce, et dans le cadre du développement durable, la réutilisation agricole des eaux épurées et des boues générées par le traitement, apparait comme une alternative pour la préservation de la ressource hydrique et de l'environnement et la promotion du secteur agricole.

C'est autour de cet axe que s'articule ce travail basé essentiellement sur l'aptitude des eaux usées épurées et des boues d'épuration de la STEP Médéa à la réutilisation en agriculture. Pour ce faire, des analyses sur ces sous produits, ont été faites au niveau des laboratoires. Les résultats obtenus, projetés et comparés aux recommandations de la FAO et aux normes de l'OMS, ont révélé que : Les eaux épurées de la STEP de Médéa, malgré leur forte salinité, sont réutilisables pour l'irrigation de certaines espèces tolérantes au sel. La concentration élevée des coliformes fécaux fait que ces eaux ne peuvent être réutilisées sans la chloration. Par la quantité relativement faible de matière organique qu'elle contient, la boue d'épuration de la STEP de Médéa est considérée comme un fertilisant, plus qu'un amendement organique. En outre, le C/N présente une importante disponibilité et une minéralisation rapide de l'azote.

Mots-clés *: Epuration, réutilisation, irrigation, épandage, normes.*

EVALUATION OF SALT SHOCKS EFFECTS ON ACTIVATED SLUDGE ACTIVITY THROUGH RESPIROMETRIC TECHNIQUES

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The floc formation in waste water treatment plant should be firm, dense, and mature in order to resist to shearing action and to be readily settleable in the secondary clarifier.

The interruption of floc formation occurs whenever one of the significant components of floc formation is not properly developed or not developed in an adequate numbers or quantities. Several operational conditions are responsible for this interruption such as fluctuations in organic loading, low dissolved oxygen concentration, pH, mixing, temperature and salinity variations.

Bacteria in activated sludge process can acclimate slowly to small increases in salinity up to 10 g/l. Although bacteria can acclimate to increases in salinity, they have much difficulty acclimating to decreases in salinity.

In this study severalpoints are elaborated using a respirometry technique (i) to study the effect of the presence of moderate and high salinities on respiratory activity, (ii) to evaluate the reduction of respiratory activity due to salinity fluctuations(iii)to estimate the biokineticconstantrelated to thesestress conditions.

***Keys words** : biokinetic constant, floc formation, respirometry, salinity.*

OXYDATION ELECTROCHIMIQUE DES SULFURES SUR ELECTRODES DE Pt , Zn ET Fe APPLICATION AUX TANNERIES

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Le procédé industriel d'élimination des sulfures de tannerie est basée sur une oxydation catalytique (air+$MnSO_4$) qui dure six heures nécessitant ainsi des bassins volumineux, de l'énergie (aération , agitation) et des réactifs coûteux.

L'oxydation électrochimique et l'électroprécipitation sont-elles des alternatives viables? La pollution par les sulfures ne se limite pas aux tanneries. Les mines, l'industrie du papier, l'activité des BSR (odeurs dans les eaux) son aussi d'autres enjeux importants. Outre ces problèmes, l'électrochimie des sulfures reste un domaine d'étude difficile (pKa_2 incertain), produits de la réaction mal définis (Kelsall), diagramme E-pH très approximatif, oscillations incomprises…On constate un regain d'intérêt pour les sulfures aquatiques et leur contribution dans la formation du DMS, acteur dans la formation des pluies. Pour étudier le comportement électrochimique des $S^{=}$ nous avons réalisé 3 types d'expériences :

Des essais de voltamétrie cyclique de Na_2S ,avec un montage classique à 3 électrodes , où nous comparons les courbes du mélange Na_2S / KCl et de KCl seul ; Les électrodes(W et aux.) sont en Pt . Nous effectuons un balayage -750/+1200 mV. Entre –750 et -450mV le courant reste nul. A -450 I augmente , passe par un pic à – 200 mV puis chuteà zéro (vers 0 mV).I reste très faible jusqu'à un E seuil de +700 mV où I augmente brutalement jusqu'à la fin du cycle . Le pic à -200 mV est conforme à la littérature où cette augmentation de I correspond à l'oxydation des $S^{=}$ en S adsorbé. Normalement l'adsorption du soufre doit réduire I car S constitue une couche isolante. Ce phénomène a été réellement observé sur l'électrode de Pt. Notre voltammograme est conforme à ce phénomène. Par contre les publications étudiées sont différentes. Dans tous les cas le courant augmente fortement pour des voltages de 750 mV et plus . La transformation directe $S/SO_4^{=}$ (redissolution de S sur Pt) peut expliquer cette augmentation de I. Dans notre VC l'étape S/thiosulfate n'est pas détectée.

Des essais de voltamétrie linéaire de Na_2S , avec un montage à 2 électrodes de platine (électrolyse/Fisher) , en milieu basique (pour simuler les rejets de tanneries) .Dans ce cas nous étudions l'influence d'une variété de paramètres.

Des essais de voltamétrie linéaire de Na_2S, avec des électrodes de fer et de zinc . Nous réalisons une électroprécipitation. C'est l'anode qui se dissout pour donner Fe^{++} ou Zn^{++} et ainsi la précipitation de FeS ou ZnS . Nous comparons les anodes de Fe et Zn où se déroulent ces réactions. L'électroprécipitation sur Fe a donné de biens meilleurs résultats que sur l'anode de Zn. Ce qui est inattendu et nécessite une discussion .Dans beaucoup de cas les rendements d'oxydation ont dépassé 85%.

LES APPLICATIONS ENVIRONNEMENTALES ET INDUSTRIELLES DE LA CHIMIE DE L'EAU

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Cette conférence a pour but de dresser un panorama des applications classiques et récentes de la chimie de l'eau dans les domaines de l'environnement et de l'industrie. Avant cela nous présenterons d'abord les propriétés fascinantes et extraordinaires de l'eau pure et de la molécule d'eau .En fin nous exposerons les tendances de la recherche (polluants, technologies et concepts émergeants).

De ces exemples nous verrons que la chimie de l'eau est :

-Un puissant outil scientifique de calcul , d'investigation et de diagnostic . En effet il est difficile d'effectuer un choix technologique (par exemple désinfecter par NaClO ou par O3, décarbonater l'eau sur résine ou par la chaux ,…), de déterminer les conditions d'oxydation ou de réduction d'un composé (E , pH ,T), de diagnostiquer un process défaillant (membrane colmatée , eau traitée encore turbide, échangeur d'ions inefficaces …) sans une connaissance approfondie de cette discipline ;

- Devenue une branche de la chimie qui nécessite un background scientifique et des méthodes d'enseignement spécifiques . Le contenu des ouvrages tels « Aquatic Chemistry » de Stumm & Morgan, « Water Chemistry » de Snoeyink & Jenkins, « Les fondements théoriques du traitement chimiques de l'eau » de M.Roques, « L'analyse de l'eau» de Rodier en sont de parfaites illustrations. Comme il est difficile de s'improviser polymériste, organicien, cristallographe il en est de même en chimie de l'eau.. .

-Mal prise en charge en Algérie (enseignement, recherche, industrie). Pour un pays qui a investi des milliards de dollars dans l'achat d'équipements (stations de dessalement, d'eau potable, d'eaux usées urbaines et industrielles), l'investissement scientifique et pédagogique reste minime et désordonné et l'orientation de la recherche déconnectée des réalités de l'industrie de l'eau , de l'industrie et du milieu naturel .

Cet exposé est basé sur :,

- Les recherches réalisées dans notre laboratoire et notre expérience industrielle :

- L'élimination des sulfures dans les tanneries ;
- La séparation, l'analyse et la valorisation des acides aminés (eaux de l'agro-alimentaire) ;
- La lixiviation sélective des métaux (valorisation des boues résiduaires de l'électrodéposition);
- Le recyclage de l'eau et du nickel par électrodialyse ;
- La production d'eau potable ar micro , ultra et nano-filtration ;
- L'adsorption des colorants textiles sur différents types de matériaux ;
- La déminéralisation des eaux par électrodéionisation ;
- Les mécanismes de dissociation de l'eau aux interfaces membrane échangeuse-solution ;
- L'économie et le recyclage de l'eau dans l'industrie(sidérurgie , dessalement , galvanisation…)

-Un revue bibliographique sur les applications classiques de la chimie de l'eau :

- La désinfection de l'eau : influence du pH de l'eau sur l'effet bactéricide de l'eau de javel ;
- La coagulation floculation : mécanisme de l'action de Al+++ ;
- Le devenir de tel ou tel métal dans l'environnement (barrage, nappe , rivière ,…)

- Les cycles naturels de l’eau , O2 , C , N , P …
  - **Un état de l’art sur les tendances de la recherche universelles**
- L’élimination de l’arsenic, des nitrates, des molécules organiques polaires,…
- Les procédés émergeants : AOP, MBR, EDI,…

Nous terminerons par cette phrase de Fritz H. FRIMMEL (Université de Karlsruhe), président de l’association allemande de chimie de l’eau : « Water chemistry is a fascination grown from the unique role of water on earth…**As a result Water Chemistry has become one of the basic columns of environmental protection ».**

PRECIPITATION OF METALLIC HYDROXIDES BY ALTERNATING CURRENT

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Precipitation of hydroxides is rarely an instant phenomenon, the balance is often achieved very slowly and the formation of precipitates is accompanied by:

- Secondary phenomenon (formation of many intermediate complexes);
- Adsorption phenomenon of ions on the particles of hydroxide formed.

Raising the temperature increases dramatically all speeds. Nevertheless, many hydroxides are difficult to precipitate due to the presence of charges on hydroxide particles. The latter may precipitated by discharging the adsorbed ions by electrolysis.

It is this original method that we used in our work to precipitate metallic hydroxides by alternating current. This method has the advantage of destroying the internal solvation sphere of the cation and favoring the kinetics of formation of hydroxide complexes.

In our research, we studied the feasibility of the precipitation of iron hydroxides by alternating current. Then, we studied the effect of some parameters such as: Time, pH, current, current density, temperature, etc...

Key words : *Alternating current; iron hydroxides, precipitation, pH, current density.*

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ENHANCEMENT OF COUNTER-ION TRANSPORT THROUGH ION EXCHANGE MEMBRANES IN ELECTRO-DIALYTIC PROCESS.

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Ion exchange membranes (IEM) are polymeric ion conducting materials. They have various applications such as : fuel cell (PEMFC), electrochemical synthesis (Cl_2 / NaOH), desalination, purification, separation and environment...[1-2]. Despite these applications, several aspects are still unknown, such as: the membrane structure, the conduction mechanisms and concentration polarization [3-4]. Concentration polarization is a common phenomenon to all systems operating selective ionic transfer through an interface, this phenomenon arises from the difference of ions mobility in the solution and in the membrane, it is the main obstacle in electro-membrane progress so, the study of this phenomenon is essential and very important. In this research we studied the effect of the ammonia buffer (NH_3/NH_4^+) on the counter-ion transfer through the anionic and cationic exchange membranes AMX and CMX respectively. The results show that the ammonia addition facilitates the counter-ion transfer in both cases and gives a total elimination of the system polarization, but with different behaviors of CMX and AMX membranes as shown (Fig.1).

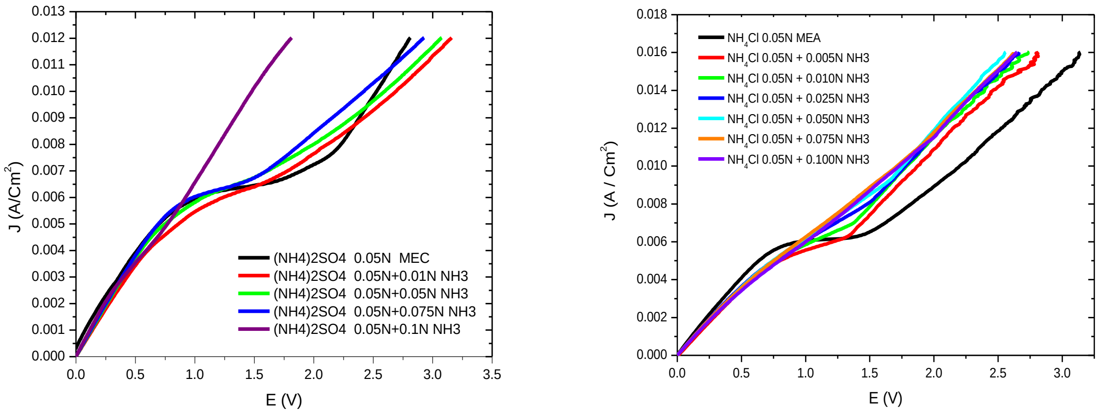

Figure 1.*Effect of ammonia addition on the I-V curve : left : $(NH_4)_2SO_4$ through CMX cation exchange membrane ; right : NH_4Cl through AMX anion exchange membrane*

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CMTDE 2013_60

CURRENT-VOLTAGE CHARACTERISTICS OF COMPETITIVE TRANSPORT THROUGH A CATION EXCHANGE MEMBRANE.

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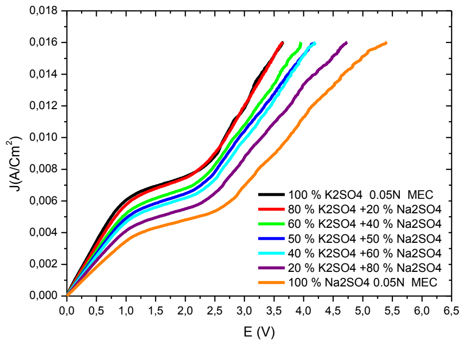
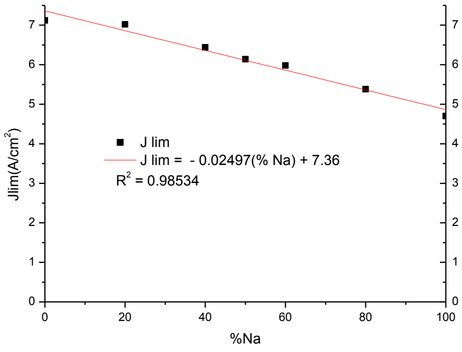
Ion exchange membranes (IEM) are polymeric ion conducting materials. They have various applications such as: renewable energy (fuel cells, reverse electrodialysis...), electrochemical synthesis(chlorine/soda,acid/base...), desalination, purification and environment (water depollution...). In all these applications the quality and the membrane properties play a key role in the success of these electro-membrane systems. The conduction mechanisms (limiting current, polarization, water splitting, over-limiting current...) and membrane selectivity are highly studied topics in order to improve the efficiency of the electro-membrane process [1-3]. In this work we studied the effect of the Na^+ proportion in the Na^+/K^+ mixture using current voltage curve (CVC) of ion exchange membrane. The comparison of the CVC, the development of the limiting current equation (I_{lim}) and concentration polarization are particularly studied

Material and methods

The current–voltage curves (CVC) are obtained using two compartments electrochemical
cell between them the ion membrane is integrated, the potential drop across the membrane is measured using two reference golden Luggin electrodes. two graphite electrodes are used to impose the current density, supplied by a potentiostat/galvanostat (Autolab PGSTAT 30, Ecochemie, the Netherlands) .

main results





1) CVC curves of Na^+ / K^+ mixture as a function of Na^+ proportion (CMX cationic membrane)

2) the limiting current density of Na^+/K^+ binary system.

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CMTDE 2013_61

DESTRUCTION OF HALOGENATED AROMATIC COMPOUNDS DISSOLVED IN WATER USING REDUCTION WITH METALLIC ALLOYS

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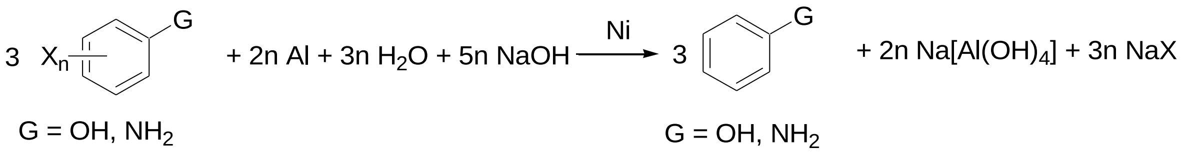
The effectivity of application of aluminium and their alloys and mixtures with copper or nickel was studied for the complete hydrodehalogenation of halogenated phenols and anilines dissolved in aqueous solution at room temperature. The reaction course was monitored by means of ^{1}H NMR and GC-MS spectroscopy[1-4].

It was found that the Raney Al-Ni is the highly effective reductant for the complete dehalogenation of studied halogenated aromatics (see Scheme 1). On the other hand, Devarda´s Al-Cu-Zn alloys can rapidly transform only brominated anilines and brominated phenols to aniline or phenol. The hydrodebromination is accompanied by the dissolution of aluminium and formation of soluble $Al(OH)_4^{-1}$ anions under these reaction conditions. After completion of the hydrodehalogenation reaction removal of the dissolved metals was achieved by precipitation of appropriate hydroxides using adjustment of the pH value and filtration. The produced aromatic compounds are easy biodegradable.



Scheme 1. Hydrodehalogenation of halogenated anilines or phenols using Al-Ni alloy.

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COMPARATIVE PERFORMANCE OF UF VS. CONVENTIONAL PRETREATMENT FOR SWRO : PILOT STUDIES

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Surface seawater intended for desalination by reverse osmosis (RO) need extensive pretreatment to control membranes fouling. Proper pretreatment is the most critical factor for successful long-term performance of seawater reverse osmosis (SWRO) plant. There are two categories of pretreatment technologies, conventional media filtration and UltraFiltration (UF). Both of these treatments are currently applied in SWRO plants in the world. In this study, two pretreatments have been compared, a conventional filtration and a UF membrane, both followed by separate RO pilot systems. The project was implemented at the Tajura on the Mediterranean Sea in Libya. Both pilots were conducted using raw feed water from open intake system for a period of four months starting in January 2013(ongoing).

The preliminary results indicate that the membrane filtration pretreatment provided superior water quality for pretreatment, measured by reduced turbidity and by the sit density index (SDI_{15}). The results has shown The membrane filtration units were able to consistently produced SDI15 values less than 3 and turbidity values less than 0.2NTU, while over 70 percent (%) of the conventional media unit SDI_{15} values were over 3 and produced an average turbidity of 0.33 NTU.

Keywords : *Conventional pretreatment, Membrane pretreatment, Desalination, Reverse osmosis*

BIOSORPTION OF BASIC BLUE 41 FROM AQUEOUS SOLUTIONS BY *POSIDONIA OCEANICA*: APPLICATION OF TWO- AND THREE-PARAMETER ISOTHERM MODELS

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Batch biosorption is carried of the basic blue 41 (BB41) removal, from aqueous solution using the marine biomass *Posidonia Oceanica*. A series of experiments are undertaken to optimize the system variables (pH, biomass dose and BB41 concentration). The highest removal yield is achieved over the pH range (8-11) with a maximum uptake capacity of 225.6 mg/g for BB41 concentration of 100 ppm. The minimum biosorbent dose experimentally found to reach the total dye removal is 0.4 g/L. Besides, the equilibrium data are modelled by three-parameter models (Langmuir, Freundlich and Temkin) and two tree-parameter models (Sips and Toth). The Langmuir and Sips equations provide the best results. An exhaustive comparative study is done to situate this marine biomass among the biosorbents already available in the literature.

***Key words** : Biosorption, Posidonia oceanica, Basic Bleu BB 41, Modelling.*

MODELING AND SIMULATION OF AGRO-FOOD WASTEWATER TREATMENT

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At this study, we will study the characteristics of the EL MAZRAA effluent; the station treats the effluent of the GIPA dairy industry and those of the EL MAZRAA poultry industry. In order to improve the efficiency of activated sludge systems, the software basing on dynamic modeling named activated sludge models are frequently used. Activated sludge models (ASM1, ASM2-ASM2d, ASM3) proposed by the IWA group (IAWPRC and IAWQ) were selected as the best combination of activated sludge process and the prediction of biological treatment of municipal and Industrial wastewater under dynamic conditions (Henze et al, 1987. Gujer et al, 1999.). Van Hulle et al (2004) are used the modified ASM1 adding two more components to account for toxic elements present in the chemical industry wastewater. Lucas et al 2005 ASM2d are modified the model to represent the biological reactions between the components of agro-food industries wastewater. Karahan et al (2007) used the ASM3 modified model; this model was adopted for the evaluation of the components of wastewater from the textile industry. Zhongda Xu et al (2006) compared the ASM1 and ASM2d model, with regard to the sensitivity of various fractions of nitrogen in the processing tomato industry wastewater. However, successful application of this model requires the estimation of kinetic and stoechiometric parameters and characterization of wastewater and activated sludge. It is therefore necessary to describe quantitatively the kinetics of microbiological processes and characterize the substrate (the influent composition) and biomass (activated sludge).

Table 1: Models used in the literature for industrial effluents

Models	
ASM1	Van Hulle and al 2004
ASM2d modified	Lucas and al 2005
ASM3 modified	Karahan and al 2007
ASM1	Vandekerckhove and al 2007
Comparison of ASM1 and ASM2d	Zhongda Xu and al 2006
Mantis	Scharaa O and al 2008

The application of dynamic models of processes wastewater treatment depends on the fundamental understanding of processes and synthesis of knowledge into a model implemented in a simulator. Mathematical models are in the form of inter-dependent differential equations that require implicit numerical routines and a computer for their resolutions. These models are classified as empirical, derived from analysis of experimental data and mechanistic developed based on the basic knowledge of the components of chemical processes, physical and biological system.

Thus, for the results obtained from experiments acquire certain universality, it should be described in terms of the relationship between inputs and outputs, ie as a model. Logic models can indeed reduce the complexity of the data and structure of scientific results in order to facilitate analysis, transmission and use.

The objective of this study is to evaluate the dairy and poultry industries effluent by analyzing various wastewater parameters characterizing (Boeglin, 1999). In addition, a biodegradability test was conducted to well characterize the effluent from each industry.

Finally, developing an optimization model of the treatment system, to best manage the operation of such a process to satisfy standards discharge and minimize the energy consumption, is a good way to achieve this goal. The simulation will include testing of the biological system operating scenarios and ventilation (setting recycling rates and control the ventilation function of the inputs). An optimized operating procedure may well include as operating adapted to the variability of operating conditions instructions. Development of a mathematical model, based on the activated sludge model ASM1 and the results of resperimotrics tests, was finished.

EFFECT OF CERTAIN PARAMETERS ON WATER DENITRIFICATION

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Biological nitrate removal from water was tested using a batch reactor. The influence of water temperature, solution pH, Substrate to biomass ratio (S/X) and the complexity of the carbonaceous substrate on nitrate removal were studied. It was found that all these parameters have a certain influence on the biological removal of nitrate using a mixed liquor obtained from a local domestic wastewater treatment plant.

The results showed an efficient and rapid process in removing nitrates. In fact, at neutral pHs the removal efficiency was 97.03%, more over the same removal efficiency was observed for a temperature of 30°C whereas for an S/X ratio of 0.1mg DCO/mg MVS the removal efficiency was of 99,74%.

Keywords : Bio-denitrification, water, Temperature, pH, S/X.

STUDY OF PHOSPHATE REMOVAL FROM WATER BY ELECTROCOAGULATION AND CHEMICAL COAGULATION PROCESS

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Treatment of water containing phosphate by electrocoagulation (EC) and chemical coagulation (CC) has been studied in a laboratory batch reactor.

For the electrocoagulation, anode is on aluminum. A comparison between three cathode materials shows that Al cathode is more suitable for phosphate removal than iron or stainless steel cathode.

The adjustment of the pH to 7 every ten minutes allows complete removal of phosphate after 40 min.

The study of co-existing ions (fluoride, nitrate, sulfate and carbonate) effect shows that these ions interfere with the phosphate during treatment with EC. These ions are also removed by EC, which explains the decrease in removal efficiency of phosphate upon addition of these ions.

The study of chemical coagulation using $Al_2(SO_4)_3$,18 H_2O as a chemical coagulant showed that after adjusting the initial pH of the solution containing phosphate and coagulant to 7, it has a total phosphorus removal from the first minute for an Al concentration of 0.5 g. The optimization of the mass needed to complete phosphate removal with initial pH of 6.5 showed that mass of 0.2 g Al coagulant is sufficient to achieve a yield exceeded 99.5%.

A comparison between the CC and EC in optimal circumstances indicates that the kinetics of phosphate removal is more rapid in the case of the CC because coagulant is fully poured into the batch reactor.

For the same Al mass provided by EC to that introduced in solution by CC, we conclude that the EC is more efficient and produces less sludge than with CC.

ETUDE DU COMPORTEMENT DE DICAMDA DANS UN SOL AGRICOLE ALGERIEN

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L'objectif de cette étude est d'étudier le comportement de dicamba dans un sol agricole algérien et d'identifier les principaux facteurs qui influencent sur la rétention du dicamba. Grace à la technique en colonne nous allons connaître le comportement de dicamba dans le sol. La colonne utilisée dans notre travail est constituée d'une seringue en plastique (diamètre interne de 6 mm et de hauteur égale à 4 cm). L'alimentation est faite en mode ascendant à l'aide d'une pompe péristaltique, l'injection des solutions de fond et des traceurs (traceur et dicamba) est faite par le bas de la colonne garnie du sol. Après l'étape de saturation de la colonne en $CaCl_2$ 10^{-2} M, la solution d'herbicide et le $CaCl_2$ 2.10^{-2} M (traceur de l'eau) est injectée avec le même débit. Les fractions de liquide sortant sont analysées par spectrophotomètre UV-visible (λmax=226 de dicamba) pour déterminer la concentration en herbicide. Les résultats obtenus montrent que le dicamba n'est pas fortement adsorbé sur les particules de sol et que sa rétention dans le sol dépend de certains paramètres tel que : la concentration initiale, PH,…..etc. Donc le dicamba est très mobile et il va disperser dans les eaux souterraines

***Mots clés** : adsorption en colonne, la rétention, herbicide, dicamba, l'adsorption dans les sols.*

PHOTOCATALYTIC DEGRADATION OF METHYLENE BLUE IN THE PRESENCE OF ZINC OXIDE

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Thegoal of thispaperis to testtheeffectiveness of semiconductor photocatalysis wich often leads to partial or complete mineralization of organic pollutants. Here the ZnO/UV(sun) photocatalytic degradation of Methylene Blue (MB) has been investigated in aqueous heterogeneous suspensions. The effects of process parameters like, catalyst loading, initial dye concentration and UV solar radiation intensity have been studied. The rate equation for the photocatalytic degradation followed pseudo-first order kinetics and the rate constants were determined using Langmuir-Hinshelwood model. The results showed that after two and a half hours of solar irradiation we obtained almost 98% dye degradation. These results suggest that ZnO/UV(Sun) photocatalysis may be envisaged as a method for treatment of waste waters in textile industries.

Key words*: Photocatalysis; Photocatalytic degradation; Dyes; Methylene blue; Water decolorization, ZnO catalyst*

DEGRADATION BY SOLAR RADIATION OF METHOMYL IN THE PRESENCE OF TITANIUM DIOXIDE

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Energy is considered a primary agent for economic development and as a significant factor in creating added value. In part against the unbridled use of this resource, especially in the last two decades has led to the real risk of environmental degradation and environmental concerns predominate. Growing evidence of environmental problems is due to a combination of factors as the environmental impact of human activities has greatly increased due to the growth of the world population, energy consumption and industrial activities. The use of renewable energy would solve this problem. Indeed, it would be useful to remember that the use of renewable energy, particularly solar energy, in different areas of development is experiencing increasing importance worldwide.

This work falls within the framework of sustainable development, by studying the photocatalytic degradation of a toxic pollutant biorecalcitrant in the presence of a semiconductor wich is titanium dioxide. The main objective of our work is to evaluate the efficiency of the solar photocatalysis for the treatment of water polluted by pesticides in a tubular solar reactor. Also to evaluate the performance of the solar photocatalysis, we studied the influence of some parameters such as initial concentration of pollutant concentration of the photocatalyst studied and the effect of the solar light flux ... etc. The degradation of this pollutant achieved a high rate of elimination more than 70%.

Preliminary tests allowed us to study the kinetics of the reaction and determine the optimal conditions lead to a high rate of degradation.

Keywords: *solar photocatalysis, solar energy, water treatment, pesticide.*

DEGRADATION PAR RAYONNEMENT SOLAIRE DU METHOMYL EN PRESENCE DU DIOXYDE DE TITANE

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L’énergie est considérée comme un agent primordial pour le développement économique et comme un facteur significatif de création de plus-value. En contre partie, l’utilisation effrénée de cette ressource, principalement ces deux dernières décennies, a engendré le risque concret de la dégradation environnementale et des soucis écologiques prédominants. L’évidence croissante des problèmes environnementaux est due à une combinaison de plusieurs facteurs puisque l’impact environnemental des activités humaines a augmenté considérablement en raison de la croissance de la population mondiale, de la consommation énergétique et des activités industrielles.

Le recours à l'utilisation des énergies renouvelables solutionnerait cette problématique. En effet, il serait utile de rappeler que l'utilisation des énergies renouvelables, particulièrement l'énergie solaire, dans les différents domaines du développement connaît une importance accrue au niveau mondial.

Ce travail entre dans le cadre du développement durable, en étudiant la dégradation photocatalytique d'un polluant biorécalcitrant toxique en présence d'un semi conducteur qui est le dioxyde de titane. L'objectif principal de notre travail est d'évaluer l'efficacité de la photocatalyse solaire pour le traitement des eaux polluées par un pesticide dans un réacteur tubulaire solaire. Ainsi pour évaluer les performances de la photocatalyse solaire, nous avons étudié l'influence de certains paramètres tels que la concentration initiale en polluant, la concentration du photocatalyseur étudié et l'effet du flux lumineux solaire…etc. La dégradation de ce polluant a pu atteindre un taux d'élimination important et qui dépasse les 70%.

Les tests préliminaires nous ont permis d'étudier la cinétique de la réaction et déterminer les conditions optimales susceptibles de conduire à un taux de dégradation élevé.

Mots clés: *photocatalyse solaire, énergie solaire, traitement des eaux****,*** *pesticide.*

POSIDONIA OCEANICA AND ITS DERIVED COAL USEFUL AS EFFECTIVE ADSORBENTS TO REMOVE PHENOL FROM AQUEOUS SOLUTION

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This study reports the removal of phenol from aqueous solution using a bio-marine plant and its derived coal as adsorbents.The textural analysis wasemployed in order to determine specific surface area and pore size distribution of the two types of adsorbents. Surface structure was characterized by using Fourier transform infrared spectroscopy. The effect of initial pH, contact time and adsorbent dosage on the adsorption was studied in a batch process mode.

The experimental data were carried out under varying experimental conditions of initial pH,

The experimental data were analyzed by the Langmuir and Freundlich isotherm models. Equilibrium data fitted well to the Langmuir model with a maximum adsorption capacity of 11.12mg/gand 1.11mg/grespectivelyon coal and*P. oceanica*raw. The results proved that the prepared coal derived from *P. oceanica* was an effective adsorbent for removal of phenol from aqueous solution.

Keywords : *Phenol, coal, Posidonia oceanica,adsorption isotherm.*

BIOSORPTION OF REACTIVE GREEN 12 AND DIRECT RED 89 PRESENT IN BINARY SYSTEM BY DRIED BIOMASS OF LEMNA GIBBA

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Dye pollutants from various industries are an important source of environmental contaminations. Most industries use dyes and pigments to color their products, which include textile, tannery, and, paper .Perhaps dyes are the serious polluters of our environment as far as color pollution is concerned.

The non-degradable nature of dyes and their stability to ward light and oxidizing agents complicate the selection of a suitable method for their removal. In comparison to the removal methods of colors, it has been well established that adsorption is the most convenient and effective technique to remove color from wastewater. Adsorption is considered to be relatively superior to other techniques because of its low cost, simplicity of design, high efficiency, availability and ability to separate wide range of chemical compounds.

In this work, we are interested to study the biosorption of textile dyes present in binary system, these dyes widely used in the Algerian textile industry; it is green cibacron (RG-12) and the scarlet solophényl (DR-89) with a dried biomass of duckweedtype Lemna gibba. A systematic study has allowed us to assess the competence of these dyes with well-defined operating conditions (exposure time, dose of biomass, pH, agitation speed and temperature) for containers mixtures of varying proportions of green cibacron and scarlet solophényl.

Experimental trials for the treatment of synthetic water containing varying proportions of green cibacron and scarlet solophényl show that the sorption kinetics of red dye is faster than the green dye. These same tests show that the maximum amount of quantity sorbed of DR-89 is high compared to the maximum amount of quantity sorbed of RG-12.

Keywords: *Biosorption, green cibacron, scarlet solophényl, binary system, L. gibba.*

BIOSORPTION DE VERT CIBACRON ET D'ECARLATE SOLOPHENYL PRESENTENT EN MELANGE BINAIRE PAR LA BIOMASSE SECHE DE *LEMNA GIBBA*

GUENDOUZS., KHELLAF N.

Les rejets industriels issus des activités industrielles de textile, papeterie et cuir présentent une charge polluante colorante importante avec éventuellement des flux importants. Malheureusement, dans la plus part des cas, ces polluants sont difficilement biodégradables. Leur décontamination par les techniques traditionnelles s'avère dans certains cas inefficace.

Dans ce travail, nous nous sommes intéressés à l'étude de la biosorption des colorants textiles présentent en système bisoluté, ces colorants abondamment utilisés dans l'industrie textile algérienne ; il s'agit de vert cibacron (RG-12) et l'écarlate solophényl (DR-89) par une biomasse sèche de lentilles d'eau de type *Lemna gibba*. Une étude systématique nous a permis d'évaluer la compétence entre ces colorants à des conditions opératoires bien définies (temps d'exposition, dose de biomasse, pH, vitesse d'agitation et température) pour des mélanges contenants des proportions variables de vert cibacron et d'écarlate solophényl.

Les essais expérimentaux relatifs à l'épuration d'une eau synthétique contenant des proportions variables de vert cibacron et d'écarlate solophényl montrent que la cinétique de sorption de colorant rouge est plus rapide que le colorant vert. Ces mêmes essais révèlent que la quantité sorbée maximale de DR-89 est élevée par rapport à la quantité sorbée maximale de RG-12.

Mots clés : *Biosorption, Vert cibacron, écarlate solophényl, mélange binaire, L. gibba*

ELIMINATION OF A TEXTILE DYE (ORANGE CELITON) BY A NATURAL BENTONITE

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Pollution ofwater and soil, accidentallyor intentionally bycertain chemicalsfrom industrial sources(hydrocarbons,phenols, dyes,…) or agriculture(pesticides, fertilizers, ...) has now becomea crucialproblem andanxiety, Becauseitis a source ofenvironmental degradationand raisesat presentaparticular interestinternationally.ProductsChemical sin general havea certain toxicity, are consideredcarcinogenicmicro pollutantsand even dangerouswhen they existin trace amounts. Theygenerallysourceforthe chemical,petrochemicalandfarmer.In mots cases they are the source of contamination from diffèrent parts of our planète.

The removal of thesepollutantsfromindustrial wasteisoftencarried out by conventionalchemical treatments such as sédimentation, flocculation, coagulation, oxidation, etc. The waste water treated by this process still contains pollutants and is charged because of the number of added reagents. In the majority of the cases, these processes are very expensive. It is necessary to think on techniques of severe effectiveness and lower cost.

The techniques of adsorption were crowned success in the elimination of the organic species.

Currently, the activated carbon is the adsorbent one most commonly employed thanks to its adsorbent capacity which is very significant with respect to the dyes, but the disadvantage is that the activated carbon is expensive because of its preparation which requires great investments (oxidation, crushing, sifting, activation, conditioning...).

It is in this context that we proposed to test a competitive adsorbent with the activated carbon based on clays available in great quantity in our country because of its easy and inexpensive exploitation.

In This context, our study is directed towards the use of a type of clay which is the bentonite used for the water treatment coloured the goal of this work is to study the influence of the experimental parameters (temperature of the medium, the stirring velocity and the effect of the concentration of the dye) on the adsorbing capacity of bentonite opposite the dye (Orange Céliton).

The results obtained at the time of this study on the scale of the laboratory, confirm the interest of the use of bentonite within the framework of water treatment contaminated by the dyes. The process used during this study is inexpensive to decrease the pollution of the chemical species and consequently to protect the environment from their harmful effects.

The experiments showed that:

- The Orange céliton is adsorbed on natural bentonite.
- The kinetics of adsorption of the Orange céliton on natural bentonite is fast.
- The capacities of adsorption of the Orange céliton to balance by bentonite are influenced by the stirring velocity, the temperature, the concentration of the dye of bentonite.

ELIMINATION D'UN COLORANT TEXTILE (ORANGE ELITON) PAR UNE BENTONITE NATURELLE

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La pollution des eaux et des sols, accidentellement ou volontairement par certains produits chimiques d'origine industrielle (hydrocarbures, phénols, colorants,...) ou agricole (pesticides, engrais,…) est devenue actuellement un problème crucial et grande inquiétude, puisque elle constitue une source de dégradation de l'environnement et suscite à l'heure actuelle un intérêt particulier à l'échelle internationale. Les produits chimiques en général ont une certaine toxicité, sont considérés comme des micropolluants cancérigènes et dangereux même lorsqu'ils existent sous forme de traces. Ils ont pour source généralement les industries chimique, pétrochimique et agricultrice. Dans la plupart des cas elles sont à l'origine de la contamination de différents endroits de notre planète.

L'élimination de ces polluants à partir des rejets industriels est très souvent réalisée par des traitements chimiques classiques tels que : la décantation, coagulation-floculation, oxydation,...etc. Les eaux résiduaires traitées par ce procédé contiennent encore des polluants et sont chargées du fait du nombre de réactifs ajoutés. Dans la plupart des cas, ces procédés sont très onéreux. Il est nécessaire de réfléchir à des techniques d'efficacité sévère et à moindre coût.

Les techniques d'adsorption ont été couronnées de succès dans l'élimination des espèces organiques. Actuellement, le charbon actif est l'adsorbant le plus communément employé grâce à son pouvoir adsorbant qui est très important vis-à-vis des colorants, mais l'inconvénient est que le charbon actif coûte cher à cause de sa préparation qui demande de grands investissements (oxydation, broyage, tamisage, activation, conditionnement…).

C'est dans ce contexte que nous nous sommes proposé de tester un adsorbant compétitif au charbon actif à base d'argiles disponibles en grande quantité dans notre pays du fait de son exploitation facile et peu coûteuse. Dans ce contexte, notre étude est orientée vers l'utilisation d'un type d'argile qui est la bentonite utilisée pour le traitement des eaux colorées.

Le but de ce travail est d'étudier l'influence des paramètres expérimentaux (température du milieu, la vitesse d'agitation et l'effet de la concentration du colorant) sur le pouvoir adsorbant de la bentonite vis-à-vis le colorant (Orange Céliton).

Les résultats obtenus lors de cette étude à l'échelle du laboratoire, confirment l'intérêt de l'utilisation de la bentonite dans le cadre de traitement des eaux contaminées par les colorants.Le processus utilisé durant cette étude est peu couteux pour diminuer la pollution des espèces chimiques et par conséquent protéger l'environnement de leurs effets néfastes.

Les expériences ont montré que :

- Le Rouge Céliton s'adsorbe sur la bentonite naturelle.
- La cinétique d'adsorption du Rouge Céliton sur la bentonite naturelle est rapide.
- Les capacités d'adsorption du Rouge Céliton à l'équilibre par la bentonite sont influencées par la vitesse d'agitation, la température, la concentration du colorant de la bentonite.

Study ofscale inhibitionof natural waters(Hamma, Fourchi) by rapid controlledprecipitation.

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Scaling is a complex phenomenon, it is characterized by the formation of the deposits adhesion on the walls in contact with natural hard waters. Scale deposits consists essentially in the formation of calcium carbonate (CaCO3).

The scaling of the drains and the domestic or industrial works has the serious technical and economic consequences such as: total or partial obstruction of pipes leading to a decrease in flow rate, seizure of valves and clogging of filters, reduced heat transfer coefficientduring the formationof the precipitatein theheat exchangers,reducing thediameter of thewater pipes.

The objective of this study is the furring inhibition of domestic and industrial power waters of Hamma and Fourchi by Rapid Controlled Precipitation method (RCP). This method was used to evaluate and inhibit scale formation in the presence of (sodium tripolyphosphates, K_2HPO_4 and K_3PO_4).

The effect ofinhibitorconcentrationand temperaturewere also studied. The rapidcontrolledprecipitationhelpedto implementthe process ofgermination, growthof calcium carbonateand adding(0.05 mg/Lofsodium tripolyphosphates, 1mg/L$K_2HPO_4$and 0.5mg/LK_3PO_4) hasdemonstratedsignificantanti-scaleeffect of theseinhibitors.

The inhibition isalmost completefor quantities(0.5mg/Lofsodium tripolyphosphates, 3 mg/L$K_2HPO_4$and 2.5mg/LK_3PO_4).

***Key words:** Scaling, Carbonate of calcium, Inhibition, Rapid Controlled Precipitation (RCP).*

Ammonium removal and recovery from municipal wastewater onto sawdust under dynamic conditions

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The present study aims to evaluate the efficiency of new continuous-flow system using sawdust as suspended biosorbent for the removal of ammonium from synthetic solution and municipal wastewater. Effects of ammonium initial concentration, sawdust dosage, flow rate and ions competition were investigated. Results showed that ammonium removal efficiency from synthetic solutions ranged between 76 -94 % for all experimental conditions tested. Furthermore, HRT of 4 hours was sufficient to ensure high ammonium removal efficiency. Moreover, the main parameters influencing the ammonium removal efficiency and the rate transport of ammonium from the bulk to the solid-liquid interface were sawdust dosage and contact time. Nevertheless, the presence of TSS in raw and treated municipal wastewater influenced the ammonium removal efficiency more than the presence of other soluble cations. In order to overcome the TSS effect it is recommended to either increase sawdust dosage or use two reactors to increase contact time.

Keywords: *Ammonium; Sawdust; Continuous flow system; Tertiary treatment; Municipal wastewat*

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ADSORPTION OF FERROUS IRON IN THE CALCITE AND THEIR INVOLVEMENT IN THE IRON REMOVAL FROM GROUNDWATER

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The effect of adsorption of Fe (II) with the calcite on the kinetics of the oxidation Fe (II) was investigated. The oxidation reaction Fe (II) was studied experimentally in the absence and in the presence of calcium carbonate in the calcite form. This reaction occurred in two distinguishable steps: (a) a rapid step has a sharp reduction of oxygen in the first five minutes was followed by a slow step (b) with the oxygen consumption decreases gradually. The removal rate of iron is influenced by the presence of calcium carbonate in suspension. This yield increases with increasing concentration of CaCO3. The time required for the complete removal of iron is reduced 11 to 4 min by varying the concentration of CaCO3 from 100 to 400 mg /L. The XRD analysis of the precipitates recovered during our experiments show that the ferrous ion is precipitated in the presence of calcite suspension as goethite.

DESIGN, MATHEMATICAL MODELLING AND THERMAL PERFORMANCE EVALUATION OF AN AIR SOLAR HEATER FOR DESALINATION PROCESS

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Solar air collectors are widely used for low to moderate temperature applications like space heating, crop drying, solar desalination and other industrial applications. The present paper deals with design, dynamic modelling and thermal performance investigation of an air solar collector to be used in humidification–dehumidification solar desalination unit. To numerically investigate the air solar collector thermal performance, we have developed dynamic mathematical model able to predict the dynamic behaviour of the solar collector. The resulting distributed parametric systems of equations are transformed into a system of ordinary differential equations using the orthogonal collocation method. A computer simulation program based on the mathematical model is developed by means of C++ software. In this simulation program, the fourth order Runge-Kutta method is used to solve the energy balance equations numerically. The simulation results show the effects of design and operational parameters on the air solar collector efficiency.

Keywords:*Solar collector, solar desalination, dynamic modeling, simulation, thermal performance.*

NITRATE REMOVAL FROM A WATER SOLUTION BY ELECTROCOAGULATION

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Nitrates are one of the major causes of water pollution; which consequences are multiple: risk for human health and eutrophication of aquatic ecosystems. They are very much soluble and migrate easily.

For all these reasons, nitrates were chosen as a representative pollutant in order to test electrocoagulation.

This process is based on the principle of an electrode (anode), under an electrical courant, which generates ions that coagulate pollutants to be removed.

The study undertaken using aluminium electrodes have shown the capabilities of reducing nitrates and confirmed the influence of certain operating parameters, on the removal process, such as electrical courant intensity and time. It was found that with an intensity of 2 A and a contact time of 90 min, removal attained an optimum of 90.61%.

Moreover, the effects of solution initial pH, temperature, nitrate concentration and salt concentration on the removal were considered as well as the evolution of sludge production, solution pH and temperature as the experiment proceeded.

Keywords*: nitrates, electrocoagulation, water treatment, nitrate removal.*

ANAEROBIC DIGESTION TREATMENT TANNERY WASTEWATER TRAITEMENT DES REJETS DE TANNERIE PAR DIGESTION ANAEROBIE : INFLUENCE DE LA CONCENTRATION ET DE LA TEMPERATURE

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Anaerobic digestion process is an interesting solution for treating tanneries' residues, since it results in a limited production of sludge and a considerable energy production.

The objective of this work is to assess the biodegradabilty of a tannery wastewater and to study the effect of different substrate to inoculum ratios of (S/I) on methane production as well as the variation of COD degradation with time under thermopile (55°C) and mesophilic (37°C) conditions.

The results showed that biochemical methane potential (BMP test) is not too much different under mesophilic and thermophilic conditions, biogas maximal production was found to be 194 ml for an organic loading rate (ORL) of 40,16 mg/l. Moreover COD degradation efficiency was found to be 66,06 % under mesophilic conditions and 67.21% for thermophilic ones. The experimental duration time was 56 days.

The low biogas production and COD degradation are due to the presence of a digestion inhibitor, in fact the high chromium concentration is the main reason since its concentration was found to be 255 mg/l as well as other operating parameters that could inhibited the process: pH and conductivity.

Key words*: anaerobic digestion, tannery, biogas, mesophile, thermophile, COD,*

CONTRIBUTION TO THE STUDY OF THE COMBINED EFFECTS OF AQUEOUS SOLUTION CONTAINING SURFACTANTS AND BIOPOLYMERS ON SOME PHYSICAL AND RHEOLOGICAL PARAMETRES

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The study of interactions between micellar systems in the presence of additives (polymer electrolyte) has attracted, in recent years, a great scientific interest because of the many practical applications such as food, pharmaceutical, cosmetic and petroleum, especially in enhanced oil recovery. In the latter case, the oil droplets are trapped in porous media and can only be moved under the combined effect of viscous and interfacial forces. This is an aim that can only be achieved with mixed polymer / surfactant systems mixed with other additives. Moreover, in other industries, the formulation of stable emulsions tends increasingly to the use of polymers having significant surface properties alone or mixed with surfactants that provide a medium viscosity and stability to the system.

This work is a contribution to the study of the interactions that may exist in a system containing both soluble biopolymers: xanthan gum and cetomacrogol 1000, two anionic surfactants: sodium dodecyl sulfate (SDS) and Sodium dodecylbenzenesulfonate (LABSNa), a oil (olive oil) in the presence and absence of an electrolyte (NaCl) and the effect of these interactions on the physicochemical and rheological properties of such systems.

CONTRIBUTION A L'ETUDE DES EFFETS COMBINES DANS UNE SOLUTION AQUEUSE DE TENSIOACTIFS ET DE BIOPOLYMERES SUR QUELQUES PAPAMETRES PHYSICOCHIMIQUES ET RHEOLOGIQUES

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L'étude des interactions entre un système micellaire en présence d'additifs (polymère, électrolyte) a suscité ces dernières années un grand intérêt des scientifiques en raison des multiples applications pratiques telles que les industries agro-alimentaire, pharmaceutique, cosmétique ou pétrolière, notamment en récupération assistée du pétrole. Dans ce dernier cas, les gouttelettes d'huile qui se trouvent piégées en milieu poreux ne peuvent être déplacées que sous l'effet combiné de forces visqueuses et interfaciales. C'est un objectif qui ne peut être réalisé qu'avec des systèmes mixtes polymère/tensioactif mélangés avec d'autres additifs. Par ailleurs, dans les autres industries, la formulation des émulsions stables tend de plus en plus vers l'utilisation de polymères ayant des propriétés surfaciques non négligeables seuls ou mélangés avec des tensioactifs qui assurent une viscosité au milieu et une stabilité au système.

Ce travail est une contribution à l'étude des interactions qui peuvent exister dans un système contenant deux biopolymères hydrosolubles , la gomme Xanthane et le cétomacrogol 1000, deux tensioactifs anioniques (Dodécyl sulfate de Sodium : SDS et le dodécylbenzènesulfonate de Sodium : LABSNa), une d'huile(huile d'olive) en présence et en absence d'un électrolyte (NaCl) et l'effet de ces interactions sur les propriétés physico-chimiques et rhéologiques de tels systèmes.

CONTRIBUTION TO THE STUDY OF THE CONCENTRATION REDUCTION OF EFFLUENT CONTAINING SURFACTANT AND BIOPOLYMER INDUSTRIAL WASTE RESULTING

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Industries consume large quantities of water and reject a part in receiving systems. The amount released is heavily polluted aqueous effluents when not undergo prior adequate treatment causing adverse effects on the environment and humans.

This work is a presentation of a mechanism will limit the effects of such discharges. The latter consists of the mixed adsorption of a polymer: polyethylene glycol (PEG) with two surfactants: sodium dodecylbenzene sulfonate (SDBS) and sodium dodecyl sulfonate (SDS) on a sorbent: activated carbon, the study is made in the aim to determine the optimal operating conditions of this aqueous effluent treatment and hence reduce the concentration to an acceptable level according to the standards rejection.

The results show a decrease in the concentration of the reagents tested.The decrease in concentration is due to the simple adsorption (for products used separately) and mixed adsorption (case mix: SDBS (SDS) + PEG) by activated carbon. Adsorption curves of the two shows that the SDBS surfactant and greater than the adsorption of the SDS, and is more important than in the case of the surfactant and the polymer mixture (SDBS and PEG). The SDBS results are better than the SDS, then it is selected with PEG for the study of the mixed adsorption: polymer surfactant.

The results show that the adsorption time is fast. The equilibrium concentrations are achieved after about an hour for the static adsorption. For The dynamic adsorption, adsorption is more faster (the equilibrium is obtained within a few minutes).

CONTRIBUTION A L'ETUDE DE LA REDUCTION DE LA CONCENTRATION D'UN EFFLUENT CONTENANT UN TENSIOACTIF ET UN BIOPOLYMERE ISSU DES REJETS INDUSTRIELS

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Les industries consomment une grande quantité d'eau et en rejettent une partie dans les systèmes récepteurs. La quantité rejetée est fortement polluée lorsque les effluents aqueux ne subissent pas un traitement adéquat préalable causant des effets néfastes sur l'environnement et sur l'homme.

Ce travail est une présentation d'un mécanisme permettra la limitation des effets de ces rejets, ce dernier consiste en l'adsorption mixte d'un polymère : le polyéthylène glycol (PEG) avec deux surfactants : le dodécylbenzène sulfonate de Soduim : (SDBS) et le dodécyl sulfonate de Sodium : (SDS) sur un adsorbant : le charbon actif, cette étude est faite en vue déterminer les conditions opératoires optimales de traitement de cet effluent aqueux et de diminuer par conséquent sa concentration à un niveau acceptable conformément aux normes de rejet.

Les résultats montrent une diminution de la concentration des réactifs testés.

La diminution de la concentration est due à l'adsorption simple (cas des produits utilisés séparément) et à l'adsorption mixte (cas du mélange : SDBS (SDS) + PEG) par le charbon actif. Les courbes de l'adsorption des deux tensioactifs montre que le SDBS et plus importante que l'adsorption du SDS, et est plus importante que dans le cas du mélange tensioactif et du polymère (SDBS et PEG). Le SDBS présente des résultats meilleurs que le SDS, il est alors choisi avec le PEG pour l'étude de l'adsorption mixte : polymère /tensioactif.

Les résultats montrent que le temps d'adsorption est rapide. Les concentrations à l'équilibre sont obtenues au bout d'une d'heure environ pour l'adsorption statique. Pour l'adsorption dynamique, l'adsorption est plus rapide (l'équilibre est obtenu au bout de quelques minutes).

CONTRIBUTION TO THE EVALUATION OF POWER FURRING OF HARD WATER BY CHEMICAL AND ELECTROCHEMICAL WAY.

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Treating hard water has been interest from several works in order to reduce the negative consequences of tartar. Hard water deposits form compact and adherent to the walls of pipes and industrial or domestic installations [1] causing enormous technical and economic consequences.

Our study focuses on the chemical treatment with KH_2PO_4 and polyphosphates harsh waters of Hamma with a hardness of 59 ° F and Negrine with a hardness of 56 ° F.

The evaluation of the effect of chemical treatment of hard water of Hamma and Negrine was carried out by using three techniques:

The chemical method for assessing the concentration effective for reducing the water hardness and the Hamma, Negrine the source temperature 30 ° F.

-The precipitation method for the rapid controlled phenomena followed germination and growth during the formation of the deposit of calcium carbonate.

-Electrochemical method of measuring impedances deposits, the deposit precipitated calcium carbonate, metal-electrolyte interface used to assess overall, by means of high-frequency resistance, adhesion and the importance of filing carbonate calcium [2], [3].

The effect of inhibitors on the morphology and adhesion of the deposit of calcium carbonate is observed by scanning electron microscope SEM. The application of chemical treatment of water Hamma and Negrine at 30 ° C showed that total inhibition of hardness requires the addition of KH_2PO_4 at a minimum concentration of 2.5mg / L for Hamma and 3mg / L for Negrine. For water treatment against Hamma and Negrine by polyphosphates inhibit scaling added at a concentration of 10 mg / L for water Hamma and 5mg / L for water Negrine. These values are reduced using the method of rapid controlled precipitation for both inhibitors 0.1mg / L for water Hamma and 1mg / L for water Negrine because the exchange of oxygen from the air with treated water accelerates the precipitation of calcium carbonate.

The drawing of the impedances of water Hamma and Negrine treated with increasing concentrations of KH_2PO_4 and polyphosphates, impedances relative to the raw water and the two sources Hamma and Negrine, decrease the amount of calcium carbonate scale as well as its adhesion by high frequency measuring resistors deposits.

Keywords*: Scaling, chemical treatment, PCR, impedance, SEM.*

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REMOVAL OF METHYLENE BLUE ONTO MINERAL MATRICES

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The textile industry generates huge volumes of wastewater concentrated with dye. Discharging of these effluents into the environment causes many diseases to human life. Therefore, adsorption of this type of dye such as methylene blue onto mineral matrices offers a very attractive method for pollution remediation. The present investigation is undertaken to test the use of Tunisian clay in natural and purified form to remove methylene blue from aqueous solution.The experimental data was determined using the Langmuir and Freundlich isotherms. However, equilibrium data fit well to the Langmuir model, and the monolayer adsorption capacity for methylene blue dye is 312,5 and 208,33 mg/g respectively with purified clay and natural clay.

MICROFLUIDIC REACTIVE POLYMER MEMBRANE FOR METALLIC ION EXTRACTION

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Microfluidics has been one of the fastest growing fields of research in recent years, as illustrated by the correspondingly large increase in the volume of publications on the subject [1]. An advantage of such devices is their large surface/volume ratios [2].

By the late nineties, membrane extraction of metals became an acceptable technology for the recovery of metals from waste streams. Moreover, there exist numerous other possibilities that are yet to be explored. On the whole membrane extraction and concentration offers some unique possibilities beyond the capabilities of conventional means, particularly in the field of automated analysis. The challenge in the future lies in enhancing selectivity, testing diverse analytes and incorporation in lab-on-a-chip devices [3]

The purpose of this research is to develop a microfluidic membrane module that incorporates a conventional flat sheet plasticized polymer membrane to employ it for the micro-scale facilitated transport of divalent ions (Zn(II), Cu(II)).

Microfluidic membrane extraction includes an extraction module and a peristaltic pump for liquid delivery. The total surface area of the microchannels is 1.64 cm^2.

The flat sheet membrane used here was polymer inclusion membrane (PIM) containing Cyanex 302 as extractant.

The flow rates of the donor and the acceptor phases were varied between 50 $\mu Lmin^{-1}$ and 910 $\mu Lmin^{-1}$. Optimum donor and acceptor flow rates were found to be 910 $\mu Lmin^{-1}$and 50 $\mu Lmin^{-1}$, respectively. The extraction efficiency (EE) in the static mode varied from 32 to 66%, while in the dynamic mode it ranged from 19 to 79%.

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OPTIMIZATION OF DYE ADSORPTION PROCESS USING RESPONSE SURFACE METHODOLOGY

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Cyclodextrins (CDs) are cyclic oligosaccharides converted from starch and have the unique property of forming inclusion complexes with various organic compounds [1].Since CDs are soluble in water, they cannot be used directly as absorbents in aqueous media. A feasible approach is to prepare water-insoluble CDs polymers, an approach which has attracted considerable attention [2]. Adsorption using cyclodextrin-based polymer as adsorbent, is an efficient technique with the advantages of specific affinity, low cost and simple design [3].

In this study, cyclodextrin based polymer was successfully used as sorbent for the removal of methylene blue from synthetic aqueous solutions in a batch system.

The **central composite design and response surface methodology (RSM)** were applied to determine the optimum conditions of the adsorption process. The experimental design was done at five levels of the operating parameters which were initial dye concentration, pH, agitation rate and NaCl concentration and their studied ranges are 4-20 mg/L, 3.0-9.0, 150-350 rpm, $2x10^{-9}$-0.2M, respectively.

The optimal conditions determined by using surface contour plots for initial dye concentration, pH, agitation rate and NaCl concentration were 12 mg/L, 6.0, 250 rpm and $2x10^{-9}$ M, respectively.

The mechanism of adsorption was both physical adsorption and hydrogen bonding due to the polymer and formation of an inclusion complex due to the CD molecules through host–guest interactions.

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CMTDE 2013_85

ETUDE DES POSSIBILITES D'UTILISATION DES EAUX EPUREES ET DES BOUES D'EPURATION DANS L'AGRICULTURE ; CAS DE LA STATION D'EPURATION DE CHENOUA (ALGERIE).

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The present study proceeded in Chenoua, a coastal town to 10 km west of Tipaza, where the scarcity of water and the lack of organic soil conditioner of the grounds contribute to justify the use of purified water and the sewage sludge in agriculture.

. The first shutter of this study treats agronomic and medical aspects purified water.

. The second aim of the study related on the one hand to the analysis of the contents of heavy metals (Cd, Zinc, Ni, Cu, Cr) and on the other hand on the study of the agronomic value of the sewage sludge.

The type of approach that we followed in the study of the quality of water of irrigation relates to problems generally being included in the four main following categories: salinity, permeability, toxicity and medical condition. The physicochemical analyses of purified water reveal a conformity of the majority of the parameters compared to the standards of re-use of this water in irrigation. The bacteriological analyses of purified water reveal a significant reduction amongst bacteria, but the number of pathogenic germs remains higher than the standards of WHO, which imposes a disinfection of purified water, with prohibition to use them on crudenesses.

The examination of the risks of toxicity by heavy metals show that the contents of metal elements traces in mud are sufficiently weak and thus do not constitute a factor limiting its use in agriculture.

The comparative study between the composition of muds, that of the urban compost and the manure of firm showed that these last contain larger quantities cogitates some and mugs some up that of the manure and the compost. However the manure contains much more carbon and of nitrogen compared to muds and the urban compost.

***KEYWORDS**: raw sewage, Chenoua, Algeria.*

ETUDE DES POSSIBILITES D'UTILISATION DES EAUX EPUREES ET DES BOUES D'EPURATION DANS L'AGRICULTURE ; CAS DE LA STATION D'EPURATION DE CHENOUA (ALGERIE).

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La présente étude s'est déroulée à Chenoua, une ville côtière à 10 km à l'ouest de Tipaza, où la rareté de l'eau et le manque d'amendement organique des sols contribuent à justifier l'usage des eaux épurées et des boues d'épuration dans l'agriculture.

. Le premier volet de cette étude traite des aspects agronomiques et sanitaires des eaux épurées.

. Le second objectif de l'étude a porté d'une part sur l'analyse des teneurs en métaux lourds (Cd, Zinc, Ni, Cu, Cr) et d'autre part sur l'étude de la valeur agronomique des boues d'épuration.

Le type d’approche que nous avons suivi dans l’étude de la qualité des eaux d’irrigation concerne des problèmes entrant généralement dans les quatre grandes catégories suivantes : salinité, perméabilité, toxicité et état sanitaire. Les analyses physico-chimiques des eaux épurées révèlent une conformité de la majorité des paramètres par rapport aux normes de réutilisation de ces eaux en irrigation. Les analyses bactériologiques des eaux épurées révèlent une diminution significative du nombre de bactéries, mais le nombre de germes pathogènes reste supérieur aux normes de l’OMS, ce qui impose une désinfection des eaux épurées, avec interdiction de les utiliser sur des crudités.

L’examen des risques de toxicité par les métaux lourds montre que les teneurs en éléments traces métalliques dans la boue sont suffisamment faibles et ne constituent donc pas un facteur limitant son utilisation en agriculture.

L’étude comparative entre la composition des boues, celle du compost urbain et du fumier de ferme a montré que ces dernières contiennent des quantités plus importantes en phosphore et en potasse que celle du fumier et du compost. Cependant le fumier contient beaucoup plus de carbone et d’azote par rapport aux boues et au compost urbain.

***MOTS - CLES** : eau usée, Chenoua, Algérie.*

THE CORROSION OF THE FE-19CR STAINLESS STEEL IN VARIOUS SAMPLES OF WATER

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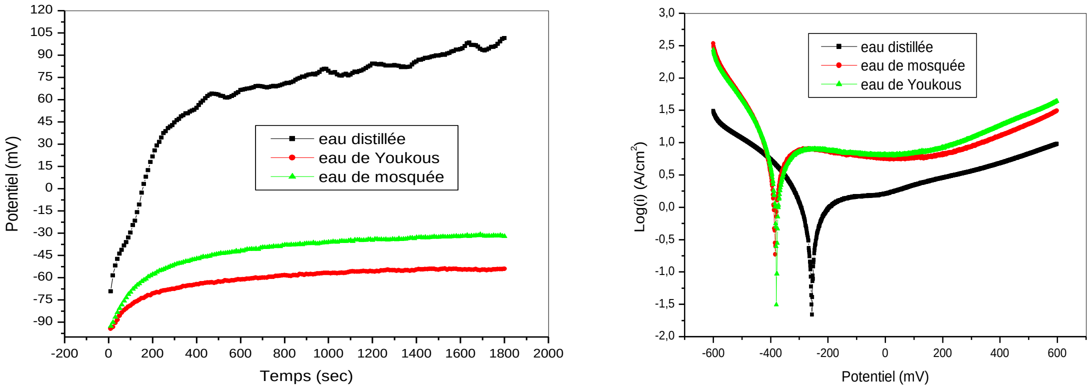
The objective of this research is to study the Fe-19Cr stainless steel corrosion , in various samples of water (distilled water, drinking water, mineral water). The used electrochemical methods are : the open circuit potential (V-t) and the polarization curve (I-V). The V-t curves from and I-V curves were carried out using an electrochemical cell with three electrodes (Fe-19Cr, Platinum, calomel saturated electrode), piloted by a potentiostat-galvanostat (voltalab PGZ 100). The free potential for the two systems mineral water and drinking water are respectively -55 mV and -31.8 mV. Moreover, the distiled water system with 105 mV is more important than the two previous systems.For the current-potential curves, the anodic and cathodic behavior of the two systems : drinking water and mineral water are identical comparing to that of distilled water system. The corrosion current of the drinking system (7.08µA/cm^2) is close to that of the mineral water system (7.87µA/cm^2) but the conductivity of the first one (1248 µS/cm) is twice as much as that of second system (564 µS/cm). This result can be explained by the nature of the ions. To determine the anions nature effect on the corrosion current, following salts were studied: chlorides ($CaCl_2$, $MgCl_2$), bicarbonates ($NaHCO_3$, $KHCO_3$), sulphates ($MgSO_4$) and silicates ($NaSiO_3$). The bicarbonates are the most corrosive electrolyte but silicates are the leastest one.



Figuere01. theopen circuit potential (left) and the polarization curve (right) of the three samples of water

THEADSORPTIONAND THE INHIBITORY PROPERTIESOF PENICILLING ON THE CORROSION OFFe-19Cr STAINLESS STEEL IN HCL SOLUTION.

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The objective of this research is to study the inhibitory properties and the mechanism of the penicillin G (fig.1) adsorption for the corrosion of alloy dental Fe-19Cr non precious in a solution of HCl. Electrochemical methods used are ; potential versus time (Vt), polarization curve IV. Vt and IV curves plot for Fe-19Cr steel in the test solutions was carried out in a system consisting of an electrochemical cell with three electrodes (Fe-19Cr, Platinum saturated calomel electrode), and a potentiostat-galvanostat PGZ VoltaLab 100. Free Potential Fe-19Cr steel in (0.4N HCl) without penicillin G reaches a steady state close to -390 mV / ECS, but, the solution with the penicillin G , the potential value increases considerably with the free content of the inhibitor.

The corrosion current density obtained by the application of the Tafel model to the polarization curve (Fe-19Cr 0.4N HCl without inhibitor) is 73.80 µA/cm^2. These current density is 47.55 µA/cm^2 when we add 20 ppm of penicillin G(fig.2). It was also found that increasing the concentration of the inhibitor causes the decrease in the current and the corrosion rate.

The adsorption of the inhibitor on the surface of Fe-19Cr steel was found to be spontaneous with the physical adsorption mechanism. The Langmuir adsorption isotherm model was considered the best isotherm that describes the adsorption characteristics of the penicillinG.

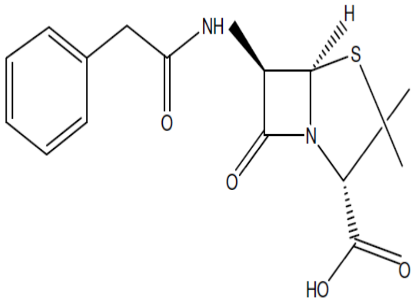

Fig. 1 Structure of penicillin G

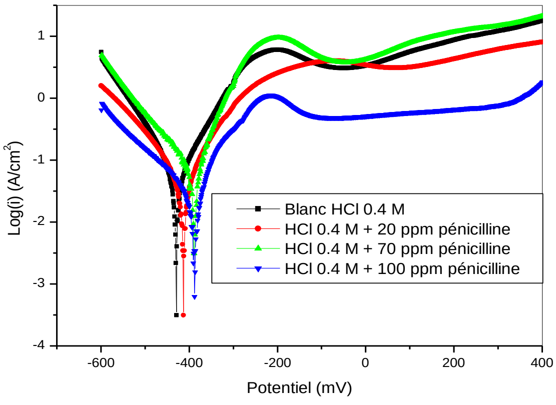

Fig.2 : Linear polarization curves of steel corrosion in 1 M HCl solution with and without the inhibitor Fe-19Cr,scan 50 mV/sec.,25°C

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KINETICS AND THERMODYNAMICS STUDIES OF COBALT IONS ADSORPTION ONTO ZEOLITE A FROM AQUEOUS SOLUTIONS

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The removal of cobalt from aqueous solutions by zeolite A was investigated. The characteristics of zeolite were determined by XRD, SEM, EDS, FTIR, DTA and TG techniques. The effects of solution *pH*, initial cobalt 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 kinetics followed both adsorption isotherms. A comparison of kinetic models applied to the adsorption of cobalt ions on the zeolite 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 Co^{2+} ions on A zeolite were determined.

Key words: Adsorption, cobalt, zeolite A, kinetic study, thermodynamic study,

VALORIZATIONOFULVALACTUCABIOMASSTYPESIN THE RECOVERY OFCHROMIUM(VI) IONS

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The environmental pollution by heavy metals is a major environmental problem that takes a dimension increasingly alarming due to industrialization and the development of various human activities, hence the need for disposal. To do this, several decontamination processes have been developed to eliminate these toxic pollutants. Most of these technologies are expensive consequently the adsorption technique on biological materials is an important alternative technique in the treatment of effluents through its effectiveness and low cost and is most commonly used for the removal of heavy metal ions.

This work involves the use of macro seaweed as Ulva lactuca for the recovery of Cr (VI) ions from aqueous solutions. The Ulva lactuca crude is from the region of Tipaza northern coast of Algeria. The alga was harvested on the beach in Ain Tagouarait (36 ° 35 '25.06'' of latitude North, 2 ° 31' 9'' of longitude) characterized by bedrock.

The biosorbent was characterized by different techniques, XRD, SEM, DTA, TG and FTIR. The effects of various parameters such as initial concentration of ions Cr (VI), the exchange temperature, the pH of the solution and the solid / liquid ratio were studied. According to the results, a fixation rate of about 75% was recorded. The results of adsorption kinetics show that equilibrium is reached in relation to 90 min. The study of the adsorption isotherms of ions of Cr (VI) on Ulva lactuca crude was performed using models of Langmuir and Freundlich. The thermodynamic parameters were determined.

Keywords: *Seaweed, Ulva lactuca, chromium (VI) adsorption, kinetics, isothermal characterization.*

STUDYOF THE ADSORPTIONOF THECr(VI) BY THE BIOMASSTYPEENTEROMORPHA

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The environmental pollution by heavy metals is a major environmental problem that takes a dimension increasingly alarming due to industrialization and the development of various human activities, hence the need for disposal. To do this, several decontamination processes have been developed to eliminate these toxic pollutants. Most of these technologies are expensive consequently the adsorption technique on biological materials is an important alternative way in the treatment of effluents through its effectiveness and low cost and is most commonly used for the removal of heavy metal ions.

In this context, a kind of marine macro algae (Enteromorpha) was used as a new biological adsorbent for this purpose. This biosorbent, from the region of Tipaza (northern coast of Algeria) is collected on the beach at Ain Tagouarait (36 ° 35 '25.06'' of latitude North, 2 ° 31' 9'' east longitude) and characterized by bedrock. The biomass Enteromorpha was characterized by different techniques such as XRD, FTIR, XRF, SEM, TGA and TDA. The biomas was also used in the removal of chromium (VI) of aqueous solutions artificially polluted with organic medium made from seaweed. A parametric study was performed by varying the following operating parameters: (pH of the solution, the initial concentration of chromium (VI), the ratio (solid / liquid) and temperature). The thermodynamic and kinetic studies as well as the adsorption isotherms of chromium (VI) were carried out according to theoretical models to explain and develop the process of biosorption.

The overall results obtained in this study have shown the interest of the use of this biological material for the removal of heavy metals due to their functional groups.

Keywords: *Seaweed; Enteromorpha, chromium (VI) adsorption, kinetics, isothermal characterization.*

VALORIZATIONOF BIOMASSTYPESTIPA TENACISSIMA LIN THE RECOVERY OFCHROMIUM(VI) IONS

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Ourstudy aims touseabiomasstypeStipa tenacissima Lin removingionsof Cr (VI) from aqueous solutions.The Arabic name fortheplant Stipa tenacissima Lis HALFA(ALFA), it belongs tothe category ofbiosorbentsagro-industrial origin.

Stipa tenacissima Lis from thecenter of theprovince of DjelfaAlgeriaregion.This biomasswas characterized byvariousanalytical techniquessuch asXRD, SEM, DTA,TGandFTIR. To optimizetheoperatingconditions forthe determination ofionsof Cr (VI), several parameters were studiedtoknowthe initial concentrationofCr(VI) ions, temperature,pHof the solution andthesolid / liquid ratio. According tothe results, afixation rateof about60%was recorded.The results of thekinetic studyshowed that asteady state isreached over100 minutes.ModelsofLangmuirandFreundlichwere appliedand thermodynamicparameters were determined.

Keywords: *Elimination, isothermaladsorptionkinetics, ionsof Cr (VI), Alfa,*

REMOVAL OF COBALT IONS ONTO ALGERIAN CLAY. CHARACTERIZATION, EQUILIBRIUM AND KINETIC STUDIES

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The removal of cobalt ions from aqueous solutions onto Algerian clay was investigated in batch. The clay samples were characterized by X-ray powder diffraction, Infrared spectroscopy, Scanning electronic microscopy, Differential thermal and gravimetric analysis and Nitrogen adsorption technique for specific area surface and porous volume. The effects of parameters as initial concentration, pH, solid-liquid ratio (S/L) and temperature were studied. The Freundlich and the Langmuir models have been applied and the adsorption equilibrium has been found to follow the Langmuir model. Kinetic studies showed that the second-order sorption model was the most prevalent for the adsorption of cobalt ions. The rate constant of the exchanged ions appears to be controlled by chemical sorption process.The thermodynamic parameters namely the enthalpy ΔH°, entropy ΔS° and free energy ΔG° of adsorption of Co^{2+} ions on Algerian clay were determined.

Key-words*: Cobalt; Algerian clay; Characterization; Removal; Environment.*

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HYBRID ELECTRODIALYSIS PERFORMANCES FOR ULTRA-SELECTIVE EXTRACTIONOF HEAVY METALS WITH SIMILAR VALENCE

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Electrodialysis is well known to be considered as a green and environment-friendly technology. The challenge in the present study is to investigate the separation of two cations of identical valence: Cd(II) and Cu(II).

In a first stage, the complexing behaviour of different chemical agents towards Cu(II) and Cd(II) have been studied and modeled from ionic forms distribution calculations. EDTA was found to be the best agent which combines the formation of negative charged complexes, a discriminant complexation ability (Cu-complex more stable than Cd-complex), and a reversible complexation reaction for the separate recovery of both copper ion and free complexing agent.

In a second stage, experiments electrodialysis have been carried out under previously optimized operating conditions (flow rates of solutions and electric voltage applied) and the influence of several parameters on the electro-extraction performances has been investigated: concentration of electrolyte solutions used, concentration of metal ions in the feed stream, continuous or batch mode applied.

The results showed high electro-extraction performances both for copper (as negative charged complex) and cadmium (as free cation) ions but a unexpected very weak cadmium ion transfer was observed through the cationic membrane, while efficient concentration of copper as complexed form could be achieved in one treatment cycle. Some limitations of the process have been identified and several ways of optimization are therefore proposed to give promising perspectives of this work.

Keywords: *industrial effluent, metal ions, hybrid electrodialysis, complexation, selective separation, recycling, environment.*

BRACKISH WATER DESALINATION BY ELECTRODIALYSIS

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The deficiency of drinking water is a major problem in Tunisia. Indeed 50% of the water in Tunisia suffer from saline contamination and is brackish. The desalination of brackish water is a means of obtaining low cost drinking water. Desalination process was divided into two cathegories thermal (evaporation) and membrane based methods. Membrane methods are less energy intensive than thermal methods and since energy consumption directly affects the cost –effectiveness and feasibility of using desalination technologies membrane methods such as reverse osmosis (RO) and electrodialysis (E D) which are competed. ED cell was used to desalinate brackish water and a full factorial design analysis was performed to screen the significant factors influencing percentage of demineralization (%Dem). Factors investigated were potential applied, flow rate and concentration salts. Maximum percentage of desalination was obtained at the lowest feed concentration and highest voltage but the flow rate has not effect. It was found that the potential is the most influential factor on ED performance.

Keywords: *brackish water; desalination; electrodialysis; Full factorial design*

INTERACTION OF PSEUDOMONAS AERIGINOSA WITH RAW AND AMMONIATED CLAY AND BIOFILM FORMATION.

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The interaction of *P. aeriginosa* with the smectite clay results in the formation of a biofilm by changing the structure of the clay, which results from contraction and expansion of its layers. This was suggested by the passage easily of organic cell derivatives in interlayer spaces and influence their swelling. The proliferation of these bacteria on clay will produce first small molecules that will replace the intefoliaire water. These molecules are replaced by second more complex polymers that will lead to a much larger expansion of the clay layers.

The clay shrinks after the destruction of these polymers and reabsorbs water. In the clay suspension, the presence of bacterial colonies is widely discussed as an important feature in the development of biofilms.

The interaction of *P. aeriginosa* with ammoniated clay confirms biofilm formation but also shows that the secreted molecules are strongly adsorbed on clay ammoniated. In this case, the main mode of fastening is highlighted on sorption cations, either directly on the ammonium or by the formation of hydrogen bonds via water molecules. These results show a strong affinity for the ammonium cation molecules. After interaction between *P. aeriginosa* and mmoniated smectite, the secreted molecules are inserted in several layers between the layers; the molecules enable the osmotic swelling of the clay.

INTERACTION DE PSEUDOMONAS AERIGINOSA AVEC L'ARGILE BRUTE ET AMMONIEE ET FORMATION DU BIOFILM.

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L'interaction du *P. aeriginosa* avec l'argile du type smectite aboutit à la formation d'un biofilm en changeant la structure de cette argile qui résulte de la contraction et de la dilatation de ses feuillets. Ceci était suggéré par le passage aisément des dérivés cellulaires organiques dans les espaces interfoliaires et qui influencent leur gonflement. La prolifération de ces bactéries sur les argiles va produire en premier lieu des petites molécules qui vont remplacer l'eau intefoliaire. Ces molécules sont remplacées en second lieu par des polymères plus complexes qui vont aboutir à une dilatation des feuillets argileux beaucoup plus importante.

L'argile se contracte après la destruction de ces polymères et réabsorbe l'eau. Dans la suspension argileuse, la présence des colonies bactériennes est discutée largement comme un trait important dans l'évolution des biofilms.

L'interaction du *P. aeriginosa* avec l'argile ammoniée confirme la formation du biofilm mais aussi montre que les molécules secrétées sont fortement adsorbées sur l'argile ammoniée. Dans ce cas, le mode de fixation principal mis en évidence est une sorption sur les cations, soit directement sur l'ammonium, soit par la formation de liaisons hydrogène par l'intermédiaire des molécules d'eau. Ces résultats montrent la forte affinité du cation ammonium pour ces molécules. Apres interaction entre *P. aeriginosa* et la smectite ammoniée, les molécules secrétées, s'intercalent en plusieurs couches entre les feuillets, ces molécules permettent le gonflement osmotique de l'argile.

ROLE OF pH, BICARBONATE CONCENTRATION AND TEMPERATURE ON IRON PRECIPITATION IN AQUEOUS MEDIUM

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In Tunisia some natural water sources contain high iron concentrations. They can pass normative values in drinking waters (1 mg/L) and feed reverse osmosis (RO) waters (<0.1 mg/L). In RO iron may precipitate on the membrane surfaces presenting a risk of fouling. Different techniques for iron removal are used in water purification processes. Several factors, like pH of water, temperature and bicarbonate concentration will affect how successful a water treatment approach. However, once the natural water conditions are known, choosing the best iron removal method or treatment will be straightforward. In the present study the effect of initial pH, bicarbonate concentration and temperature on iron precipitationwere studied.

Iron precipitation was provoked by oxidizing the ferrous iron with dissolved oxygen in bicarbonate solution (aeration method). The Fe(II) oxidation with O_2 in natural water leads to the formation of ferric oxides or hydroxides according to the following reaction:

$$4Fe(II) + O_2 + 10H_2O \rightarrow 4Fe(OH)_3 + 8H^+$$

The experimental results showed that increasing pH favoured iron precipitation. Above pH = 6.8, 90% of iron was precipitate in less than 40 minutes. Working in bicarbonate solution promotes iron precipitation and increase precipitation ratio following the formation of an iron(II)-bicarbonate complex which accelerate the overall kinetics precipitation of iron hydroxide. It was shown that temperature dependence on precipitation rate of Fe $(OH)_3$is large. For a given pH, precipitation rate of iron hydroxide increases with temperature. For T= 20°C, 90% iron precipitation require 150 min, for T= 60°C, 100% iron precipitation require just 50 min.

***Keywords**: Scale, iron hydroxide, precipitation, pH, bicarbonate.*

VALORIZATION OF A NATURALRESIDUE(SAWDUST) FROMADSORBENT TO REMOVAL THEACETICACIDIN AQUEOUS SOLUTIONS

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The objectiveof this work presents a double environmental aspect, on the one hand, a valorizationof a naturalresidue (sawdust) as adsorbent, and on the other hand, the study of its ability toremove the acetic acidin aqueous phase.The adsorbentwas prepared bychemical treatment ofsawdust(NaOH, 5M) followed by carbonizationat 250°C.Thephysico-chemical characterization was carried out bythermogravimetry(TGA), FTIR spectroscopy, analysis ofthe specific surface areabyBETandSEMmorphology. The effect ofthe initial concentration, contact time,stirring speed, adsorbentmass, solution temperatureand ionic strengthwas studiedinbatch mode.Theadsorption kineticsofaceticacid checks patternof pseudo-second order withthe contribution of theintra-particlediffusion.The results of theadsorption equilibriumwere analyzed byfour models(Langmuir, Freundlich, TemkinandDubinin-Raduskevich). The resultsare of interestandencourage us totest otherchemicalpollutants thatcontaminate water.

Keywords :*Adsorption,sawdust,aceticacid, kinetic, equilibrium.*

VALORISATION D'UN RESIDU NATUREL (SCIURE DU BOIS) EN ADSORBANT POUR L'ELIMINATION DE L'ACIDE ACETIQUE EN PHASE AQUEUSE

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L'objectif de ce travail présente un double aspect environnemental, d'une part la valorisation d'un résidu naturel (sciure de bois) comme adsorbant, et d'autre part, l'étude de sa capacité d'éliminer l'acide acétique en phase aqueuse. L'adsorbant a été préparé par traitement chimique de la sciure de bois (NaOH, 5M) suivi d'une carbonisation a 250°C. La caractérisation physico-chimique a été réalisée par thermogravimétrie (ATG), spectroscopie FTIR, analyse de la surface spécifique par BET, et la morphologie par MEB. L'effet de la concentration initiale, temps de contact, vitesse d'agitation, masse de l'adsorbant, température de la solution et la force ionique ont été étudiés dans le mode batch. La cinétique d'adsorption de l'acide acétique vérifie le modèle de pseudo-second ordre avec la contribution de la diffusion intra-particulaire. Les résultats de l'équilibre d'adsorption ont été analysés par quatre modèles (Langmuir, Freundlich, Temkin et Dubinin-Raduskevich). Les résultats obtenus s'avèrent intéressants et nous incitent à tester d'autres polluants chimiques susceptibles de contaminer les eaux.

Mots clés : *Adsorption, sciure de bois, acide acétique, cinétique, équilibre.*

CONTRIBUTION TO KINETIC INVESTIGATIONS OF Cd^{2+} ANDPb^{2+}ADSORPTION ONTO ACID-ACTIVATED CLAY: APPLICATION TO WASTE WATER TREATMENT

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A sample of clay from Maghnia (N.W. Algeria) was chemically treated and characterized by powder X-ray diffraction, FT-IR spectroscopy and elemental analysis. The acid-activated clay (AAC) was used as adsorbent for of Cd^{2+} and Pb^{2+} ions from aqueous solutions by mean of batch experiments. The kinetic process was tested by applying pseudo-first order and pseudo-scond order. Additional studies indicated that the acid-activated clay (AAC) selectively sorbed Pb^{2+} in the presence of competing ions Cd^{2+}.

Keywords:Acid-activated clay (AAC), Removal, wastewater, Pb^{2+}, Cd^{2+}

CONTRIBUTION TO KINETIC INVESTIGATIONS OF Zn^{2+}IONS ADSORPTION IN THE PRESENCE OF COMPETING IONS ONTO ACID-ACTIVATED CLAYS FROM MAGHNIA AND MOSTAGANEM (N.O. ALGERIA): APPLICATION TO WASTEWATER TREATMENT

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Two differents samples ofCa-clay and Na-clay from M'Zila (Mostaganem) and Hammam Boughrara (Maghnia), N.W. Algeria, respectively, were chemically treated and characterized by powder X-ray diffraction, FT-IR spectroscopy and elemental analysis. The acid-activated clays (AAC) were used as adsorbent for Zn^{2+}ions from aqueous solutions by mean of batch experiments. The kinetic process was tested by applying pseudo-first order and pseudo-scond order. Additional studies indicated that these acid-activated clays (AAC) selectively sorbed Zn^{2+} in the presence of competing ions when applied to wastewater treatment, the case of the effluents of the Lab-ONEDD, in Ben Aknoun (Alger). The removal percentage was 50% and 25% by adsorption onto acid-activated clays of Maghnia and Mostaghanem, respectively.

Keywords: Acid-activated clay (AAC), Removal, wastewater, Zn^{2+}

STUDY OF THE INFLUENCE OF OPERATING PARAMETERS ON BORON REMOVAL BY REVERSE OSMOSIS AND NANOFILTRATION MEMBRANES

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Boron is vital element for organism growth, but excess of boron in water poses à problem due to adverse effects to plants and humans. However, it has been challenging to remove boron from water. It is not significantly removed by reverse osmosis and nanofiltration membranes with the natural conditions. In this paper, boron removal from aqueous solutions by the use of nanofiltration (NF) and reverse osmosis (RO) membranes was investigated. The SG (Osmonics) and NF-90 (Filmtec) membranes have been characterized by determination of the permeability, the transfer mechanism and the surface load.

Several working parameters, such as pH, operating pressure, feed concentration, temperature, ionic strength and effect of other ions were studied in an attempt to achieve a higher removal capacity. The experimental results indicated that the Retention was dependent on the membrane type and the operating parameters. Indeed, for the three membranes, the boron can be effectively removed only at pH of feed solution close to 11. This retention is very little influenced by pressure and feed concentration. In contrast, it perforce depends to the ionic strength, the presence of other ions in solution and the temperature.

Keywords: Boron, Reverse osmosis, Nanofiltration, operating parameters

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REMOVAL OF HEAVY METALS USING DK NANOFILTRATION MEMBRANE

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The use of treated wastewater has become a necessity and an integral part of the current strategy to mobilize all available resources. Pollutant loads contained in wastewaters have various origins. The five main categories of polluters are industry, agriculture, households, transport and urbanization. Particularly industrial wastewater containing heavy metals must be treated before being discharged into the natural environment or in sewage treatment plants. The presence in the environment of these toxic metals is an increasing danger to human health and to the balance of ecosystems. The incorporation of membrane technology in the effluents treatment process loaded with metal ions has emerged. The membrane processes (microfiltration, ultrafiltration, nanofiltration and reverse osmosis) were then used for this purpose with various effectiveness and selectivity.

This study describes the rejection of heavy metal ions (Cu(II), Cd(II),Zn(II) and Mn(II)) using a commercial nanofiltration membrane DK. The effect of transmembrane pressure, pH and metal concentration on the metal rejections and permeate flux was explored. The results showed that for optimal pH (pH = 1) and in the case of single heavy metal, the maximum rejection was obtained for P = 5 bar for all studied heavy metals. The rejections of Cu, Cd, Zn and Mn were 86, 79, 94 and 94%, respectively when the concentration of each heavy metal was fixed to 500 ppm and were 92, 92, 94, and 96% respectively when the concentration was increased to 900 ppm.

The treatment of different mixtures containing Cu(II), Cd(II), Zn(II) and Mn(II) metals by nanofiltration using DK membranes was also studied at optimal conditions of pH and transmembrane pressure. The experimental results show that similar values of retention rates and permeate fluxes were obtained in the case of mixtures than those previously observed in the case of single heavy metal.

Keywords: Nanofiltration, heavy metals, rejection, membrane, permeate flux.

COMPARISON OF DIFFERENT CONFIGURATIONS FOR MEMBRANE DESALINATION OF SEAWATER COUPLED WITH SOLAR ENERGY

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Membrane distillation (MD) is a thermal membrane separation process which uses hydrophobic porous membranes to separate a solution physically. Being capable of directly using solar thermal energy, the solar MD desalination systems were assessed as a promising green technology for alleviating the water resource problem. The use of solar collector is for heating the sea water.This work proposes new configurations for desalination of seawater using systems based on coupling of membrane distillation and solar energy. The coupling of solar energy can be carried out according to three possibilities.

- The distillation module is separated from the solar system (system not integrated),
- The module is integrated in the solar collector (integrated system).
- The module is immersed in the solar collector,

For the first possibility, control of the temperature level of water feeding the membrane module is possible; we can provide storage if temperature admissible by membrane module is exceeded and we can also used an auxiliary energy when needed. The second possibility is more original it makes it possible to reduce the components of the installation and the heating of sea water is direct. It is necessary to study and evaluate the contribution of the sun and the possibilities of energy storage either to the lover or with the downstream.

Various configurations of membranes modules integrated in the solar collector can be designed. The study related to the integration of a fiber module in an absorber of a cylindro-parabolic collector and to the integration of a membranes planes in a flat plate solar collector.

The scientific interest is that solar flow is variable and intermittent during the day and all the year. This will lead to a study of the system in transient regime.

The study of different configurations showed the benefits of integration of membrane module in the solar collector. This possibility reduces heat loss and also has a compact installation, this leads to improved productivity. This improvement is mainly observed in the case where the velocity is low (below 0.4 m/s). However, integration is facing several technical limitations. Indeed, given that sea water must necessarily circulate in the solar collector, it is necessary to use noble's materials for the construction of the collector (eg titanium). This problem does not arise in the case of the configuration where the membrane module is separated from the collector. A second constraint is the large gap between the membrane area required compared to the collector surface necessary, because for 1 m² membrane area, 10 m² collector surface are necessary for the functioning of the membrane. This problem can be solved with concentrating collectors. On the other hand, the improvement of productivity is observed in the case of low fluid velocities, these speeds are not adequate for the functioning of membranes. In fact, the velocity needed to be greater than 0.5 m/s and this to minimize the fouling of the membrane.

The study of different configurations has allowed us to present the processing advantages and disadvantages of each configuration, and enabled us to suggest recommendations on the choice of the configuration according to the type of membrane and the application context (objective, constraints, availability of modules...).

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BIOSORPTION OF PENICILLIN ON DRIED BIOMASS

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Recently, the attention of many researchers working in the environmental field was focused on the presence in the environment (and more specifically in waters) of pharmaceuticals as a new class of pollutants. Antibiotics are potential pollutants being responsible for disturbing the wastewater treatment processes and the microbial ecology of surface waters. In the present work, the attention is focused on penicillin, a broad-spectrum antibiotic, widely used in human and veterinary medicine. Biosorption is a well established and powerful technique for treating domestic and industrial effluents. Activated carbon is the most widely, effectively and cost used adsorbent. The potential use of dried Pleurotusmutilis:waste of a drug produced by fermentation as a substitute for powdered activated carbon for removal of penicillin one of the most widely used antibiotics in Algeria, from aqueous solution was examined. Some pre-treatment of dried Pleurotusmutilis, such as washing by distilled water or rinsing with HCL solution, has been done.

We examined the static kinetic of biosorption of the penicillin /dried biomass system using penicillin as a pollution model. HPLC is used as a method of analysis. The influence of some essential parameters, namely, initial penicillin concentration, contact time and temperature on the static biosorption of the penicillin/ biomass system has been investigated.

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

Langmuir and Freundlich isotherms were used to analyze the equilibrium data at different temperatures. The results show that experimental data fit perfectly the Langmuir model. The results showed that kinetic data were followed more closely the pseudo-second order model than the pseudo-first order.

Keywords*: Biosorption; Penicillin; Pleurotus mutilis; Equilibrium*

DIFFERENTIAL CONTROL AND CONSTRUCTION OF A TEST BENCH FOR WATER SOLAR HEATING

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Provide clean energy in sufficient quantity and at a good price, is today a major imperative for the development of any nation. In view of the global environment pollution issue it is important to exploit renewable, and as a part of it, solar energy better. One possibility to exploit solar energy better is the efficiency enhancement of the control of water solar thermal heating systems. This paper presents a differential control and construction of a test bench for solar water heating. The differential control system operating with fixed switch-on and switch- off temperature differences. It maximizes solar gain.

Keywords:*Solar energy, water heating, differential control, construction, efficiency.*

EFFECT OF TEMPERATURE ON TREATMENT OF GREY WATER BY ELECTROCOAGULATION

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The grey water is the water slightly polluted by human activity, which after appropriate treatment, can be used again: for flushing the toilets, for watering garden plants and for cleaning. Grey water consists of 50-80% of waste water in a traditional home. It is produced during domestic processes such as dishes washing, bathing and washing.

The grey water is contaminated with various kinds of detergents so it is important to remove them before re-using it. One way of grey water treatment process is the application of electrocoagulation. Model researches were carried out to determine the influence of grey water temperature on treatment process by electrocoagulation. The study used the water from the bath. Effect of temperature solution was used to increase the conductivity of the solution. The result of increasing the conductivity of the electrolyte solution is to speed the migration of ions between the electrodes. As results, the detergents are separated from solutions, leading to faster treatment of grey water.

Output of this study helped to determine the effectiveness of this process and the suitability of treated water for re-usage. For this purpose, the determinations were made for the basic treatment: COD, turbidity, concentration of non-ionic detergents and anionic detergents, conductivity, pH.

Key words: *water treatment, grey water, electrocoagulation*

NUMERICAL STUDIES ON THE THERMAL SOLAR MEMBRANE DISTILLATION EQUIPPED WITH A HELICALLY COILED FIBERS

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This work concern the study of some parameters of vacuum membrane distillation installation coupled with solar energy. The used membrane module, in our case, is composed of two hollow fibers membrane wound in helically coiled shape. These fibers are placed in parabolic through concentrator absorber. Four parameters are studied in this paper in order to their optimization. After the establishment of the equations system, which is composed of two dimensional Navier-Stokes equations, the resolution was done with the finite element method. The results show that the optimized values of fiber geometric configuration are for the coil pitch is 3.22 cm, for the fiber diameter is 6 mm and the optimum distance between the fiber and the absorber internal wall is 4.3 mm. The value of the optimized absorber diameter is 14 cm. For this configuration case, the permeate flow rate is equal to 18.6 10^{-5} kg/s

Keywords :*Vacuum membrane distillation, Solar energy, Helical fiber, Numerical studies*

STUDY OF THE CORROSION BEHAVIOR OF ZINC AND Zn–Co ALLOY ELECTRODEPOSITS OBTAINED FROM GLYCINATE BATH

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Co-deposition of Zn–Co alloy coatings that were electrodeposited from weakly alkaline glycine solutions has been studied by cyclic voltammetry, chronopotentiometry, ALSV analyses were used to study The influence of cobalt concentration, scan rates and current density of déposition on chemical composition, and phase structure of the coatings. Corrosion behavior of the coatings was also studied using potentiodynamic polarization tests in 3.5 wt% NaCl solution. Cyclic voltammetry results showed that in Zn–Co deposition from an alkaline bath in the presence of glycine, cobalt deposited at a potential near to that of zinc together with successful co-deposition of Co and Zn. The corrosion resistance of the deposits was also highly influenced by the composition a of the coatings. Overall, Zn–Co deposit elaborated at -16mA/cm^2 showed that the highest corrosion resistance among the coatings .

Keywords:Electrodeposition; Zn-Co Alloys; complexing agent; ALSV; chronopotentiometry;

MODELINGANDOPTIMIZATIONOF A SOLAR STILL WITH FINS

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After study of the parametersaffectingthe performance ofa simplesolar still
Greenhouse , The results showedthat it isinfluencedby the transmission coefficientofexternal convectionatthe glass. So we concluded that the yield is proportional to the heat loss by convection through the glass,
in this case, we thought to increasetheheat loss, by carrying out a glass with fins.
To study themode of operationof the solar still,the numerical methodof finite differenceswas chosento solve thesystem of equations, where we have establishedtheflow chart reflects the generalstructure of thecalculation main program.

SYNTHESIS AND CHARACTERIZATION OF NEW CROSSLINKED POLYETHERSULFONE MEMBRANES FOR PEMFC APPLICATIONS

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New crosslinked proton exchange membranes were prepared using chlorosulfonated polyethersulfone (SO_2Cl-PES) and 1,6-hexane diamine and 4,7,10-trioxa-1,13-tridecandiamine as crosslinking agents. The best results have been obtained when using SO_2Cl-PES with 1.3 SO_2Cl group per monomer unit crosslinked by 0.2 equivalent of 1,6-hexane diamine. The membranes obtained are less brittle than pristine S-PES. The corresponding properties were characterized by TGA, DMA, DSC... A preliminary electrochemical study allowed the determination of the ionic conductivity, transport number, and water swelling of the membranes. The results show that they present very promising performances in proton exchange membrane fuel cells.

***Keywords**: Ionic conductivity; crosslinked membranes; sulfonated polyethersulfone; Proton exchange membrane fuel cell.*

SIMULATION MODEL OF A PROCESS FOR ANAEROBIC DIGESTION

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The anaerobic digestion model No. 1 (ADM1), conceived by the international water association (IWA) task group for mathematical modeling of anaerobic digestion processes is a structured generic model which includes multiples steps describing biochemical and physicochemical processes encountered in the anaerobic degradation of complex organic substrates and a common platform for further model enhancement and validation of dynamic simulations for a variety of anaerobic processes. In this study the ADM1 model was applied to simulate the thermophilic anaerobic digestion of olive mill wastewater (OMW) with olive mill solid waste (OMSW). The ADM1 equations were coded and implemented using the simulation software package MATLAB/Simulink. The most sensitive parameters were calibrated and validated using updated experimental data of Fazzani's 2008 work. The results indicated that the ADM1 model could simulate with good accuracy: gas flows, methane and carbon-dioxide contents, pH and total volatile fatty acids (TVFA).

***Key words**: Anaerobic digestion; ADM1; Simulation; MATLAB/Simulink*

AGEING OF ION EXCHANGE MEMBRANES USED IN AN ELECTRODIALYSIS FOR FOOD INDUSTRY: SEM, EDX AND LIMITING CURRENT INVESTIGATIONS

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Ion-exchange membranes (IEM), used in some food industrial electrodialysis (ED) applications, were investigated by measuring their physico-chemical and structural parameters, in order to evaluate their evolution during this application.

Two used membranes (one cationic and one anionic) were analyzed at the end of their useful life (2 years of ED operation) and compared with their respective fresh new samples to assess the evolution of their structural and physicochemical characteristics, and explore their deterioration. The limiting current density, ion- exchange capacity, water content and contact angle values were determined for each new and used membrane. Scanning electron microscopy (SEM) and energy dispersive X-ray (EDX) were also performed.

The used cation-exchange membranes (CEMs) suffered significant degradation; nonetheless, it was generally more robust and resistant than the anion-exchange counterpart, which was more unstable. A significant degradation in the polymer matrix of both membrane types was found. Both used CEMs and anion-exchange membranes (AEMs) lost a part of ion-exchange sites and the different parameters show a fouling of the AEM and a loss of functional sites of the CEM.

***Keywords:** Ion-exchange membrane, Ageing, Electrodialysis, Limiting current density, SEM, EDX*

AN ECO-FRIENDLY TECHNIQUE FOR WASTE REDUCTION IN LIME WATER SOFTENING PROCESS

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The hardness (mostly calcium and magnesium ions) in water causes cost of millions and even billions of dollars annually due to the heat loss and scaling in boilers and heat exchangers. Separation and removal of hardness ions from water is called softening. Water softening is almost a common unit operation in many industries and makes the water suitable for use in cooling towers or prepares it for additional purification. Lime softening is an established process where both the flow rate and the bicarbonate hardness of raw water are high. The performance of this process is highly depending on lime dosage. The addition of lime is currently adjusted manually based on chemical tests aimed at maintaining the simple and total alkalinities in a certain range. However, lime softening process upsets can often occur quickly and frequently. In this paper, a critical analysis of softening process control was presented and it was shown that current control of lime dosage is not often correct. It was illustrated that electrical conductivity can play as a good indicator for following the performance of lime clarifier. Therefore an eco-friendly and also cost effective technique has been developed for reducing a considerable amount of chemical waste in lime softening process.

Keywords: *Control, Electrical conductivity, Softening process, waste reduction.*

REMOVAL OF CHLORIDE IONS BY ADSORPTION ONTO MICELLAR COMPOUND

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This study focuses on the removal of chloride ion by adsorption onto a cationic surfactant. This soluble macromolecule will exchange his ions with Cl^- present in solution and the whole can be separated by an ultrafiltration membrane. The tetradecyltrimethylammonium bromide ($C_{17}H_{38}BrN$), was selected as cationic surfactant, its structure contains a long hydrocarbon chain, which allows to obtain highly charged micelles with large sizes, and hydrophilic groups which are actively involved in complexation of chloride through the ion exchange for his ion cons.The study of the removal of chloride ions by adsorption on the surfactant mentioned above was carried out in batch system, with solutions synthesized in the laboratory. The effects of various parameters such as contact time, solution pH, surfactant concentration, initial concentration of chloride and temperature were studied. The obtained results showed the rapidity of the process, equilibrium occurred within about 30 min with best yields adsorption. Indeed, a maximum Cl^- removal, *80.28%* was observed at: surfactant concentration 20mmol /L, pH = 4, T = 25 °C and an initial concentration of chloride of 900mg /L. The equilibrium data have been analysed and modelled in a wide range of initial chloride concentration. The application of several models of mono-solute, two and three parameters equilibrium isotherm has generally shown that the adsorption of Cl^- is on two types of sites, Freundlich model described the isotherm data with a high correlation at low chloride concentrations, and the Langmuir, Dubinin-Radeshkevichmodels described very well the isothermdataat high concentrations. The maximum adsorption capacity found using these models was equal respectively 1666 $mg.g^{-1}$ and1480 $mg.g^{-1}$.The results obtained revealed that the ions chloride are considerably adsorbed on surfactant and it could be an efficient method for the removal of this ions from aqueous systems

Keywords: *Adsorption, ion chloride, Tetradecyltrimethylammonium bromide, micelles, ultrafiltration.*

UTILISATION DE MICELLES D'UN TENSIOACTIF CATIONIQUE POUR LE TRAITEMENT DE SOLUTIONS AQUEUSES CONTAMINEES PAR LES IONS CHLORURES

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La présente étude porte sur l'élimination des ions chlorures (Cl^-) par adsorption sur un tensioactif cationique : le tétradecyltrimethylammonium bromure ($C_{17}H_{38}BrN$). Cette macromolécule soluble peut échanger son contre ion contre l'ion Cl^- présent en solution et l'ensemble est séparé par une membrane d'ultrafiltration. Les essais expérimentaux ont été réalisés en système batch. L'influence de certains paramètres opératoires tels que le temps de contact, le pH de la solution, la concentration en tensioactif et la concentration initiale en chlorures, sur le rendement d'adsorption des ions Cl^- sur le tensioactif a été examinée. Les résultats expérimentaux obtenus ont révélé la rapidité du processus d'adsorption, un équilibre est atteint au bout de 30mn de contact. Les isothermes d'équilibre d'adsorption des ions Cl- sur le tensioactif ont été décrites par l'application des modèles de Langmuir, Freundlich etDubinin-Radeshkevich aux valeurs expérimentales. Les résultats ont montré que les trois modèles reproduisent bien les résultats expérimentaux dans des domaines de concentrations initiales en chlorures différents. La capacité maximale d'adsorption estimée par le modèle de D-R (1497$mg.g^{-1}$) s'avère plus proche de la valeur expérimentale 1457$mg.g^{-1}$.

Mots-clés : *Adsorption, Cl^-, Tetradecyltrimethylammonium bromure, micelles, ultrafiltration*

ADSORPTION OF CATIONIC DYE ON ACTIVATED CARBON PREPARED FROM USED TIRE

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The aim of the present study, concern the removal of methyl green dye from aqueous solutions by adsorption. As adsorbent, activated carbon prepared from cryogenic grinding used tire was used. Characterization of the activated carbon obtained by chemical analysis, FTIR and SEM, was studied and the results conclude that the prepared activated carbon is mesoporous. The adsorption experiments were conducted in a batch system at different parameters such as, adsorbent dose, adsorbate concentration, temperature, equilibrium time and pH. According to the experiments results, the equilibrium time, optimum pH, adsorbent dosage and dye concentration were found 60 min, pH = 3, 30 mg/L and 8 mg/L respectively. The kinetic data supports pseudo-first order model, it shows very poor fit for pseudo-second order model. Langmuir, Freundlich and Dubinin-Raduchkevich isotherm models were applied to describe the experimental data. It was found that Langmuir model fit well the results, the maximum adsorption capacity obtained was equal 34,48 mg/g. In addition, the thermodynamic parameters, standard free energy, standard enthalpy and standard entropy of the adsorption process were calculated. The results show that the produced activated carbon from used tire is an alternative low-cost adsorbent for removing dyes from solutions.

Key words: *Adsorption, methyl green, cryogenic grinding, tire, activated carbon.*

ADSORPTION D'UN COLORANT CATIONIQUE SUR UN CHARBON ACTIF ISSU DU BROYAGE CRYOGENIQUE DE PNEUS USAGES

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Un charbon actif a été préparé par activation chimique à l'acide phosphorique H_3PO_4 à partir d'une poudre issue du broyage cryogénique d'un pneu usagé et utilisé comme adsorbant d'un colorant cationique : le vert de méthyle. Les résultats obtenus ont permis de confirmer par analyse infrarouge l'introduction de fonctions de surface et par analyse MEB la nature mésoporeuse du charbon actif préparé qui présente une surface spécifique égale à 356 $m^2.g^{-1}$. Des essais expérimentaux en système batch ont été réalisés en examinant l'influence de divers paramètres opératoires tels que le temps de contact, le pH de la solution, la masse du charbon actif et la concentration initiale en colorant, sur le pouvoir décolorant du charbon actif préparé. L'étude de l'influence du temps de contact a révélé un temps de l'équilibre d'adsorption de 80 min. L'application des modèles classiques des isothermes d'adsorption Langmuir, Freundlich et Dubinin-Radeshkevich indique une meilleure description des résultats expérimentaux par le modèle de Langmuir avec une capacité maximale d'adsorption de 32.89mg.g^{-1} proche de la valeur expérimentale.

Mots clés *: Adsorption, vert de Méthyle, charbon actif, pneu usagé.*

SCALING ASSESSMENT IN BRACKISH WATER REVERSE OSMOSIS DESALINATION: THE ALGERIAN DESERT CASE

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Shortage of fresh water resources and growth of industrialization have increased the reliance on unconventional water desalination. Thermal and membrane processes are the major desalination technologies used now-a-days. Desalination is a separation process used to reduce the dissolved salt content of saline water to comply with the required water quality specifications. Lately, Reverse Osmosis (RO) is rapidly overtaking thermal desalination in terms of market shares. As a desalination process, RO involves three water streams: the saline feed water, low-salinity product water, and very saline concentrate (brine or reject water). The amount of freshwater that can be recovered from the feed is limited by membrane fouling and scaling. Scale formation is among the limiting factors in seawater or brackish water RO desalination of Produced Water. Scaling limits the economic viability of the desalination process by increasing the energy consumption and decreasing the efficiency the yield and the lifespan of RO membranes. Calcium carbonate is the major contributor to scaling in desalination processes. It is likely to precipitate immediately when its solubility is exceeded. It is then very important to assess the scaling behavior of water along RO modules to conceive the best raw water pretreatment process that allow avoiding such fouling. This can be performed by simulation. For this purpose a computer code has been developed and implemented to assess the scaling propensity in RO desalination for any kind of feed water. It accounts for transport phenomena and chemical reactions involved within RO modules with a good estimate of the activities of relevant chemical spices.

In this work scaling assessment for water RO desalination in the southern part of Algeria will be considered. In these desert regions the only available water resources are underground fossil water. The scaling assessment will be performed for several pretreatment scenarios of this brackish water.

Keywords: *Algerian Desert, Brackish Water, Desalination, Reverse Osmosis, Scaling Assessment*

FEED WATER FOULING CHARACTER ASSESSMENT IN SEAWATER REVERSEOSMOSIS DESALINATION

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Shortage of fresh water resources in Tunisia and all over the word is driving towards the reliance on seawater desalination. Thermal and Reverse Osmosis (RO) desalination are the most widely used techniques. Lately, RO techniques are overtaking the market for new desalination units are. This was a result of the extraordinary development of efficient and cost effective membrane production techniques along with a substantial energy consumption reduction in RO processes. However, operating cost and membrane life expectancy in seawater desalination is highly dependent of seawater feed quality. Indeed RO desalination is hindered by membrane scaling and fouling. Scaling is the accumulation of mineral deposits due to supersaturation as pure water is recovered. Fouling is the buildup of organic, biological and colloidal matter. These phenomena are handled with proper feed water pretreatment in accordance with the fouling and scaling character of the seawater.

In aim of this work is to assess the fouling character of seawater feeding the RO desalination unit of the Tunisian Company of Electricity and Gas (STEG) power plant in Ghannouch. The desalination unit has a production capacity of 22 m^3/h. It is a single stage unit achieving 40% conversion rate. The investigation involved monitoring fouling index before and after coagulation-flocculation pretreatment. Fouling assessments were performed with conventional fouling indexes such as Silt Density Index (SDI) and Modified Fouling Index (MFI). Modeling of the flow through the membrane was also performed.

For fresh seawater, the foulent buildup has two forms: a linear portion corresponding to an incompressible accumulated matter and a further portion characterized by a compressible layer. After pretreatment, foulent accumulation on the SDI membrane could be modeled using pore blockage model followed by an incompressible cake filtration model.

Key words:*Sea water, fouling, assessment, Silt Density Index (SDI) and Modified Fouling Index (MFI)*

USE OF REVERSE OSMOSIS BRACKICH WATER DESALINATION BRINE FOR PHOSPHORIC ACID PROCESSING: EFFECTS ON PROCESS OPERATION

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In the southern part of Tunisia, water consumption is much higher then the available renewable water resources. To provide part of water needs, geothermal brackish water is desalinated using Reverse Osmosis (RO). For this purpose a desalination unit, run by the National Water Distribution Utility (SONEDE), has been operating since 1995 at 74% conversion rate and a nominal production capacity of 360 m^3/h. Unfortunately, the desalination process discharges highly saline brine causing the pollution of the recipient environment. On the other hand, phosphoric acid production, main activity of the Tunisian Chemical Group (GCT) plants, consumes large water quantities right next to the desalination plant.

Using the brine as part of the process water in phosphoric acid manufacture would be win-win situation for both the desalination unit and the GCT. In fact, this solution has a great environmental achievement since it allows saving large quantities of conventional water and avoiding the negative environmental effects of the brine. However, the presence of mineral and organic impurities may interfere with the reaction process which may yield a decline of the acid production performances.

The objective of this work is to unfold the influence of water quality on the phosphoric acid production process operation. To simulate the continuous industrial process at a laboratory scale, it is necessary to carry out series of batch reactions until achieving a steady state. An experimental investigation was conducted to produce phosphoric acid with three different water qualities containing: 0%, 50% and 100% brine (B).Figure 1 shows a typical evolution of the acid concentration for the three water qualities. The impact of brine addition on the process operation will be discussed.

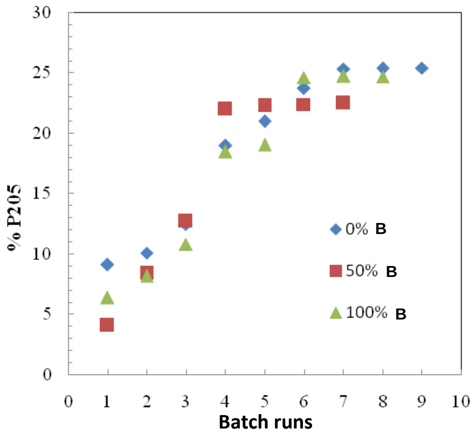

Figure 1: Phosphoric acid concentration vs. batch runs

Keywords : *Reverse osmosis desalination, brines, recovery, production of phosphoric acid, conducting*

VALORISATION DES SAUMURES D'UNE STATION DE DESSALEMENT PAR OSMOSE INVERSE DANS LA FABRICATION D'ACIDE PHOSPHORIQUE : IMPACT SUR LA CONDUITE DU PROCEDE

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En Tunisie, des études font apparaître une diminution alarmante des réserves d'eau vu que la demande en eau dépasse très largement l'offre constituée par les ressources naturelles. Pour combler ce déficit, la SONEDE procède au dessalement de l'eau géothermale. Le dessalement est réalisé par l'osmose inverse engendrant un rejet important de saumures caractérisé par une forte salinité. Ces effluents constituent une source de pollution du milieu récepteur. Par ailleurs, la production de l'acide phosphorique, principale activité des usines du Groupe Chimique Tunisien (GCT), consomme de grandes quantités d'eau. L'idée est de valoriser les saumures dans le procédé de fabrication de l'acide phosphorique. En effet cette solution a un grand mérite environnemental puisqu'elle va permettre d'économiser des quantités importantes d'eau conventionnelles et d'éviter les effets néfastes sur le milieu de réception de saumures. Cependant la présence d'impuretés minérales et particulièrement de séquestrant dans l'eau de rejet peut gêner le processus réactionnel.

L'objectif de ce travail est de dégager l'influence de la qualité de l'eau utilisée sur la conduite de la réaction de fabrication d'acide phosphorique. Pour simuler le procédé industriel continu à l'échelle laboratoire, il est nécessaire de recourir à une série de réactions en batch jusqu'à atteinte du régime de production. Une étude expérimentale a été réalisée pour fabriquer l'acide phosphorique avec trois différentes qualités d'eau : 0%, 50% et 100% saumures. La figure 1 donne l'évolution typique de la concentration de l'acide obtenu pour les trois qualités d'eau. L'impact de l'ajout des saumures sur la conduite du procédé sera discuté.

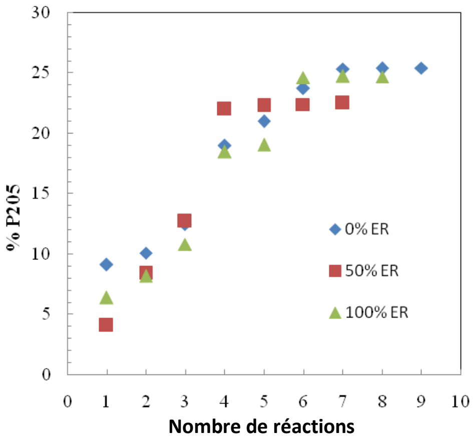

Figure 1 : Evolution du %P_2O_5 de l'acide en fonction du nombre de réactions

Keywords : *Dessalement par osmose inverse, saumures, valorisation, fabrication d'acide phosphorique, conduite du procédé*

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USE OF REVERSE OSMOSIS BRACKICH WATER DESALINATION BRINE FOR PHOSPHORIC ACID PROCESSING: EFFECTS ON GYPSUM CRISTALLISATION AND ACID FILTRATION

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Water is a precious, fragile and very limited resource, which should be managed coherently and rationally. In Tunisia, especially in the southern part, water scarcity has promoted the use of non-conventional water resources. Reverse osmosis desalination of geothermal brackish water continues to provide part of the local need with water of good quality. However, this process rejects a large amount of highly saline brine which has negative effects on the environment. On the other hand, the industry of phosphoric acid production at the Tunisian Chemical Group (GCT) consumes huge water quantities. It would be then beneficial to think of using these brines in the phosphoric acid manufacturing process. This will allow the GCT to reduce its desalinated water demand and evading at the same time the harmful environmental impact of the brine. However, the presence of antiscalant in the brine can hinder the crystallization of phospho-gypsum, key reaction in acid processing, yielding a decline of acid filtration efficiency.

The purpose of this work is to determine the impact of the reverse osmosis brackish water desalination brine use in phosphoric acid processing. An experimental study was carried out to investigate the effects of brine use on phosphor-gypsum crystallization and acid filtration performances. Several laboratory tests were conducted to produce acid with water qualities of different brine contents. After each test, phosphoric acid and phospho-gypsum were separated by filtration. Gypsum crystals size distributions were determined. Figure 1 shows filtration curves obtained for three water qualities containing: 0%, 50% and 100% Brine (B). The impact of the addition of brine on phospho-gypsum crystallization and acid filtration efficiency will be discussed.

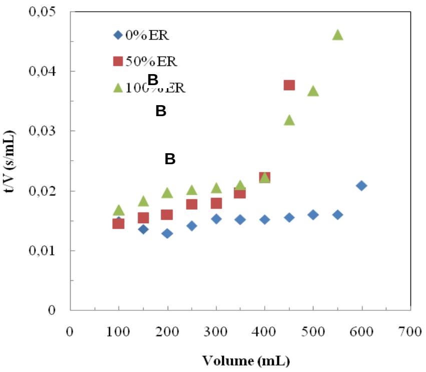

Figure 1: Filtration curve of phosphoric acid produced with different water qualities.

Keywords : *Reverse osmosis desalination, brine, phosphoric acid processing, gypsum crystallization, filtration*

VALORISATION DES SAUMURES D'UNE STATION DE DESSALEMENT PAR OSMOSE INVERSE DANS LA FABRICATION D'ACIDE PHOSPHORIQUE : IMPACT SUR LA FILTRATION DE L'ACIDE

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L'eau représente une ressource à la fois très précieuse, fragile et limitée qui doit faire l'objet d'une gestion cohérente et rationnelle. En Tunisie, la rareté de cette ressource, en particulier dans le sud où règne climat semi-aride, a favorisé le recours à des ressources non conventionnelles. Le dessalement d'eau géothermale fossile a permis de fournir une eau de bonne qualité pour une large population du sud-est Tunisien. Cependant ce procédé rejette une grande quantité de saumures caractérisées par une forte salinité ayant un effet nuisible sur l'environnement. D'un autre coté et dans la même région, l'industrie de production d'acide phosphorique consomme des quantités importantes d'eau. Il serait bénéfique de penser à valoriser les saumures dans le procédé de fabrication de l'acide. Cela permettra au GCT de réduire sa demande en eau de process et n'épargner à l'environnement les effets négatifs des saumures rejetées par la station de dessalement. Cependant la présence de séquestrants dans l'eau de rejet peut gêner la cristallisation du phosphogypse dégradant le rendement de séparation de l'acide par filtration. L'objectif de ce travail est d'élucider l'impact de l'utilisation des saumures sur la cristallisation et la filtrabilité de l'acide.

Une étude expérimentale a été réalisée à une échelle laboratoire pour dégager les effets de l'utilisation des saumures sur la cristallisation du gypse et la filtration de l'acide produit. Des essais ont été conduits pour produire l'acide avec des qualités différentes d'eau renfermant des fractions variables de saumures. Après chaque essai, l'acide et le phosphogypse sont séparés par filtration et des analyses granulométriques sont conduites par caractériser les cristaux formés. La figure 1 donne les courbes de filtration obtenues avec 3 trois qualités d'eau : 0%, 50% et 100% saumures. L'impact de l'ajout des saumures sur le rendement de filtration de l'acide sera discuté.

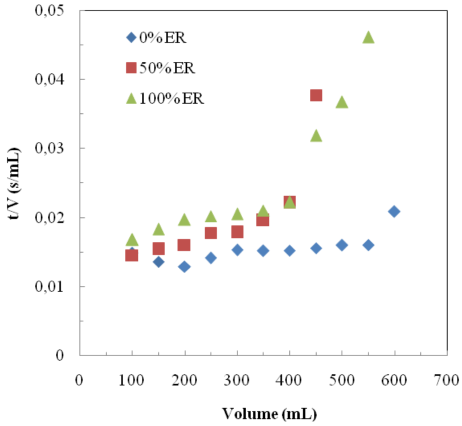

Figure1 : Courbe de filtration de l'acide phosphorique avec différentes qualités d'eau

Mots Clés : *Dessalement par osmose inverse, saumures, valorisation, fabrication d'acide phosphorique, cristallisation, filtration*

DYNAMIQUE SAISONNIERE EN MICROCLIMAT AGGLOMERES ET MULTI VARIABLES - INDICES ET CORRELATIONS JUIN 2013

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Climate change and environnemental variation flow caracterize the regions city
We compare this speci of each Town to design scenario model evolution microclimat to save also sea and sweel naturel fluctuation and interactions of wind water and soil by studing parameters evolution of weight diameters color and orientation stries of helix asperges

PREPARATION AND CATALYTIC ACTIVITY OF Fe ALGINATE GEL BEADS FOR OXIDATIVE DEGRADATION OF THE 3-METHYLINDOLE 'SKATOLE'

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This study focuses on the application of Fenton process by use of catalytic activity of Fe alginate beads to remedate the 3-methylindole.

Important factors affecting catalyst activity and skatole removal efficiencies were studied, i.e. the effect of pH, temperature, catalyst concentration, hydrogen peroxide concentration and the stability of the catalyst. The adsorption of sktaole from aqueous solution by heterogeneous catalysts was also examined.

Results showed that an almost complete removal of skatole (90%) was possible to achieve after 180 min of treatment with significant removal of chemical oxygen demand, without significant leaching of Fe ions.Consequently, the stable performance of Fe alginate beads opens promising perspectives for economical treatment of wastewater polluted by the 3-methylindole or similar organic contaminants.

After optimization of the operational parametres ot the Fenton process. Initially, we identified and carried out the quantitative follow-up of the aromatic and aliphatic reaction intermediates formed during treatment.

The mineralization efficiency of treated solutions was determinded in term of total organic carbon (TOC) measurements, a mineralization ratio of 90 % was obtained. The kinetics analysis of concentration decay of the polluant under examination permitted to determine the apparent constants (Kapp) of the reaction between sktaole and hydroxyl radical.

***Keywords Alginate** : Gel bead, Fenton catalyst, Skatole, degradation, mineralisation,*

EXPERIMENTAL STUDY OF SOLAR STILL PERFORMANCE COUPLED TO A SOLAR COLLECTOR FOR POTABLE WATER PRODUCTION

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The problem of water shortage is a worldwide issue and without doubt a serious problem in arid regions as in Libya. Different classical energy processes were used to partly solve the problem, but they were suitable only for large population areas due to their high capital, operation and maintenance cost. For these reasons, alternative methods must be sought for rural arid areas. This work deals with studying and modeling of solar stills. The basic idea of the work is to check the production of basin still and tilted wick still for solar desalination of brackish water. The still is basically a rectangular basin lined with black or blackened porous material that acts as the solar energy collector. The porous medium acts as a heat sink when the value of solar radiation is high and acts as additional source of heat when the value of the solar radiation decreases.

The productivity of tilted type still with a preheated water was 5.307L/m^2 per day at an average solar radiation of 676.5w/m^2. A mathematical model was developed and used to predict the performance of such still at different conditions.

EXERGETIC ANALYSIS OF AN INDUSTRIAL SEAWATER REVERSE OSMOSIS DESALINATION PLANT

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In this paper, the exergetic analysis of n industrial seawater reverse osmosis desalination plan was conducted by using actual operating data. Exergy flow rates were evaluated throughout the plant and the rates of exergie destruction in the major process components has been determined. The results revealed that 80% of the exergy destruction is placed on core processes (high pressure pump, reverse osmosis separation, valves regulation andpressure drops through various process components). The second law efficiency of the plant was found to be very low (about 4%). This indicates that opportunities of improvement exist to reduce exergy destruction and make the plant operation more cost effective. The most reasonable way to reduce power input to the plant, thus improving its performance and cost, has been shown to be replacing the valves on the reverse osmosis brine stream by an energy recovery device such as pressure exchanger.

Keywords : Exergy, Reverse osmosis desalination, Plant performance

INTEGRATED MEMBRANE SYSTEMS (IMS) FOR TAJOURA SEAWATER PLANT

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The Tajura seawater reverse osmosis (RO) desalination plant commenced operation in year 1984 with only 50% of its production capacity (10,000 m3/d) utilizing xxx spiral wound elements. Feed water is supplied from open intake located in Tajoura at the Mediterranean Sea and treated prior to RO using a conventional filtration system. As time passed, the SDI is a major obstacle for continuous operation of the RO plant. The coagulation–flocculation unit is out of operation, the tanks are corroded and leakage from the tank. Non continuous plant operation increased differential pressure, salt passage and decreased water production through the membranes.

Recently, ultrafiltration has been recognized as competitive pre-treatment for reverse osmosis system. A system designed with an ultrafiltration as pre-treatment prior to reverse osmosis system has been referred to as an Integrated Membrane System (IMS). This paper describes the problems encountered in the existing pretreatment system and the conceptual IMS design as a part of plant rehabilitation process of Tajoura RO plant.

***Keywords**: Conventional pretreatment, Membrane pretreatment, Desalination, Tajoura SWRO plant design*

STUDIES ON REMOVAL OF BORON FROM AQUEOUS SOLUTION BY ACTIVATED CARBON MODIFIED BY CYCLODEXTRIN

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Boron is an element widely used around the globe. In an aqueous solution it occurs in a form of boric acid and belongs to the group of essential trace elements for living organisms.

As a novel adsorbent for boron removal from the aqueous solution, activated carbon supported cyclodextrin was synthesized by grafting beta cyclodextrin to activated carbon surface. The surface of the adsorbent was characterized by FT-IR, SEM, XRD, TGA, Raman and elemental analysis, which indicated that the modification of the activated carbon surface was successfully performed.

The characteristics of the adsorption process were also evaluated by using the Langmuir and Freundlich adsorption isotherms, and the maximum adsorption capacity of AC-CD was found to be 1.68 mg. g^{-1}.

The adsorption equilibrium could be obtained within 10 min and the experimental data were well described by the Langmuir-Freundlich model. It was therefore concluded that the adsorbent of AC-CD could be promising for boron removal from salt lake brine.

Keywords : *Boron, Activated carbon, grafting, cyclodextrin, adsorption.*

SPECTROMETRIC STUDY OF METHYLENE BLUE IN PRESENCE OF POLY (SODIUM-4-STYRENE-SULFONATE) AND ITS REMOVAL BY POLYELECTROLYTE ENHANCED ULTRAFILTRATION

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The application of polyelectrolyte enhanced ultrafiltration (PEUF) on the retention of methylene blue is a promoting technique and depends on the choice of the couple polyelectrolyte-dye. Removal of methylene blue from aqueous solutions by PEUF was investigated. Regenerated cellulose membrane of molecular weight cut-off 10 KDa was used. Different cases, namely, feed polyelectrolyte, transmembrane pressure, effect of solution pH and electrolyte concentration have been studied. The ultrafiltration experiments showed best rejection in presence of poly (sodium-4-styrene-sulfonate). The highest rejection for MB dye is due to the formation of some complexes between polyelectrolyte-dye systems. This result was confirmed by the change of the maximum absorption wavelength. High retention was obtained at pH above 4. The retention of MB decreases with salt concentration. The permeate flux depended slightly on polyelectrolyte concentrations, transmembrane pressure, ionic strength and pH.

Keywords: *Methylene blue; poly (sodium-4-styrene-sulfonate); Ultrafiltration; PEUF*

ADSORPTION OF CONGO RED FROM AQUEOUS SOLUTIONS ONTO Fe_3O_4- CLAY

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CR removal from aqueous solution, using the adsorption process onto Fe_3O_4-clay, was investigated. The effect of parameters such as temperature, pH and initial dye concentration was studied. The first-order, pseudo-second-order kinetic and the intraparticle diffusion models were used to describe the kinetic data. The Langmuir and Freundlich isotherms models were applied and the Langmuir model was found to best fit the equilibrium isotherm data.

Key words *: Adsorption, Congo Red, Fe_3O_4-clay, Kinetics, Equilibrium.*

COUPLING PHOTOCATALYSIS WITH BIOSORPTION PROCESS FOR DYE REMOVAL IN AQUEOUS SOLUTIONS

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The aim of the present work was the application of the hybrid biosorption/photocatalysis system for removal of methylene blue (MB) from water. Batch biosorption experiments were carried out in the presence of the biomass derived from locally available material (*Luffa cylindrica*) and the effect of pH (3-10), biomass dose (1.5-15 g/L), MB concentration (10-500 mg.L^{-1}) and temperature (20-60 °C) on the biosorption process were investigated. The experimental data were analyzed by various isotherm models, and the results show that the isotherm data were well correlated by the Langmuir model. Kinetic studies indicated that the pseudo-second order model fit suitably the experimental data. The maximum monolayer biosorption capacity was found to be 39.37 mg/g at 20 °C. Thermodynamic parameters showed that the biosorption process was spontaneous, exothermic and physical in nature. In a second step, the photocatalytic degradation was carried out in presence of ZnO photocatalyst. The choice of ZnO elaborated by nitrate route is motivated by the low cost, non-toxicity and chemical stability over a wide pH range (2-12.5). The MB removal from aquatic medium is fast under sunlight. The discoloration of MB obtained by the hybrid process (98 %) occurred within 45 min of irradiation. This present study demonstrated that this biosorption-photocatalysis technology can be used as a viable and attractive alternative for the treatment of wastewater.

Keywords : *Photocatalysis ; Biosorption ; Hybrid systems ; Methylene blue (MB) ; Luffa cylindrica ; catalyst ZnO.*

CO_2 ABSORPTION IN AQUEOUS SOLUTION WITH STIPA TENACISSIMA FIBERS

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In the past decade, the capture of carbonic dioxide and its storage or transformation have emerged as major tasks to achieve, in order to control the pollution atmospheric and the increasing atmospheric temperature of our planet. One possibility rests on the use of Esparto-Stipa Tenacissima, the hydration of neutral aqueous CO_2 molecules to ionic bicarbonate HCO_3^- species. In this paper, the principle underlying the use of Esparto - Stipa Tenacissima is summarized. During the characterization Fourier Transform Infrared Spectroscopy (FTIR), X-ray Diffraction (XRD), and Scanning Electron Microscopy (SEM) were employed to investigate the structural and morphological changes in Esparto - Stipa Tenacissima fibers.

INFLUENCE OF AIR FLOW RATE ON AEROBIC REMEDIATION SOIL POLLUTED WITH GASOIL

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Bioremediation of soils in bioreactors offers economical and ecological alternatives to traditional physicochemical, thermal technologies and in situ Bioremediation. Soils and groundwater contaminated with hydrocarbons poses a strong environmental threat; polycyclic aromatic hydrocarbons persist in the environment. The bioreactors, of advantage used when pollution is important, allow in addition to the control of the parameters of culture (pH, temperature, nutriments, etc), a better contact between the phases biotic and abiotic and of the relatively weak residence times by accelerating considerably the kinetic of degradation of the pollutants. The aim of this study is to investigate the biodegradation of gasoil in the soil. We are mainly interested by the effect of the air flow rate on the biodegradation.

The experimental part is carried out on a fluidised cylindrical column of 80 mm diameter and 500 mm height fitted with pressure taps. This column is filled with sand particles of the Geldart class B (with 430 µm mean diameter and 2656 kg/m^3 density). The pollution of the soil by the gasoil is done artificially at a rate of 10 g/kg of soil. Once polluted, humidified at 15% and enriched (C/N/P = 100/10/1), the soil will be preserved at the free air during 15 days so that the indigenous flora of the soil can adapt to the medium. After 15 days, the ratio C/N/P was readjusted to 100/10/1 and in the same time the gasoil rate was readjusted to 10 g/kg of soil by introducing a solution of NH_4Cl and KH_2PO_4. All experiments wereachieved in 06 aerated bioreactors at different air flow rate equal respectively at: 0, 0.25, 0.5, 1, 1.5 and 2 L/min.

For each air flow rate 02 bioreactors were used: a biotic one and an abiotic one.We are specially interested by the evolution of the gasoil concentration and the microbial growth biomass, in order to determine the gasoil biodegradation rate at different air flow rate and especially the kinetic of gasoil biodegradation.

In the biotic reactors the bacterial population has passed from 10^5 to 10^7 UFC/g.

The kinetic coefficient of gasoil degradation passed from 0.049 day^{-1} at 0.25 L/min to 0.159 L/min at 2 L/min in the biotic reactors. Also, the elimination rate of gasoil augmented until 97% at 2 L/min.

REMOVAL OF HEAVY METALS FROM AQUEOUS SOLUTION BY POLYACRYLIC ACID ENHANCED ULTRAFILTRATION

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One of the recent developed water treatment processes is the Polyelectrolyte Enhanced Ultrafiltration (PEUF). This technique combine a membrane filtration process (Ultratfiltration) and a cation–polyectrolyte complexation technique.

PEUF is showing to be an efficient technology for the removal of heavy metals from liquid effluents even at low concentrations. In this proposal, the removal of three heavy metals (Cadmium, Copper and Zinc) from aqueous solutions by polyelectrolyte enhanced ultrafiltration (PEUF) process was investigated.

The poly(acrylic acid) (PAA) with an average molecular weight 100 kDa was used as complexing agent. The ultrafiltration experiments were performed using a tangentiel cell system equipped with a polyethersulfone membrane having a 10.000 Molecular Weight Cut-Off (MWCO).

To improve the retention of the heavy metal ions, the effect of some operating parameters and solution characteristics were studied.

For different PAA concentrations, this study showed that all permeate fluxes increased linearly by increasing transmembrane pressure.

For the three studied metals, the best retentions were observed at 2 10^{-3} mol L^{-1} PAA concentration, 3 bar transmembrane pressure and pH above 5. The removal of Cadmium, Copper and Zinc exceeded respectively 80%, 93% and 70%.

Keywords: *Cadmium, Copper, Zinc, polyacrylic acid, Removal ions, Polyelectrolyte Enhanced-UltraFiltration*

L'INTERET DES INDICATEURS DE PERFORMANCE DANS LA GESTION DE LA STEP DE MEDEA

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En dépit de l'ampleur des retombées générées par les eaux usées sur la dégradation du milieu environnemental, sur la pénurie d'eau et par voie de conséquence sur la santé publique, en Algérie, peu d'importance est accordée aux services d'assainissement comparés aux services d'approvisionnement en eau potable. Ces problèmes d'assainissement demeurent une préoccupation majeure et nécessitent une prise en charge conséquente par des mesures appropriées dans une optique de sauvegarde et de respect de l'environnement. De la collecte à l'épuration, cet itinéraire d'eau usée mérite d'être diagnostiqué afin de maîtriser le système d'assainissement et optimiser ses faciès, par la prospection et la recherche des indicateurs de performances qui permettent d'identifier les insuffisances et de proposer des solutions techniques pour une meilleure gestion des eaux usées.

Pour cela nous avons identifié les paramètres physicochimiques les plus significatifs en terme d'impact sur le milieu récepteur par une analyse de 10 variables physicochimiques (température, pH, conductivité électrique, NTK, NO3-, NH4+, PO4-, DCO, DBO_5, MES) des eaux usées de la ville de Médéa. Cette étude définit les valeurs de concentrations moyennes, les ratios et les gammes de variations associées, caractéristiques des eaux usées. Par la suite, nous avons calculé des ratios indicateurs de pollution qui doivent nous permettre de mettre en évidence les optimisations nécessaires à la station d'épuration de Médéa.

***Mots-clés** : Assainissement, épuration, ratios, optimisation, performances.*

KINETIC AND THERMODYNAMIC STUDY OF THE TEXTILE POLLUTANT ELIMINATION BY ADSORPTION ON CLAY UNTREATED

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The kinetic and thermodynamic study of the adsorption of a textile dye (Basic Blue 41) was performed under the conditions of free pH and initial dye concentration of 100 mg / L. The adsorption kinetics is relatively fast with equilibrium time of 45 min. Kinetic models of first and second order were tested to describe the elimination reaction on the adsorbent surface.The elimination of textile pollutant is governed by a pseudo first order kinetics with a correlation coefficient R^2 = 0.91. The application of the Weber and Morris models showed that the internal diffusion can not be the only limiting step in the adsorption rate. The determination of thermodynamic parameters showed that the adsorption process is endothermic, the system tends to increase the disorder in the adsorbate-adsorbent surface and the transformation is spontaneous

Keywords: *adsorption, water treatment, pollutant textile, Basic Blue 41, kinetic model.*

ETUDE CINETIQUE ET THERMODYNAMIQUE DE L'ELIMINATION D'UN POLLUANT TEXTILE PAR ADSORPTION SUR UNE ARGILE NON TRAITEE

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L'étude cinétique et thermodynamique de l'adsorption d'un colorant textile (bleu basique 41) a été réalisée dans les conditions de pH libre et une concentration initiale en colorant de 100 mg/L. La cinétique d'adsorption est relativement rapide avec un temps d'équilibre de 45 min. Les modèles cinétiques du 1^er^ et 2^ème^ ordre ont été testés pour décrire la réaction d'élimination à la surface. L'élimination du polluant textile est régie par une cinétique de pseudo 1^er^ ordre avec un coefficient de corrélation R^2 = 0,91. L'application du modèle de Weber et Morris a montré que la diffusion intraparticulaire ne peut être la seule étape limitante de la vitesse d'adsorption. La détermination des paramètres thermodynamiques a montré que le processus d'adsorption est endothermique, le système tend vers l'augmentation du désordre à la surface adsorbant-adsorbat, et la transformation est spontanée.

Mots-clés: *adsorption, traitement des eaux, polluant textile, bleu basique 41, modèle cinétique.*

STUDY OF ADSORPTION PARAMETERS OF A METAL CONTAMINANT ON AN ACTIVATED CARBON OF VEGETABLE ORIGIN IN A BATCH REACTOR

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The aim of this study is to test the effectiveness of the Pb^{2+} removal by adsorption onto activated carbon prepared from coconut shells. The various tests are carried out in a stirred batch reactor. At first, several activated carbons were prepared under various chemical activation and carbonization conditions. The activating agent is sulfuric acid. The best adsorption efficiency is obtained when the concentration of acid is of 50%. The variation of Pb^{2+} elimination versus of contact time showed that the equilibrium is reached after 50 minutes. The initial pH of the solution and the stirring rate influence the removal of Pb^{2+} with the maximum values of 4 and 300 rpm, respectively. Unlike the mass of coal, the initial concentration of pollutant affects little the removal efficiency. Finally, the temperature does not seem to have a significant influence on the adsorption.

Keywords: *adsorption, metallic contaminant, activated carbon, vegetable waste.*

ÉTUDE DES PARAMETRES D'ADSORPTION D'UN POLLUANT METALLIQUE SUR UN CHARBON ACTIF D'ORIGINE VEGETALE DANS UN REACTEUR EN BATCH

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L'objectif de cette étude est de tester l'efficacité de l'élimination du Pb^{2+} par adsorption sur un charbon actif préparé à partir des coques des noix de coco. Les différents essais sont réalisés dans un réacteur agité en batch. Dans un premier temps, plusieurs charbons actifs ont été préparés dans diverses conditions d'activation chimique et de carbonisation. L'agent d'activation étant l'acide sulfurique. Le meilleur rendement d'adsorption est obtenu avec un pourcentage de l'agent chimique égal à 50%. L'évolution de la quantité adsorbée du Pb^{2+} en fonction du temps a montré que l'équilibre est atteint au bout de 50 minutes. Le pH initial de la solution et la vitesse d'agitation influencent l'élimination du Pb^{2+} avec l'existence de valeurs maximales à 4 et 300 tr/min, respectivement. A la différence de la masse du charbon, la concentration initiale en polluant n'influe que peu sur le rendement d'élimination. Enfin la température ne semble pas avoir une influence notable sur l'adsorption.

Mots-clés: *adsorption, polluant métallique, charbon actif, déchet végétal.*

USING OF NEW PROTON EXCHANGE MEMBRANE 'S-PESOS/S-PES' ELECTRODIALYSIS OF SYNTHETIC SOLUTIONS

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Electrodialysis is an electrochemical process applied to desalination and concentration of electrolyte solutions. A novel cationic exchange membrane was used in this study to test their selectivity towards monovalent and bivalent cations.

We are interested to binary Sulfonated polyethersulfone grafted with octylamine (S-PESOS) and sulfonated polyethersulfone (S-PES) membranes. This cationic exchange membrane was, in first, electrochemically characterized by measuring ionic exchange capacity, water uptake and transport number of proton (Hitorff method).

Then, we analyzed the separation properties of this cationic membrane for electrolyte solutions when they contained Na^+, K^+, Li^+, Ca^{2+} and Mg^{2+} by electrodialysis in imposed current. We conducted the study of variation in the concentration of each cation taken apart, at the end of electrodialysis.

The variation of the concentration of cations with time of electrodialysis was also studied and the order of the different univalent cations are removed in the following order: $Li^+ > K^+ > Na^+$, concerning the bivalent cations elimination order is as follows: $Ca^{2+} > Mg^{2+}$.

Keywords : *electrodialysis, proton exchange membranes, characterization, selectivity, univalent cations, bivalent cations.*

COMPARATIVE STUDY OF THE SELECTIVITY OF CATIONIC EXCHANGE MEMBRANES TOWARDS THE MONOVALENT AND BIVALENT CATIONS.

APPLICATION IN ELECTRODIALYSIS OF REAL SOLUTION

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Membrane processes such as electrodialysis (ED) are increasingly being utilised in water treatment to remove dissolved contaminants.

In this study, we have tested the selectivity of three cationic membranes, polyethersulfone grafted with octylamine (S-PESOS), sulfonated polyéthersulfone hexamethylenedisulfonamide (HEXCL) and Nafion®towards Na^+, K^+,Ca^{2+} and Mg^{2+} ions, from water of Sebkhet-El Sijoumi by electrodialysis process. Variation with time during electrodialysis of the concentration of each ion of the central compartment was measured.

The results that we found shows that electrodialysis with ours cationic exchange membranes give good results and present a high selectivity for the transfer of cationic ions.

The best selectivity of ions is assigned to Nafion® membrane, S-PESOS; HEXCL membranes have also good results.

For the three membranes, the order of the different ions are removed in the following decreasing order $Na^+ > ca^{2+} > Mg^{2+} > K^+$.

MONITORING WATER QUALITY USING CALIBRATED PASSIVE SAMPLING DEVICES "POCIS" FOR THE EVALUATION OF THE CONTAMINATION DEGREE OF WATER WITH ORGANIC CONTAMINANTS.

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Pesticides arethe most recurrentsourceofepisodic and chronicpollution problemsobservedin aquatic systems. Indeed,their"arbitrary"use by farmers enhances their dispersionin the atmosphere, to be drained finallyinto aquaticenvironments byrainwater.Pesticidesarenowthe source ofdiffusepollutionthat contaminatesallinland waters: rivers,groundwater andcoastal areas. The discharge of these contaminants in water makeswater unfit forconsumptionor may degradesome of its properties(Bliefert andPerraud2001).They would bepotentially responsible of long-termcarcinogenicdiseases. Toavoid or minimizethe negative effects ofsuch compounds,monitoring water quality seems then a crucial step. According to the EuropeanDirective, this monitoring requirespowerful toolsfor quantifying such as thesecontaminants in water.Thepassive sampling, represent recently an alternative approach to monitoring programs that rely on collecting grab samples (punctual sampling) or sampling through aquatic organisms (biological sampling). Passive sampling enables determination of time weighted average concentration of contaminants present in the dissolved phase of water over extended sampling periods; it also permits the detection of trace and ultra-trace contaminants due to its pre-concentration ability. Passive sampling is capable to detect all episodic events that could be happened in the environment during sampling period and offers significant handling, use and economic benefits (Kot et al., 2000; Mazella 2007, Bueno 2009, Thomatou 2011). Among the passive samplers available, the most widely used for sampling polar organic pesticides is the polar organic chemical integrative samplers (POCIS). It is usually used for the sampling of hydrophilic pesticides which their partition coefficient octanol-water (log Kow) is less than 3 (Alvarez et al., 2004; Mazzella et al., 2007 and Harman et al., 2009).

In this work, we discussed the laboratory calibration of this device as any analytical device before its use in water monitoring. The accumulation through passive samplers based on a diffusion phenomenon of analytes from the aquatic media to the sorbent phase through the different compartments of the device was evaluated for different types of contaminants. The effects of different environmental factors such as water salinity, temperature, biofouling… were also evaluated. Results for application of POCIS in environmental sites were also shown.

AN AUTOPSY STUDY OF A FOULED REVERSE OSMOSIS MEMBRANE ELEMENT USED IN CPR MUNICIPAL WATER DESALINATION PLANT

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Despite the good quality of the water feeding the reverse osmosis plant of the Electricity Production Center of Rades, several problems was detected : increased rate of passage of salts, decreased conversion rate, low flow production and an increase in the differential pressure along the reverse osmosis installation.

The different investigations showed that the installation is exposed to certain risk of scaling by mineral salts, biological fouling and fooling by organic matter, colloids and suspended matter. To determine with sureness the reason of membrane fouling, an autopsy of a fouled reverse osmosis membrane element removed from the third stage of the plant after nearly 2 years of service was realized. To monitor the development of the fouling layer, top surface and the interlayers of the fouled membrane element were analysed using diffraction by X-Ray, Fourier transform infrared spectroscopy (FTIR), atomic force microscopy (AFM) and Scanning Electron Microscopy (MEB).

The results showed that the fouling layer is composed of 21% organic matter and 79% inorganic material. The X-ray results showed that the inorganic phase consists essentially of quartz and clay. These two compounds can be owed to the leaks detected at the sand filters during backwashing. Also the germination of calcium carbonate’s crystals specifically the variety aragonite was detected; it’s owed to the irregular use of the antiscalant.

The characteristics bonds obtained by IR indicate the presence of proteins and polysaccharides that constitute a source for further microbiological growth, this result was proved by SEM analysis which revealed the presence of spores on the surface of the membranes.

AFM analysis showed that the extend of fouling was uneven on the membrane surface also it has been proved that the external surface of the membrane present the highest value of roughness, this value decrease across the membrane element.

TECHNOLOGY DEVELOPMENTS IN FORWARD OSMOSIS TO ADDRESS WATER PURIFICATION

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Forward Osmosis (FO) is a natural process and occurs in the cells of all living things when liquids of differing solute concentrations are separated by a semi-permeable membrane. FO differs from Reverse Osmosis (RO) in that natural osmotic pressure, resulting from the difference in solute concentration in the two liquids, is the sole driving force for the transport of pure water across a membrane. Water is driven through a semi-permeable membrane in the RO process, using hydraulic pressure resulting in significant energy expenditure, and hence cost in producing the desalinated product. With FO, osmosis is allowed to occur naturally, without external force, resulting in a very low energy method for desalinating water. FO provides a number of advantages over RO for seawater desalination in addition to the energy savings. Lower fouling of the membrane provides longer lifetime and lower maintenance costs. Other advantages of FO include higher maximum feed water recoveries and a reduced level of pretreatment.

ULTRAFILTRATION OF OIL-IN-WATER EMULSIONS USING ROTATING MEMBRANES

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Separation of water from water-in oil emulsions is of importance in several industries. Due to the presence of surfactants and co-surfactants, the emulsions are very stable and conventional methods cannot be applied. During the last decade, the development of membranes technologies has most embodied applications in the processing of emulsion treatment. Several studies have reported that cross flow membrane microfiltration and ultrafiltration are effective process in concentrating oil-water emulsions. However, they do have several limitations. Foremost among these are the accumulation of retained oil drops and the adsorption of surfactants at the membrane surface. This phenomenon is called concentration polarization and is responsible of the limitation of the transmembrane flux. Several methods were proposed to reduce the concentration polarization and fouling.

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

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

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

Keywords: *Emulsion, Ultrafiltration, Rotating disk, Vanes, Turbidity.*

REMOVAL OF CADMIUM BY ADSORPTION ON ACTIVATED ALUMINA

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The ability of activated alumina as adsorbent was investigated for adsorptive removal of cadmium from aqueous solutions. Various physico-chemical parameters such as pH, initial cadmium concentration, adsorbent dose of activated alumina and temperature were studied.

In order to optimize the effect of the main parameters and their mutual interaction for the adsorption process, a full factor design of the type n^k has been used. Thus, the total number of trial experiments needed for an investigation is 2^4. The adsorbent dose of activated alumina, initial cadmium concentration and temperature are the most significant parameters affecting cadmium adsorption.

The Freundlich and Langmuir models have been applied and the equilibrium adsorption data were better fitted to Freundlich adsorption isotherm model. A comparison of kinetic models applied to the adsorption of cadmium on activated alumina was evaluated for the first-order and the second-order models respectively. Results show that the second-order kinetic model was found to correlate the experimental data well. The thermodynamic study showed that the adsorption of cadmium by activated alumina is an exothermic and spontaneous process.

Keywords*: cadmium, adsorption, activated alumina, Freundlich, Langmuir.*

ADSORPTION D'UN COLORANT SYNTHETIQUE SUR DES CARBONES ACTIVES PREPARES A PARTIR DE COQUES D'ABRICOT

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L'industrie textile rejette une quantité considérable d'effluents colorés contenant des colorants synthétiques non biodégradables ce qui peut dégrader la qualité de l'eau des rivières. En raison d'une législation de plus plus sévère, il est nécessaire d'éliminer les colorants présents dans les eaux usées industrielles avant leur rejet. Une des méthodes parmi les plus utilisés pour le transfert des polluants est l'adsorption sur des charbons actifs. Il y a un fort intérêt dans la synthèse de nouveaux adsorbants à base de déchets végétaux. Nous avons préparés des carbones activés à partir de coque d'abricot, étudiés leurs caractéristiques, ainsi que les différents mécanismes d'adsorption d'un colorant synthétique. Ces carbones activés s'avèrent être des matériaux prometteurs pour le traitement des eaux.

Mots clés *: adsorption ; carbone activé ; colorant synthétique ; traitement des eaux*

PHENOL REMOVAL FROM WATER BY AG REVERSE OSMOSIS MEMBRANE

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The presence of organic compounds such as pesticides, phenol, resorcinol and other toxic substances in raw surface and grand water is one of the emerging problems in the drinking water production. Phenols are generally considered as an organic pollutant discharged into the environment causing unpleasant taste and odor of drinking water and are poisonous to aquatic life, plants and human as a product of the bio-concentration. Accordingly, various treatment technologies for removal of phenol from water have been used such as liquid-liquid extraction, ionic exchange with resins and membrane processes. Technologies using membrane processes are increasingly employed in many industrial sectors as important alternative technologies to classical processes of separation. In the present study, removal of phenol from aqueous solutions was investigated using a polyamide thin film composite reverse osmosis membrane denoted as AG 2514 TF from Osmonics Company. The mechanism of transport through this membrane is also studied. In order to determine the reflection coefficient of the membrane (σ), the solute permeability of ions (P_s) and to quantify the convective and diffusive parts of the mass transfer, the Kedem-Katchelsky model was applied. In addition, retention of phenol was investigated and the influence of the different parameters, such as feed concentration, ionic strength, transmembrane pressure and recovery; on the elimination of phenol was also studied.

Keywords : *Phenol remova l; Reverse osmosis ; Kedem-Katchelsky model ; Mass transfer*

DIAGNOSIS OF DESALINATION PLANT OF ELECTRICITY PRODUCTION CENTER OF RADES

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Fouling and scaling in membrane filtration processes are unavoidable as they occur with the retention of contaminants that accumulate on the membrane surface. Fouling is caused by a number of foulants including inorganic scales, microorganisms, particulates and organic matter. In sea/brackish water applications, pretreatment of RO feed water is the key step in designing the plant to avoid membrane fouling and scaling. Recent developments in pretreatment processes are more adapted to raw water quality. But, in some cases, raw water quality varies during seasons and is also influenced by the environment. Thus pretreatment design becomes complicated and should cope with the raw water quality changes. The desalination plant of Electricity Production Center of Rades (CPR) fed from water distributed by the National Society of Water Exploitation and Distribution SONEDE. This station has revealed difficulties related to the loss of membrane performance. Membranes are regularly cleaned during operating years. To identify the causes for the poor performance, different investigations should be carried out. This study aims to make a diagnosis and monitoring the functioning of the station. Assessment of various parameters of the station shows that the membranes underwent scaling with mineral salts and clogging by organic matter, colloids and suspended matter.

Keywords*: Membrane; Reverse osmosis; Brackish water; Desalination plant; Fouling; Diagnosis*

REMOVAL OF ZINC IONS FROM WATER BY ELECTRO COAGULATION PROCESS USING ALUMINUM ELECTRODES

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Heavy metal contamination of waters and soils is particularly dangerous to the living organisms. Different studies have demonstrated that electrocoagulation has a high removal capacity for divalent heavy metal ions in contaminated waters. Zinc is naturally present in water. The average zinc concentration in seawater is 0.6-5 ppb. Rivers generally contain between 5 and 10 ppb zinc. Algae contain 20-700 ppm, sea fish and shells contain 3-25 ppm, oysters contain 100-900 ppm and lobsters contain 7-50 ppm. The World Health Organization stated a legal limit of 5 mg Zn^{2+} L^{-1}. In this research we have studying the performance of electrocoagulation in the removal of Zn (II) ions using aluminum electrodes. Batch studies were performed to evaluate the influence of various experimental parameters such as pH, current density, electrolyte doses, energy consumption, initial concentration, initial temperature of water, and electrocoagulation time. The performance of the treatment, the operating cost, and the state of the aluminum plates are also studied. Optimum conditions for zinc removal were found to be pH = 7, current density of 7, 35 A m^{-2}, potential inter-electrode of 5V, conductivity of 5, 3 mS cm^{-1}, initial temperature of 50 °C and electrocoagulation time of 20 minutes. We can note that the surface deposit disappears with increasing current density. At low current density of 3.5 A m^{-2}, a darkening that cannot be removed by mechanical polishing of the plates by sand paper appears on the surface of the cathode. This could be due to chemical corrosion of the cathode. These operating conditions can simultaneously achieve a good mix, a good flotation, stability of flocs and thus efficient removal in a relatively short reaction time and low cost with a percentage of removal up to 93.66 %. In the light of these results, this method promises interesting industrial applications.

Keywords *: Electrocoagulation ; Zinc removal ; Aluminum electrodes ; Water treatment.*

ZINC IONS REMOVAL BY ELECTRO COAGULATION : OPTIMIZATION OF OPERATING PARAMETERS AND REACTOR DESIGN

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Pollution of water with Heavy metals and its compounds is a universal problem due to their adverse effects in the human's health and the environment. The average zinc concentration in nature is varying from 0.6 ppb (sea water) to 900 ppm (oysters). Zinc is naturally present in water. The World Health Organization stated a legal limit of 5 mg L^{-1}.

One of the well-known methods that could be used to remove zinc from water is electrocoagulation. Given the time-scale over which electrocoagulation technology has been utilized, it is somewhat surprising that the available literature does not reveal any systematic approach to electrocoagulation reactor design and operation.

In this study, investigation of development parameters in electrocoagulation reactor design effect was carried out to develop zinc removal efficiency. To optimize the experimental conditions of electrocoagulation reactor, the effects of the inter electrode distance (d_{ie}), the electrode connection mode, the ratio (S/V) and the initial temperature of the solution (T) were studied. Experimental results obtained showed that optimal zinc removal was achieved for: d_{ie}=0,5cm, bipolar connection mode, (S/V) = 13, 6 m^{-1}, and an initial temperature T_i = 50 C°. The effect of the electrocoagulation time current were studied the experimental data showed an optimum electrocoagulation time of t_{EC} = 30 min with a percentage of removal up to 93.66%. At low distance between electrodes of d_{ie}=0,5cm, a darkening that cannot be removed by mechanical polishing of the plates by sand paper appears on the surface of the cathode. For low current densities (0.3 mA cm^{-2}), a white deposit with a gelatinous appearance was observed on the anode. Performance of the EC process, and the operating cost for the removal of Zn (II) were calculated and presented. This investigation will be helpful for further application of electrocoagulation process to be carried out for the treatment of wastewater containing heavy metal ions exceeding their permissible limits.

Keywords : *Electrocoagulation ; Zinc removal ; reactor design ; Optimization ; Water treatment.*

OPTIMIZATION OF THE ELECTRO COAGULATION PROCESS FOR THE REMOVAL OF LEAD FROM WATER USING ALUMINUM AS ELECTRODE MATERIAL

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Lead is a priority substance in the framework of the European water policy (Water Framework Directive 2000/60/EC [1] and Water Environmental Quality Standards Directive 2008/105/EC), because it presents a significant risk to biota and humans, given its persistence, toxicity and bioaccumulation characteristics.

This study is devoted to focus on lead removal by means of electro coagulation. The performance of electro coagulation (EC) process with aluminum electrodes for removal of lead on laboratory electrochemical cell was studied. The effects of various parameters on the percentage of lead removal were investigated, including electro-chemical treatment time, solution pH, current density (J), electrolyte concentration, the faradic efficiency and electrical energy consumption. The optimal operating conditions can simultaneously achieve a good mix, a good flotation, stability of flocs and thus efficient removal in a relatively short reaction time and low cost. Under optimal conditions with 60 min treatment, the lead removal efficiency reached 99 %. In the light of these results, this method promises interesting industrial applications.

Keywords : *Electro coagulation, lead removal, Aluminum electrodes, chemical parameters Water treatment.*

COMPETITIVE ADSORPTION BETWEEN FLUORIDE AND NATURAL ORGANIC MATTER ON ACTIVATED ALUMINA

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Natural organic matter (NOM) is an important water constituent that affects the performance of drinking water treatment processes and the quality of drinking water.

In addition, several studies have shown that the NOM can be adsorbed on the surface of oxides.

The overall goal of this study was to investigate the influence of the presence of NOM on fluoride removal by adsorption onto Activated Alumina (AA).

For a better understanding of the influence of background organic compounds on this process a commercial humic acid extracted from soil was used as a model compound for NOM.

The UV/Visible absorbance of humic acids was measured in the range λ=200 nm to 800 nm and the specific absorbance $SUVA_{254}$ was determined.

The studied systems were grouped into (a) single solute adsorptions (b) simultaneous adsorption on fresh AA and (c) simultaneous adsorption on preloaded AA.

The results demonstrated that the presence of NOM affect negatively the performance of AA for removing fluoride ions since; after a contact time of 7 hours the percentage removal decrease from 70% to 51% for the simultaneous adsorption and to 37% in the case of preloaded AA.

A High Pressure Size-Exclusion Chromatography (UV/Vis detection) measurements showed a non reversible adsorption of NOM after addition of fluoride ions and a preferential adsorption of the lower-sized fractions.

Keywords: *Natural organic matter, Adsorption, Aluminium oxide, Defluoridation, Water treatment.*

BIODEGRADATION OF P-CRESOL BY A PSEUDOMONAS SPP

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A Phenols are toxic to several biochemical reactions**.** However biological transformation of phenols to non-toxic entities exists in specialized microbes, owing to enzymatic potential involving enzymes of aromatic catabolic pathways. In this study, a series of experiments were performed to examine the effects of the mineral medium composition and the pH on p-cresol removal. In this purpose, p-cresol biodegradation was carried out in a batch reactor containing mixed bacteria; the temperature (30°C), the stirring velocity (200 r /min), the KH_2PO_4 concentration (1.5 g/L), the K_2HPO_4 concentration (2 g/L) and p-cresol concentration (100 mg/L) were kept constants. The initial pH was varied in the range 5 – 9 and the mineral components were tested in the following concentration ranges: 0 – 2 g/L for Nitrogen sources (NH_4Cl, KNO_3 and NH_4NO_3), 0 – 0.5 g/L for NaCl and 0 – 0.2 g/L for $MgSO_4$. Their effects on p-cresol biodegradation and specific growth rate were examined. The shorter biodegradation time of p-cresol was 32 h for NH_4Cl, NaCl and $MgSO_4$ concentrations of 1, 0.3 and 0.1 g/L respectively. Maximum specific growth rate (0.34 h^{-1}) and total p-cresol removal (99.99 %) were recorded for an optimal pH value of 8.

Keywords: *Biodegradation, p-cresol, Pseudomonas Spp, Kinetic.*

ION EXCHANGE EQUILIBRIUM BETWEEN AMX MEMBRANE AND ELECTROLYTES SOLUTION : EFFECT OF IONIC STRENGTH

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The importance of ion exchange processes has increased attention due to their application in various fields such as chemical industry, pharmaceutical industry, medicine, pollution control and protection of the environment, the treatment of liquid effluents, the recycling of wastewater, and production of drinking water from natural sources.

In this work, the ion exchange equilibrium between AMX anionic membrane and the binary systems (Cl^-/NO_3^-), (Cl^-/SO_4^{2-}) and (NO_3^-/SO_4^{2-}) was studied at various ionic strength from 0.1 to 0.5 mol.L^{-1} at constant temperature (298 K).

Ion exchange isotherms were established for the studied systems, the order of affinity was: $Cl^- < NO_3^- < SO_4^{2-}$ at I=0.1 mol.L^{-1}. This order was: $SO_4^{2-} < NO_3^- < Cl^-$ at 0.3 mol.L^{-1} and 0.5 mol.L^{-1}.

Selectivity coefficients $K_{Cl^-}^{NO_3^-}$, $K_{2Cl^-}^{SO_4^{2-}}$ and $K_{2NO_3^-}^{SO_4^{2-}}$ and thermodynamic constant were calculated.

Ion chromatography coupled to a conductimetric detector is used as a method of analysis.

Keywords : *AMX membrane, binary system, equilibrium, selectivity coefficient, ionic strength.*

DEFLUORIDATION OF SOUTH TUNISIAN BRACKISH WATER BY ELECTROCOAGULATION USING EXPERIMENTAL DESIGN METHODOLOGY

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Fluoride ion in water has both beneficial and harmful effects on the environment and the human. Waters with high fluoride content are usually found at the foot of high mountains and in areas with geological deposits of marine origin. Face to the rarefaction of the resources in drinkable water of good quality, the treatment of natural south Tunisian water with an excessive content of fluoride will become a necessity. Various treatment technologies, based on the principle of precipitation, ion exchange, membrane and adsorption process have been proposed and are tested for fluoride removal efficiency from drinking water as well as industrial effluents. Fluoride removal from aqueous solution was investigated using electrocoagulation process in reason of the efficiency and the simplicity of the process.

Preliminary experiments were carried out to study the effect of some operating parameters such as: initial pH, initial fluoride concentration, the conductivity of the solution, the inter-electrode distance, the electrode connection mode, the ratio (S/V) and the current density. Experimental design methodology using two-level full factorial design was applied to evaluate statistically the most significant operating parameters. Therefore, three operating parameters which are supposed to affect the removal efficiency were chosen: initial fluoride concentration, current density and initial pH. From the statistical analysis, it is inferred that current density (J) and initial fluoride concentration had a considerable effect on fluoride removal by EC. Initial fluoride concentration has a positive effect unlike current density has a negative effect. Nevertheless, initial pH was estimated as unimportant factor. Experiment tests were performed to evaluate the efficiency of electrocoagulation process for south Tunisian brackish water with high fluoride concentration. The obtained results showed that fluoride removal reached 55%.

Keywords : *defluoridation, electrocoagulation, full factorial design, brackish Tunisian water.*

REMOVAL OF CADMIUM FROM THE MODEL WATER BY REVERSE OSMOSIS AND NANOFILTRATION MEMBRANES

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Nowadays, various methods for cadmium removal from the water have been extensively studied. Among these methods are found the reverse osmosis and nanofiltration processes. In this paper, the AG, SG and HL (Osmonics) membranes, were used for the removal of cadmium. In the first part, we have characterized these four membranes by determination of permeability, the load. In second part, the effect of the feed pressure, feed concentration, ionic strength, type of anion associated to cadmium and pH on the retention of cadmium were studied. The retention of cadmium exceeds 90% for the four membranes. It relatively depends on the applied pressure, pH, ionic strength and the feed concentration.

A complementary study was conducted to determine the parameters of transfer cadmium, which are deducted from the Speigler-Kedem model. This model allows determining phenomenological parameters σ and Ps respectively, the reflection coefficient of the membrane and the solute permeability of ions. The convective and diffusive Parts of the transfer were determined and the result shows the difference of the mechanisms of transfer for the four membranes.

Keywords *: Cadmium, Reverse osmosis, Nanofiltration, operating parameters, Spiegler-Kedem model*

ADSORPTIVE REMOVAL OF PHENOL FROM AQUEOUS SOLUTION OVER GRANULAR ACTIVATED CARBON: OPTIMISATION THROUGH EXPERIMENTAL DESIGN METHODOLOGY

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Removal of hazardous compounds from industrial effluents is one of the growing needs of the present time. Phenols are considered as priority pollutants in wastewaters. Major sources of water pollution with phenolic compounds are industries like oil refineries, petrochemicals, plastic, pesticides, insecticides and pharmaceuticals. The maximum concentration of total phenols in drinking water is given as 0.5µg.L^{-1} by the European Union. Compared to other methods, adsorption technique is widely used for water treatment due to its sludge-free clean operation, economical, availability of wide range of adsorbents. Activated carbons are often used for the removal of organic contaminants from water.

This paper investigates the adsorptive removal of phenol from aqueous solution over commercial granular activated carbon (GAC) and carries optimisation of removal efficiency for the process using a two-level full factorial design. The effects of different parameters such as pH, initial phenol concentration, adsorbent dose, contact time, speed agitation, temperature and ionic strength on adsorption were studied to find the best operating conditions.

In order to evaluate statistically the most significant operating parameters, an experimental design methodology was applied. The main and interactive effects of four different experimentally controlled environmental factors like pH, initial phenol concentration, adsorbent dose and temperature are investigated through the model equation designed by a full factorial design. The statistical analysis showed that the four studied parameters have an influence on the phenol elimination. The adsorbent dosage was found to have the most significant impact on the phenol removal efficiency.

Besides the adsorption isotherms were correlated with the Langmuir, Freundlich, Temkin and Dubinin Redushkevich adsorption equations. Thermodynamic parameters for the adsorption system were determined at different temperature. The kinetic studies showed that the adsorption followed a pseudo-second order reaction. The adsorbed phenol can be recovered by treatment with 0.1M NaOH solution.

***Keywords** : Phenol removal, activated carbon, factorial design, adsorption isotherms, adsorption kinetic, thermodynamic, desorption.*

DISTRIBUTION OF POLYCHLORINATED BIPHENYLS IN SURFACE WATER SAMPLES COLLECTED FROM BIZERTE LAGOON, NORTH TUNISIA

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The aim of this study was to investigate the distribution of polychlorinated biphenyls (PCBs) for fourteen water samples collected from Bizerte lagoon, Tunisia. Extraction of water samples was performed by liquid-liquid extraction with hexane. Gas chromatography with ^{63}Ni electron capture detector (GC-ECD) was used to perform qualitative and quantitative determination. Procedural blanks were analyzed simultaneously to check for interferences or contamination from solvent and glassware. PCBs congener studied are PCB-28, 52,101, 138, 153,180 and 209 the sum expressed as ∑PCBs. Results show that ∑PCBs concentrations in surface water samples varied between 17.60 and 511.31 ngL^{-1}. The predominant PCBs congeners in all surface water samples were PCB-52 and 180 with a maximum of 417 ngL^{-1} obtained in station 14 and 235.14 ngL^{-1} obtained in station 2 respectively. The lowest concentrations (0.55 ngL^{-1}) were obtained in station 6 for PCB-138 and in station 13 for PCB-28 (0.40 ngL^{-1}). The different samples from Bizerte lagoon were found to be moderately contaminated by PCBs. This pollution was attributed to agricultural and industrial activities, which are very important in this area.

Keywords: *polychlorinated biphenyls, surface water, Bizerte lagoon, gaz chromatography, electron capture detector.*

EXPERIMENTAL INVESTIGATION OF NEUTRALIZATION DIALYSIS IN THREE COMPARTMENT MEMBRANE STACK

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This work is concerned with the feasibility of surface water desalination by the Neutralization Dialysis (ND) process and the difficulties related to this process. The pH and the conductivity of model saline solution have been measured during different ND operations using a three-compartment membrane stack of 64 cm² active area for each Ion-Exchange Membrane (IEM). The central solution concentration is maintained at 0.02 mol.L^{-1}. The influence of three parameters has been investigated, *i.e*. the flow rate (from 35 to 100 mL.min^{-1}), the alkaline solution concentration, and the acidic solution concentration (from 0.02 to 0.1 mol.L^{-1}).

We have shown that Diffusion Boundary Layers (DBLs) have a great influence on the ion-exchange kinetics through the IEMs. A leakage of HCl solution through the CEM has been proved. Its influence is more pronounced when the acidic and alkalie solution concentrations are low. These leakages modify the shapes of the pH *vs.* time and conductivity *vs.* time curves, and decelerate the desalination efficiency.

After 2 to 3 hours of desalination process, the conductivity reached the value of 0.25 mS.cm^{-1}, as recommended by the OMS for a drinking water. The desalination process was achieved within a reasonable duration in all the experiments.

***Keywords** : Ion-exchange membrane ; Neutralization Dialysis ; Desalination ; Surface water.*

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EFFECT OF IONIC STRENGTH ON ION EXCHANGE EQUILIBRIUM

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Ion exchange is an effective method used in numerous works as water softening, environmental remediation, wastewater treatment, chromatography and biomolecular separations…
In this work, ion exchange equilibrium was studied between the cation exchange resin DOWEX 50X8 and electrolytes solutions containing the most dominant cations of natural water (K^+, Na^+ and Ca^{2+}) at different ionic strength (I = 0.1, 0.3, 0.5 mol.L^{-1}). Humidity percentage and ion exchange capacity of DOWEX 50X8 resin were determined.
Ionic exchange isotherms for the binary systems (Na^+/K^+), (K^+/Ca^{2+}) and (Na^+/Ca^{2+}) were established at constant temperature (298 K). The affinity order was determined for the studied ionic strength. Selectivity coefficients $K_{Na^+}^{K^+}$, $K_{2K^+}^{Ca^{2+}}$ et $K_{2Na^+}^{Ca^{2+}}$ and thermodynamic constants $K_A^{\circ B}$ of ion exchange were calculated. Results were compared with those obtained with CMX cationic membrane.

***Keywords**: DOWEX 50X8 resin, binary systems, isotherms, selectivity coefficients, affinity order, thermodynamic constants.*

PREDICTION OF THE POTENTIAL FOR SCALING IN WATER: VALIDATION OF A PROGRAM STUDYING CALCOCARBON BALANCES

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Scaling and aggressiveness of the water turns out serious problems due to its consequences affecting canalisations and increase badly the consumption of energy.

The model of Legrand and Poirier permit to study the calco-carbonic system in natural waters having low salinities. A thermodynamic model is then developed and incorporated in a computer program. It is designed to determine the water character and the corrective treatment to bring the encrusting or aggressive water to calco-carbonic equilibrium.

In this work, the study was conducted to evaluate the improvement in the diagram of Legrand and Poirier. This improvement consisted of expanding the field of ionic strength, using hydrated forms of limestone, taking into account the formation of ion pairs and using the activity coefficients in the model of generalized Debye-Huckel. Characters of water samples was studied and determined with this model at different temperatures from 10 to 40°C. Furthermore it permits the determination of the amount of calcium hydroxide necessary to bring water to calco-carbonic equilibrium.

Keywords : *Calco-carbonic equilibrium, Legrand and Poirier model, ionic strength, calcium hydroxide*

NITRATES REMOVAL IN NATURAL WATER USING DONNAN DIALYSIS PROCESS: PARAMETERS OPTIMIZATION

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The excess of nitrates in the tap water causes major health problems. In this study, the use of Donnan Dialysis as membrane separation process turned out as adequate solution. The membrane employed is an AM3 anion exchange membrane. The nitrate removal efficiency obtained with a synthetic nitrate solution (62 ppm) used as feed solution is off 97 % which is an encouraging percentage. The optimal Donnan Dialysis conditions are defined and an experience with a tap water gives a removal efficiency of about 84%.

Keywords *: donnan dialysis, nitrate, membrane, boundary diffusion layer.*

EFFECT OF OPERATING CONDITIONS ON THE RETENTION OF TOLUIDINE BLUE BY POLYELECTROLYTE ENHANCED ULTRAFILTRATION

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The aim of this work is to use ultrafiltration enhanced by polyelectrolyte (PEUF) for the removal of dye from aqueous solution. The solution is processed by ultrafiltration using a membrane with pore sizes (10 KDa) small enough to block the passage of the polymer and adsorbed dye ions. The experiments showed that the highest dye rejection was about 99% in case of poly(acrylic acid)(PAA) and 97% in case of poly (ammonium acrylate)(PANH4) due to the high electrostatic interaction between anionic polyelectrolytes and cationic dye. The retention depended slightly on dye and polyelectrolyte concentration, ionic strength and pH. However, permeate flux decreases when polyelectrolyte concentrations increases which was mainly attributed to the concentration polarisation and osmotic pressure L.

Keywords : *Poly (acrylic acid), Poly (ammonium acrylate), Toluidine blue, Polyelectrolyte Enhanced-Ultrafiltration, Rejection coefficient.*

SPECTRAL STUDY ON THE INTERACTION OF SAFRANIN T WITH ANIONIC POLYELECTROLYTES

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The aim of the work is to study the interaction between Safranin T (ST), a cationic dye, with poly (ammonium acrylate) and poly (acrylic acid), an anionic polyelectrolytes. The absorption at λ_{max} of ST (519 nm) decreases progressively upon addition of increasing amounts of polyelectrolyte solution and a new band appeared at 476 nm and 493 nm respectively which indicated that a new metachromatic complex were formed. The large hypsochromic absorption shift obtained is attributed to dye H-aggregates. The stoichiometry of both complex evaluated by the molar ratio method are 1:1 for ST– $PANH_4$ and 2:1 in the case of ST -PAA. The effect of additives such as sodium chloride and cetylpyridinium chloride on metachromasy has been studied by varying concentrations of the salt and the surfactant and pH of the solution. The thermodynamic parameters of interaction ΔG, ΔH and ΔS at different temperatures were evaluated to determine the stability constant of the complex.

Keywords : *Safranin T, Poly (ammonium acrylate), Poly (acrylic acid), Stoichiometry, Thermodynamic parameters.*

REMOVAL OF TOLUIDINE BLUE FROM AQUEOUS SOLUTION USING ORANGE PEEL WASTE

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The adsorption of Toluidine blue (TB) from aqueous solution using a low–cost adsorbent, orange peel waste (OPW), has been studied by batch adsorption technique. The adsorption process was investigated by varying the initial concentration, adsorbent dose and pH. Other factors affecting the adsorption as stirring rate, ionic strength and temperature of the initial dye solution were evaluated. The equilibrium data was analyzed using Langmuir, Freundlich and Temkin isotherm models. The adsorption process fitted very well to the Langmuir model. The kinetic data obtained was analyzed using a pseudo-first-order, pseudo-second-order. The experimental results showed that the pseudo-second-order equation is the best model that describes the adsorption behavior with the coefficient of correlation $R^2 \geq 0.99$. Thermodynamic studies indicated that the adsorption was exothermic for the dye. The results suggested that OPW has high potential to be used as effective adsorbent for Toluidine blue removal.

Keywords : Adsorption, Orange peel waste, Toluidine blue, Isotherms, Kinetics

PHYSICO-CHEMICAL CHARACTERIZATION OF A POLYMERIC IONIC CONDUCTOR: APPLICATION TO DEFLUORIDATION BY ELCTRODIALYSIS

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The aim of this work is to study the characteristic of an anionic membrane which will be the subject of an application for defluoridation by electrodialysis. The first objective of this work is to evaluate the physico-chemical characteristic of the membrane used in experiments by determination of the exchange capacity, the humidity yield, the ionic conductivity and the transport number (Hittorf method). The second part consist to study the effect of differents parameters such as the electrodialysis time, the supporting electrolyte concentration, the coexisting ions such as (SO_4^{2-}, Cl^- and NO_3^-), the current density and the pH of the solution to evaluate the effectiveness of the process for defluoridation by electrodialysis.

***Keywords**: Electrodialysis, anionic membrane, defluoridation*

EFFLUENT LIQUID RETENTION BY GRAFTED CERAMIC MEMBRANE

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In this paper, the retention of a series of dyes, wastewater and salt molecules by two membranes (symbolized MLS and AMLS) was studied. Filtration tests were performed on a laboratory scale filtration, using a recycling configuration at 5 bar.

In the present study the application of the filtration process is investigated mainly in the retention of color, heavy metals and chemical oxygen demand (COD) present in wastewater.

Filtration studies using ceramic membranes were performed for solutions containing salts, Congo red, lead ($Pb(NO_3)_2$) and industrial waste water.

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

The rejection rate salts and Congo red was strongly influenced by the electrical interactions between ionic species and surface membrane. The maximum observed solute retention, using AMLS membrane, of lead ion, Congo red and NaCl was 100%, 95% and 47% respectively.

Cross-flow filtration was carried out then, in order to reduce the turbidity and chemical oxygen demand (COD). The result showed a high retention of turbidity (100%) and COD (87%).

Key words: *ceramic membrane, synthesis, COD, dyes, heavy metals and flux*

PHYSICOCHEMICAL AND MICROBIAL CHARACTERIZATION OF SEBKHA BEN GHAYADHA TUNISIA

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A study of physico-chemical parameters (DCO, dry matter DM, total salinity and nitrogen) and microbiological parameters (mesophilic and thermophilic bacteria, test of antibiotics resistance) of some strains isolated from the Sebkha of Ben Ghayadha were determined. The obtained results showed that the water of the Sebkha Ben Ghayadha is loaded in organic pollutants, the DCO values of the analyzed samples of water taken at various depths remain higher than 4000 mgO_2 / l and exceed the values recommended by the Tunisian Standard NT 106.02 (1989) of Environmental protection. While the other parameters studied as DM [12mg / l] and the total nitrogen values vary according to the site chosen. Indeed, values of 1,949 mg / l and 47,844 mg / l were recorded at the level of 2 and 4 meter depth, corresponding values in Tunisian standards. The results related to bacteriological parameters showed that the number of the fecal germs was lower than those recommended on Tunisia Standards.

Keywords *: Sebkha, salinity, microbiology, pollution*

REMOVAL OF BORON BY COAGULATION ENHANCED WITH ADSORPTION ON FRESHLY MAGNESIUM HYDROXIDE

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Boron is an important micronutrient for plants, animals and humans but the excess and the deficiency of this element are harmful. The World's Health Organization WHO recommended a limit value of 2,4 $\mathrm{mg.\,L^{-1}}$ of boron in drinking water.

The use of hybrid processes has often been found to improve the removal efficiency of trace pollutants in water. It was demonstrated that boron removal using coagulation-flocculation does not exceed 30%. The aim of this study is to improve the boron removal by coagulation-flocculation combined to the adsorption on magnesium hydroxide.

The boric acid and borates reacts with compounds containing multiple hydroxyls groups to form an anionic complex that's why we employed the $\mathrm{Mg(OH)_2}$. The results obtained indicate that the process is strongly influenced by the pH and the amount added of magnesium. The effect of flocculants such as FABI and PEI was investigated.

A full factorial design was used to determine the effect of individual variables and their interactional effects on boron removal. This design involves three variables; boron concentration, magnesium/boron molar ratio and time of coagulation. When the optimum conditions are selected, the process reached 76% of boron removed.

Keywords *: Coagulation-flocculation, Adsorption, Boron removal, Magnesium hydroxide*

EXPERIMENTAL STUDY OF THE INCLINED SOLAR FILM EVAPORATOR

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The present study investigated the experimentation of an inclined solar film evaporator in the meteorological conditions of the town of Bizerte, in Tunisia. The experimental device used in this study has a parallelepiped form. It is primarily constituted by an inclined metal plane plate. A water film falls on the external face of this plate through a porous tissue. A glass cover, placed on a wooden frame putted on the plate, is exposed to the solar radiation acting as a solar panel. An ascending air flow enters in the evaporator where is in direct contact with the falling water film. This experimental device is designed and supplemented by a protocol of measurements to conduct this study. The thermocouples installed along the metal plate were connected to an automatic acquisition making it possible to read and store the measured temperatures values. The evaporated flow is measured by an electronic balance and a stopwatch. Moistures and the air velocities are measured using a digital multifunction device. The series of measurement are carried out in natural and forced convection. The profile of the liquid film temperature and the variation of the evaporated flow are measured for the two modes of convection. To quantify the effectiveness of the solar evaporator, the thermal and mass yields are calculated. The results show that the evaporated flow is more significant in forced convection and that the thermal and mass yields of the solar evaporator are higher than 80%.

Keywords : *solar evaporator, liquid film, natural convection, forced convection, yield.*

"Advanced MED-TVC Design"

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Reducing water production costs in thermal seawater desalination systems is a primary R&D goal. For Multi-Effect Distillation (MED) systems, assuming fuel cost range of 50$/barrel, preliminary estimates show that a 50% increase in the Gain Output Ratio (GOR) can result a 30% saving in steam costs and a 20% saving in the total water production costs. As a rule of thumb, the higher the fuel cost, the higher savings will be. Since GOR is directly related to the temperature range of thermal desalination systems, the main objective of this research, in order to reduce water cost, is to rise up Top Brine Temperature (TBT) to approximately 100°C.

Increasing TBT will have several advantages, e.g. more distillate production rate in the existing cell, enhancing the performance of next cells, reducing heat transfer area by enhancing heat transfer rate. Thus, a better understanding of scale formation mechanisms, development of novel anti-scalant and implementing enhanced heat transfer coefficient to calculate heat transfer area can have significant impact on the process performance and water cost reduction.

For these purposes, a dedicated pilot test unit was designed and constructed by Doosan Heavy Industries & Construction Co. Ltd. (Doosan) in Changwon South Korea, in collaboration with BASF. Pilot testing efforts were focused on evaluating the performance of anti-scalant, and scale measurement by using different techniques such as atomic absorption spectroscopy "AAS", scanning electron microscopy "SEM", energy dispersive X-ray spectroscopy "EDXS" and X-ray diffraction "XRD" as well as deriving new empirical evaporation heat transfer coefficient for high TBT condition. A test program under various temperatures, feed flow rate and anti-scalant dosing rates was implemented in stages, the final results were used in developing a Scale Index and Empirical Evaporation Heat Transfer coefficient. These data led to conceptual design of 20 MIGD high-temperature MED-TVC.

Key words : *MED-TVC, TBT, heat transfer coefficient, scale formation, anti-scalant, calcium carbonate, magnesium hydroxide.*

ELECTROCHEMICAL TREATMENT FOR THE SURFACE INDUSTRY WASTEWATER

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This study had like main aim the combination in the same cell of electrolysis two types distinct of treatment: the electroflotation (EF) and the electrochlorination (ECH), with an objective to eliminate the inorganic pollutants. At the time of this study, it was shown that with a wise choice of operating conditions, the cell of EF presents an excellent performance for the elimination of heavy metals. The results obtained showed that the EF is a method of separation effective for the copper reduction. Thus, it is possible to carry out rates of recoveries going up to 88.90 %, without chemical addition of additive. The examination of the effect of the operational parameters shows that the initial pH is a determining factor in the EF process. Indeed, it proves that a sufficiently high pH generates the formation of the flocs of good buoyancy what contributes to the improvement of the effectiveness of the technique. Moreover, the rise in the intensity of current makes it possible to decrease the processing time. For the treatment of the solutions Cu-EDTA by EFF, one notes the remarkable effect of the presence of the EDTA. After the elimination of the copper not complexes by EF of its precipitate, a quantity of complexes copper can be recovered with the cathode by deposit according to the content of EDTA in the solution. Oxidation by ECH showed its effectiveness for the elimination of the EDTA. Indeed, a total destruction of this pollutant can be obtained in the cell of EFF. The study also showed that the electro-oxidation of the EDTA is ensured by active chlorine produces *in sit*u. In addition to the examination of the influence of the various factors made it possible to retain that the intensity of current and the content chloride are two big factors in elimination by ECH. In addition, the tests carried out on the mixed solutions Cu-EDTA*,* indicate that coupling EF-ECH makes it possible to eliminate the organic and inorganic pollutants simultaneously. Thus, this process can constitute an alternative or a complement of the traditional methods. Moreover, this coupling presents a particular interest, because it seems to be perfectly adapted to the industry of the surface treatments, by reducing the capacity complexion of the organic pollutants, which constitute a serious constraint for the treatment of this kind of effluent, and by thus allowing the elimination of heavy metals. This not-conventional approach to the treatment of the aqueous solutions containing of heavy metals gave promising results.

Keywords *: Electroflotation – Electrochlorination – effluent treatment – Copper – EDTA*

INFLUENCE OF SUBSTRATE NATURE ON HETEROGENEOUS STRUVITE PRECIPITATION

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Struvite crystals are known to be formed during anaerobic digestion in wastewater treatment plants. This phenomenon can cause the scaling of pipes and recirculation pumps. The impact of three materials (PVC, polyamide, stainless steel) on struvite precipitation was investigated in this study. The results obtained showed that the susceptibility to scale formation is more important on polyamide and PVC than on stainless steel. However, the particle size of struvite crystals is higher for stainless steel material than for PVC and polyamide materials.

***Keywords** : struvite, scaling, heterogeneous*

TREATMENT OF TANNERY EFFLUENT BY ANAEROBIC DIGESTION: EFFECT OF CONCENTRATION AND TEMPERATURE

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The process of anaerobic digestion is an interesting solution for the treatment of tannery wastewater, because it results in a low sludge production and energy generation.

The objective of our work is to study the biodegradability a tannery effluent,

The aim is to evaluate the effects of different Inoculums to Substrate (I / S) ratios on the production of methane and the variation of COD degradation under thermophic conditions (55 ° C) and mesophilic ones (37 ° C).

The study showed that the biochemical methane potential (BMP test) is not very different under both operating conditions (37 ° C and 55 ° C), the maximum biogas production obtained was of 194 ml / g TVS for an organic load (OL) of 17.66 g/l at 37 ° C, and 108 ml / g TVS for the same OL at 55 ° C; we reach a degradation efficiency of organic material under mesophilic conditions 66.06% and 67.21% under thermophilic ones, for a period of 56 days.

In fact, the low yield is due the presence of high chromium concentrations which play a inhibitory role in anaerobic digestion as well as pH and conductivity

***Keyword** : anaerobic digestion, tannery, biogas, mesophile, thermophile.*

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