

**Spatial Evaluation of Preservability of Mild Steel by Coal Tar Epoxy Coatings Via Spectroscopic and Microscopic Techniques**

- Humaira Bano , Azhar Mahmood , Mazher Islam Khan , Syed Arif Kazmi

**Abstract:**

Generally film coatings are formulated by accounting average weather conditions, corrosivity level and any metal substrate, while accelerated (salt spray) test usually considered adequate to predict performance of a coating system. This established a need to evaluate compatibility of a coating system to a particular operational conditions for preservation of underlying substrate metal. In this communication, epoxy-polyamide primer and coal tar epoxy topcoat system were tested for preservation of mild steel under various natural exposures including marine, industrial and urban test sites of Karachi city, while accelerated test was also conducted for comparison. Condition of coating was assessed by visual morphological inspection, gloss measurements, scanning electron microscopy (SEM), energy-dispersive X-ray analysis and by oxygen/carbon ratios. Resulted data were statistically analyzed through principal component analysis and explained a variance of 99.82 % when two components were considered. Severe blistering, acute loss of gloss and high degradation in the surface characteristics of coal tar epoxy coating systems were noticed after natural exposure testing at marine and industrial sites as compared to accelerated (salt spray) testing. However, comparison of performance of coal tar epoxy coating systems applied on mild steel with our previous study on electrogalvanized mild steel has shown faintly better preservability of mild steel samples by coal tar epoxy coating systems. This was also proved by relatively lower oxygen/carbon ratios for the coating systems applied on mild steel which correspond to lower coating degradation products.

**Research Article - Chemistry**

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**Critical Study of Multiple Regressions Modelling for Monitoring of Haloacetic Acids in Water Reservoirs**

- Sadia Ata , Feroza Hamid Wattoo , Muhammad Imran Din ,  
Muhammad Hamid Sarwar Wattoo , Muhammad Abdul Qadir , Syed Ahmed Tirmizi,  
Pauzi Abdullah

**Abstract:**

Haloacetic acids are disinfection by-products formed during oxidation of natural water. In this study, linear and nonlinear models were developed based on field-scale investigations. These statistical models were applied to predict the formation of haloacetic acids in the treated water. Pearson's correlation was used to check significance of raw water determinants at the probability of 0.05. Multiple forward stepwise regression method was used to develop these models which were then validated using another set of results from the identical source. These predicted results show that linear model was better fit than nonlinear model. A plot of predicted and measured values showed that the Pearson's coefficient and the slope were in good agreement. The developed models can thus be used to reduce the occurrence of haloacetic acids in treated water by means of regulating the raw water quality used for the treatment plant.

**Modified Point Defect Model for the Electrochemical Behavior of the Passive Films Formed on Alloy C (UNS N10002) in Borax Solutions**

- A. Fattah-alhosseini

**Abstract:**

Utilizing potentiodynamic polarization, and electrochemical impedance spectroscopy (EIS), the passive films properties of alloy C in borax solutions under open circuit potential condition were evaluated. The potentiodynamic polarization curves suggested that alloy C showed excellent passive behavior in borax solutions. The capacitance versus potential curves revealed that the passive films displayed p-type semiconductive characteristics, where the Ni(II) vacancies preponderated over the oxygen vacancies and interstitials. The EIS data showed that the equivalent circuit  $R_s[(R_f s Q_f s)(R_f Q_f)(R_{mf} Q_{mf})]$  by three time constants is applicable. These results also revealed that the measured value of polarization resistance increases with decreasing concentration of borax

**Study of Acid–Rock Reaction Kinetics Under High Temperature and Pressure Conditions Based on the Rotating Disk Instrument**

- Nianyin Li , Yinsheng Feng , Pingli Liu , Zhifeng Luo , Liqiang Zhao

**Abstract:**

In this paper, a rotating disk instrument was used to simulate the acid–rock reaction under high temperature and pressure reservoir conditions. By changing the reaction temperature, pressure, rotational speed and acid concentration, the reaction rate was measured first, and then the reaction parameters such as reaction rate constant, reaction order and effective mass transfer coefficient of  $H^+$  were analyzed through data processing and regression analysis; reaction kinetics equation was therefore obtained, and the effect of various factors on the acid–rock reaction rate were also analyzed. Test results indicated the following: Acid–rock reaction rate increased first and then decreased with acid concentration; minimum value of  $H^+$  effective mass transfer coefficient was found with the variation of rotational Reynolds number; the effect of pressure can be neglected when the pressure is above 6 MPa; reaction rate increases with the increase of reaction temperature, which shortened the effective time for acid reaction, but the conductivity can be enhanced by non-uniform etching.

**Study and Optimization of the Polymerization Parameter of Furfuryl Alcohol by Algerian Modified Clay**

- Djamel Eddine Kherroub , Mohammed Belbachir , Saad Lamouri

**Abstract:**

Furfuryl alcohol (FA) which is derived from lignocellulosic biomass polymerizes into poly(furfuryl alcohol) (PFA) under acidic catalysis. A greener and more sustainable catalytic pathway was suggested in order to replace hazardous acidic catalysts by Algerian modified clay (maghnite- $H^+$  or mag- $H^+$ ). The possibility of the polymerization of FA by mag- $H^+$  was reported, and it was found that the polymerization of FA was initiated by mag- $H^+$  in dichloromethane. The reaction parameters such as time, temperature, and mag- $H^+$ /monomer weight ratio were optimized to improve the yield of the reaction and increase the average molecular weight. The kinetics indicated that the polymerization rate is first-order with respect to monomer concentration. The structural analysis of the polymer was carried out by IR,  $^1H$  NMR and  $^{13}C$  NMR spectroscopies. Thermal properties of the polymer were studied by TGA and DSC analyses. The novelty of this work is the exploitation of local clay that is widely available, inexpensive and has excellent properties and high quality features, which make it the subject of continuing research. These results will be a starting point and an essential reference for a comparative study, with the results of future work concerning the synthesis of PFA/maghnite nanocomposites.

**Full Factorial Design Approach to Hg(II) Adsorption onto Hydrogels**

- Deniz Bingöl , Dursun Saraydin , Dilek Şolpan Özbay

**Abstract:**

A 2<sup>4</sup> factorial design was used to evaluate the quantitative adsorption of Hg(II) ions in an aqueous solution onto radiation crosslinked poly(acrylic acid/acrylamide) hydrogels. The influence on the binding ratio (*r*) of variables such as pH, temperature, initial concentration of solution, and material was analyzed statistically using a suggested regression equation. The results demonstrate that the initial concentration of Hg(II) is the most significant parameter. A maximum Hg(II) ion uptake of 15.50 mg/g (with standard deviation, 0.20) was achieved at a high initial Hg(II) concentration (100 mg/L), low pH (2.5), and low temperature (15 °C) for both of radiation crosslinked poly(AAm-co-AAc) hydrogel samples in a significance level of 5%.

**Thermal and Microstructure Stability of Cordierite–Mullite Ceramics Prepared from Natural Raw Materials-Part II**

- Abdulmula Ali Albilil , Martin Palou , Jana Kozánková , Martin Boháč

**Abstract:**

Six mixtures for cordierite–mullite ceramics were synthesized at various temperatures from 1,523.15 K (1,250°C) for pure cordierite to 1,773.15 K (1,500°C) for pure mullite. Then, the samples were submitted to the test of thermal shock resistance based on cycling heating–quenching procedure. X-ray diffraction (XRD), scanning electron microscopy and mercury intrusion porosimetry (MIP) have been used to characterize the samples before and after heating–quenching test. Sample 6 of mullite was broken after 35 heating–quenching cycles, while the five other composites remained stable over 45 cycles. The refractoriness of samples is found to be higher. XRD shows that heating–quenching procedure has led to crystallization of cordierite and mullite phases. Apart from sample 6, the pore structure is stable with slight consolidation that was found depending on cordierite/mullite ratio. Also, the microstructure images confirm the results of XRD and MIP showing crack in sample 6 only, but compact and larger particles resulting from crystal growth in other samples due to the repeated action of heating.

**Occurrence of High Levels of Persistent Organic Pollutants (POPs) in Particulate Matter of the Ambient Air of Riyadh, Saudi Arabia**

- Aarif H. El-Mubarak , Ahmed I. Rushdi , Khalid F. Al-Mutlaq , Abdulqader Y. Bazeyad, Staci L. M. Simonich , Bernd R. T. Simoneit

**Abstract:**

There are no research reports on the presence of persistent organic pollutants (POPs), in the ambient air of Saudi Arabia. POP emissions represent an environmental hazard negatively affecting public health and productivity. The complex interrelated sources and the heavy load of air pollutants are due to accelerated developmental activities and economic growth in Saudi Arabia over the past three decades. Such development included both agricultural and industrial progress. The consequences found in this study reveal that PAHs, pesticides and PCBs are present at elevated concentrations in the ambient air of Riyadh. The average concentrations of pesticides range from 2 to 8,216 ng/m<sup>3</sup>, indicating their heavy use around the city and possibly long-range transport. The average concentrations of PAHs range from 18 to 1,003 ng/m<sup>3</sup> and of PCBs from < 1 to 20 ng/m<sup>3</sup>. Some of these POPs were originated locally, while others might be transported over long distances. These POP concentrations were noticeably high; therefore, Saudi Arabia should focus on reducing such emissions through concerted efforts at the national level.

**Application of Sensory Assessment, Electronic Tongue and GC–MS to Characterize Coffee Samples**

- E. Várvölgyi , A. Gere , D. Szöllősi , L. Sipos , Z. Kovács , Z. Kókai , M. Csóka , Zs. Mednyánszky , A. Fekete , K. Korány

**Abstract:**

Several efforts have been made by researchers to predict the sensory profile of coffee by instrumental measurement results. The aim of the work reported here was to determine the applicability of instrumental methods on coffee samples to replace the sensory analysis. For this purpose, we evaluated the most important sensory attributes of coffee capsule samples by sensory evaluation, electronic tongue and chemical analysis (SPME–GC–MS). The trained sensory panel was able to distinguish the samples based on global odor ( $p = 0.01$ ), and bitter ( $p < 0.01$ ), winey ( $p = 0.01$ ), fruity ( $p < 0.01$ ) taste attributes. The electronic tongue distinguished the pure origin and the blended coffee samples. The aroma analysis did not find significant differences among the various coffee samples; primarily, the components formed during roasting were measured. Promising models were developed by the instrumental measurement results to predict definite sensory attributes, e.g., in case of global odor intensity ( $R = 0.99$ , RMSECV = 1.56), acidity ( $R = 0.96$ , RMSECV = 0.94).

**Hydrothermal Ageing of Metallocene Polyethylene Films in Presence of Grafted Amine Stabilizers**

- Radu Setnescu, Mustapha Kaci , Nadjat Dehouche , Tanța Setnescu , Lounis Nasri , Traian Zaharescu

**Abstract:**

The hydrothermal degradation at 90°C in distilled water of metallocene linear low density polyethylene films (mLLDPE) has been studied using low density polyethylene (LDPE) for comparison. FTIR spectroscopy, DSC and chemiluminescence techniques were used for investigation of the hydrothermal ageing-induced changes. The stabilization effect of a commercially available HALS, namely Sanduvor PR 31, able to graft on polyolefin structures has been also studied, as well. It was found that intense oxidation process occurs in the case of LDPE: hydroxyl, carbonyl and unsaturated groups were identified in FTIR spectra. mLLDPE reference films presented considerably higher stability as compared to LDPE ones, this behaviour being assigned to the structural peculiarities. Sanduvor PR 31 induced higher stability in LDPE, possibly by grafting mechanism, but it did not present a significant effect in the case of mLLDPE. Besides a possible antagonist interaction with the process stabilizer or a graft-hindering effect of the alkyl side groups, the intrinsic higher stability of the mLLDPE which offers less active sites for grafting could be supposed to explain this lower effectiveness.

**Employing a Central Composite Rotatable Design to Define and Determine Significant Toxic Levels of Heavy Metals on *Shewanella putrefaciens* in Microbial Fuel Cell**

- Abdallah Nasser Zuheir Al-Shehri

**Abstract:**

Microbial fuel cells (MFCs) are a unique technology that takes advantage of bacterial metabolism to generate electricity and remove chemical oxygen demand (COD) from organic pollutants. Existence of heavy metals in fuel affects vitally bacterial activity in MFC. Present study aimed to define the negative effect of three most toxic heavy metals, namely mercury ( $\text{HgCl}_2$ ), lead ( $\text{Pb}(\text{NO}_3)_2$ ), and cadmium ( $\text{CdCl}_2$ ), on the activity of bacterium *Shewanella putrefaciens* with respect to electricity generation and COD removal in MFC from food industry wastewater. A central composite rotatable design was employed to determine the significant toxic levels of used heavy metals. The results indicated that the main effect of  $\text{HgCl}_2$ ,  $\text{Pb}(\text{NO}_3)_2$ , and  $\text{CdCl}_2$  was  $-62.17$ ,  $-58.55$ , and  $-31.65$  %, respectively, with respect to electricity generation, as well as  $-34.32$ ,  $-32.25$ , and  $-18.95$  %, respectively, with respect to COD removal, at 95 % confidence. The statistical design determined the significant toxic levels for each factor of heavy metals alone as (mg/100 mL)  $\text{HgCl}_2$  23.45,  $\text{Pb}(\text{NO}_3)_2$  34.38, and  $\text{CdCl}_2$  48.31, with respect to electricity generation, as well as 26.34, 31.84, and 52.56, respectively, with regard to COD removal at 95 % confidence. The coefficient of determination ( $R^2$ ) was found to be 0.93 and 0.98 for electricity generation and COD removal, respectively. The confirmatory experiments showed closeness of predicted and observed values.

**Apparent Molal Volume and Compressibility of Glucose and Maltose at Different Temperatures in Lysozyme Solution**

- Jamal Akhter Siddique , Sheetal Sharma , Saeeda Naqvi , Akil Ahmad , Asma Khaton, Siti Hamidah Mohd-Setapar

**Abstract:**

In the present research, we study the thermodynamic parameters of ternary system of two different sugars, i.e., (a)D(-)glucose+lysozyme+water and (b)maltose+lysozyme+water. It has been done at various temperatures (293.15, 303.15, 313.15 and 323.15 K) and concentrations of sugars. The apparent molal volume and apparent molal compressibilities have been calculated for these systems. The partial molal volume of D(-)glucose and maltose has also been evaluated in aqueous lysozyme solution. We have made an attempt to examine transfer volume of the said solutes from water to aqueous lysozyme solution. Interaction between sugars and water molecules is expected to create polar environment, which helps to increase the hydrophobic interactions in proteins, thus stabilizing the protein.

**Electrochemical Behavior and Passivation of Cu–30Zn Alloy in Aqueous NaOH Solutions**

- Arash Fattah-Alhosseini , Sajad Alizad

**Abstract:**

In this work, the electrochemical behavior and passivation of Cu–30Zn alloy in aqueous NaOH solutions was investigated using various electrochemical methods. Potentiodynamic polarization curves showed that increasing NaOH concentration leads to increase corrosion current densities. Mott–Schottky analysis indicated that the passive films displayed p-type semiconductive characteristics and the acceptor densities increased by increasing NaOH concentration, while the flat band potential decreased. Moreover, electrochemical impedance spectroscopy studies showed that the impedance value decreased by increasing NaOH concentration, due to increase in the Zn dissolution of Cu–30Zn alloy, which is consistent with the results of the polarization experiment and X-ray diffraction patterns.

**Preparation, Infrared Emissivity and Electromagnetic Property of  $\text{Sn}_{(1-x)}\text{Fe}_x\text{O}_2$  ( $x = 0, 0.03, 0.06, \text{ and } 0.09$ ) Solid Solution Powders by Coprecipitation Method**

- Xiaolei Su , Yan Jia , Junbo Wang , Jie Xu , Xinhai He , Chong Fu , Songtao Liu , Le Ma

**Abstract:**

$\text{Sn}_{(1-x)}\text{Fe}_x\text{O}_2$  ( $x = 0, 0.03, 0.06, 0.09$ ) solid solution powders have been prepared by coprecipitation method using tin chloride ( $\text{SnCl}_4 \cdot 5\text{H}_2\text{O}$ ) as the starting material, ammonium hydroxide ( $\text{NH}_3 \cdot \text{H}_2\text{O}$ ) as the precipitator, and ferric nitrate ( $\text{Fe}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$ ) as the doping source, respectively. The phase and microstructure of the prepared powders have been characterized by X-ray diffraction (XRD) and scanning electronic microscope (SEM), respectively. The electromagnetic property in the frequency range of 8.2–12.4 GHz and average infrared emissivity in the wavelength range of 8–14  $\mu\text{m}$  of prepared powders have been determined. The electromagnetic properties ( $\epsilon'$ ,  $\epsilon''$ ,  $\mu'$ , and  $\mu''$ ) of prepared powders increased with increasing Fe-doping content. The electromagnetic loss mechanism has been discussed. The average infrared emissivity has exhibited the opposite trend.

**Electrochemical Behavior of the Passive Films Formed on Alloy 22 (UNS N06022) in Acidic Solutions**

- Arash Fattah-alhosseini , Ali Jalali , Saeid Felegari

**Abstract:**

Passive behavior and semiconducting properties of alloy 22 in sulfuric and nitric acidic solutions were studied. Corrosion current density was measured from potentiodynamic polarization plots, defect density was drawn from Mott–Schottky analysis, and finally polarization resistance and passive film thickness were estimated by electrochemical impedance spectroscopy. Potentiodynamic polarization curves suggested that alloy 22 showed excellent passive behavior in both nitric and sulfuric solutions. Mott–Schottky analysis revealed that the passive films formed on alloy 22 in both acidic solutions behave as *n*-type and *p*-type semiconductors. Also, this analysis indicated that the donor and acceptor densities are in the range  $10^{21} \text{ cm}^{-3}$  and increased with solution concentration. In conclusion, electrochemical impedance spectroscopy and Mott–Schottky analysis revealed that dilute nitric and sulfuric acidic solutions offer better conditions of the passive film formation on alloy 22 with higher protection behavior than concentrated nitric and sulfuric solutions, due to the growth of a much thicker and less defective films.

**Optical Properties of Poly(2-(5-bromo benzofuran-2-yl)-2-oxoethyl methacrylate)/Organoclay Nanocomposites**

- Adnan Kurt , Murat Koca

**Abstract:**

Novel nanocomposites of benzofuran-containing polymer poly(2-(5-bromo benzofuran-2-yl)-2-oxoethyl methacrylate) with different contents of organoclay were prepared and characterized with FTIR, XRD and SEM techniques. The thermal decomposition temperature of poly(BOEMA)/organoclay nanocomposites is higher than that of pure poly(BOEMA) about 5–14 °C at 10 % weight loss. The optical characterization was tested with a UV–VIS spectrophotometer. Transmittances of nanocomposites decreased to lower values by organoclay loading. Dispersion parameters such as steepness parameter, single-oscillator parameter, average oscillator position and strength, and moments of the imaginary part of the optical spectrum were changed as a function of organoclay nanofiller. As the organoclay content increased to 5 % in the polymer matrix, the existence of wide-band tails increased to 1.30 eV whereas the optical energy gap decreased to 2.92 eV. Analysis reveals that the type of transition is the indirectly allowed one.

**Assessment of Tributyltin and Triphenyltin Compounds and Their Main Degradation Products in Saudi Coastal waters**

- Mohsen A. Al-shatri , Abdulmumin A. Nuhu , Chanbasha Basheer , Abdulrahman Al-Arfaj , Bassam Al-Tawabini

**Abstract:**

Comprehensive studies to determine the level of predisposition of Saudi environment to many micro-contaminants are scanty. To improve on the available literature, an attempt was made here to determine concentrations of six species of organotins in water samples collected from 17 coastal sites in the Eastern Province of Saudi Arabia. These sites were grouped into three sampling stations: Near Dammam Corniche, King Abdulaziz Port (Inside), and King Abdulaziz Port (Outskirts). The samples were extracted using solid-phase extraction and then derivatized by propylation using Grignard reagent. Analytes were separated and quantitatively determined on gas chromatography–mass spectrometric system using selected ion monitoring mode. Recoveries for  $0.1 \mu\text{g L}^{-1}$  spiked sea water samples were between 81 and 89 %, and limits of detection of 5.2–11 ng/L were estimated at  $S/N = 3$ . Total organotin concentration found at each station was averaged at  $3.70 \mu\text{g L}^{-1}$ . The individual species detected and quantified as the butylated species were tributyltin ( $0.14\text{--}1.9 \mu\text{g L}^{-1}$ ), dibutyltin ( $0.11\text{--}0.70 \mu\text{g L}^{-1}$ ), and monobutyltin ( $0.13\text{--}1.5 \mu\text{g L}^{-1}$ ). For the phenylated tins, triphenyltin ( $0.12\text{--}1.9 \mu\text{g L}^{-1}$ ), diphenyltin ( $0.21\text{--}1.9 \mu\text{g L}^{-1}$ ), and monophenyltin ( $0.11\text{--}0.62 \mu\text{g L}^{-1}$ ) were determined in the samples. These determinations had %RSD of 6.1–11.5 % for the different analytes. Using ratios of tributyltin and triphenyltin to their respective degradation products, fresh input of these micro-contaminants into the marine environment was inferred.

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**Spectral, Computational, Electrochemical and Antibacterial Studies of Iron(III)–Salen Complexes**

- P. Karuppasamy, D. Thiruppathi , J. Vijaya Sundar , V. Rajapandian M. Ganesan , T. Rajendran , S. Rajagopal , N. Nagarajan , P. Rajendran , V. K. Sivasubramanian

**Abstract:**

Herein, we report the solvothermal method for the synthesis of iron(III)–salen complexes (salen = *N,N'*-bis(salicylidene)ethylenediaminato) from salicylaldehyde, 2,2'-bis ethylenediamine and ferric chloride in a single step. The solvothermal method involves the synthesis of complexes with good quality having excellent control on the composition. An insight into the spectral, computational, electrochemical and antibacterial studies highlights the structural, redox and clinical aspects of the complexes. The calculated energy of spin multiplicity sextet ( $S = 6$ ) obtained from DFT lies below doublet ( $S = 2$ ) and quartet ( $S = 4$ ) surfaces by 13.7 and 5.8 kcal mol<sup>-1</sup>, respectively, indicating that sextet is more stable compared to the other two multiplicities for eight iron(III)–salen complexes. The excitation energies and intensities of the electronic transitions calculated by the TDDFT method are in good agreement with the experimental values. Electron-donating substituents in the salen moiety produce a cathodic shift and electron-withdrawing groups the anodic shift in Fe(III)/Fe(II) redox potential values. The results of preliminary antibacterial study reveal that the iron(III)–salen complex was effective against clinically important Gram-negative bacterium (*Escherichia coli*) (7.2 μg ml<sup>-1</sup>) than the Gram-positive bacterium (*Staphylococcus aureus*) (158.3 μg ml<sup>-1</sup>).

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**The Effect of Surfactant “2-[(3-Dodecanamidopropyl)dimethylamino] Acetate” on Structural Properties of Polyacrylonitrile Copolymer**

- Said Abdul Nour

**Abstract:**

Hydrodynamic properties of polyacrylonitrile (PAN) in *N,N*-dimethylformamide (DMF) medium were studied in the presence and absence of amphoteric surfactant “2-[(3-Dodecanamidopropyl)dimethylamino] acetate” known as betaine, through changes in a viscosity and specific electrical conductivity. The critical micelle concentration of betaine is determined by specific electrical conductivity. Thermodynamic functions of micelle formation of betaine are studied. Reduced viscosity of PAN copolymer in DMF is studied at different temperatures; it is found that temperature change does not affect the mechanism of a crystalline structure formation of PAN solutions. The reduced viscosity of PAN solution in the presence of betaine decreases 40 % on average at high concentrations. Hydrodynamic volume of PAN macromolecules decreases in the presence of betaine. The hydrogen bonding formation between the carbonyl groups of acrylamide in PAN copolymer and the amide groups in betaine is identified by FT/IR spectra. Crystalline structure of PAN in the presence of betaine and its absence is studied by X-ray diffraction and scanning electron microscopy.

**Eco-thermoplastic Elastomer Blends Developed by Compatibilizing Chlorinated Polyethylene into Industrial-Waste-Filled Polypropylene/Acrylonitrile Butadiene Rubber System**

- Khalil Ahmed

**Abstract:**

Eco-thermoplastic elastomer blends based on industrial-waste-filled polypropylene (PP) and acrylonitrile butadiene rubbers (NBRs) were prepared by melt mixing with blends being exclusive consideration on the blend ratio and compatibilized with chlorinated polyethylene (CPE). The use of compatibilizer based on polyolefins is a significant approach for the preparation of blends with marked dissimilarities in terms of chemical structure between their constituents. The exploit of CPE improved the compatibility between the PP and NBR in the presence of industrial waste, such as marble waste (MW) and mixing torque, mechanical and aging properties of the resultant blends compared well with those of uncompatibilized MW- filled PP/NBR blends. Exceptional mechanical performance, particularly tensile strength, modulus tear strength and better elongation at break (lower values) and improved aging resistance were obtained with the compatibilization, but the performance of blends was inferior to that observed for uncompatibilized blends.

**Research Article - Chemistry**

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**Conductivity Measurements of Electrochemically Synthesized Selenophene–Thiophene Conducting Materials: Effect of Temperature and Polymerization Solution**

- Fadi Alakhras

**Abstract:**

The electrical conductivity measurements of selenophene-thiophene copolymers were successfully achieved using a four-probe technique. The influence of the polymerization solution, the applied polymerization potential and the monomer feed ratio on the electrical conductivity was investigated. The conductivity of obtained films generally increased with increasing temperature, implying more electrons might acquire enough energy to move from the valence to the conducting band.

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**Comparison of the Interactions Between Anionic Surfactants and Polyacrylonitrile**

- Said Abdul Nour

**Abstract:**

Viscosity and specific electrical conductivity of polyacrylonitrile (PAN) in *N,N*-dimethylformamide (DMF) medium are studied in the presence and absence of anionic surfactants as sodium oleate, sodium dodecyl sulfate and palmitic. Critical micelle concentrations of these surfactants are determined in DMF medium. Thermodynamic functions ( $\Delta H^{\circ}_m$ ,  $\Delta G^{\circ}_m$  and  $\Delta S^{\circ}_m$ ) of micelle formation of sodium dodecylbenzene sulfonate and sodium dodecyl sulfate are determined. Curves of X-ray diffraction and differential thermal analysis showed that the PAN samples containing SDS lead to the development of the crystalline structure of PAN, and the initiation temperature decreases of the cyclization reaction of nitrile groups of PAN by 8.5 °C, respectively.

**Synthesis of Polycarbonates by Copolymerization of Carbon Dioxide and Cyclohexene Oxide Using Schiff Base Complex as Catalyst**

- Lidan Fan , Gang Qin , Shaokui Cao

**Abstract:**

A novel Schiff base complex BCED–Zn has been found to be an effective catalyst for copolymerization of CO<sub>2</sub> and cyclohexene oxide to afford alternating copolymer poly(cyclohexenylene carbonate) (PCHC), and the turnover number was up to 421.1 at 110°C and 4 MPa CO<sub>2</sub> pressure for 24 h. The influence of the reaction conditions such as reaction time, reaction temperature and CO<sub>2</sub> pressure was discussed and optimized. The thermal stability of PCHC was measured by thermogravimetric analysis, indicating that the 5 % weight loss temperature was about 232 °C and the maximum weight loss temperature was around 256 °C.

**Conformational Preferences and Electrochemical Performance of Ethyleneoxy Phenylboronate Electrolyte Additives**

- Avhapfani W. Bebeda , Teunis van Ree

**Abstract:**

It is generally accepted that the structural characteristics of a molecule determine its physical and electrochemical properties. In this study, the conformations and some electrochemical properties of various boronates were investigated through computational study using density functional theory (DFT) with the Becke's three-parameter hybrid method utilizing the Lee–Young–Parr correlation functional (B3LYP). After initial energy optimization using Møller–Plesset perturbation theory (MP2), the conformational preferences and energetics were investigated using DFT calculations and the 6-31G(d,p) basis set in vacuo. The calculations and first results show that the ethyleneoxyboronates can be expected to perform well as redox shuttles, and boron-based redox shuttles can contribute to overcharge protection and safer batteries. HOMO–LUMO energy differences also indicate higher reactivities of the boronates, contributing to better solid electrolyte interphase formation.

**Influence of Preparation Conditions on the Properties of Keratin-Based Polymer Hydrogel**

- Sujuan Pan, Xiaochun Yin , Yu-Feng He , Yubing Xiong , Rong-Min Wang

**Abstract:**

In this study, a novel keratin-based polymer hydrogel (K-PmaH) was successfully prepared by graft-copolymerization of methacrylic acid onto keratin, cross-linked with *N,N'*-methylene-bis-acrylamide, then blended with agar. The influence of reaction temperature, dosage of reductant, initiator, and monomers on graft-copolymerization and that of heating methods on blending process was investigated. The results demonstrated that the dosage of DTT has prominent effects on the graft-copolymerization, and microwave radiation has significant effects on hydrogel properties. The swelling properties and in vitro degradation characteristic of K-PmaH also have been investigated, respectively. Determination results indicate that the K-PmaH has moderate swelling capacity in water and swelling–shrinkage behavior in saline solution. Moreover, K-PmaH reveals an excellent degradable characteristic in pepsin solution and trypsin solution. Consequently, the hydrogel K-PmaH is expected to be applied to the wounds and burns covering materials or bandages.

**Preparation of Reversible Thermochromism Supramolecules of 4-Aminophenol-Modified Polydiacetylene**

- Rui Niu , Xiao-lei Meng , Dan-dan Yang , Yue Chang , Fei Zha

**Abstract:**

A novel diacetylene monomer was synthesized *via* the esterification of 10,12-pentacosadiynoic acid with 4-aminophenol. The polymer of 10,12-pentacosadiynoic acid-4-aminophenyl ester was formed by self-assembly of the monomer, followed by UV irradiation at room temperature. It was characterized by the methods of NMR, laser diffraction, SEM and UV measurement. The polymer demonstrated a reversible purple-to-red colorimetric transition when the temperature changes from 25 to 70°C.

**Calixarene-Composited Host–Guest Membranes Applied for Heavy Metal Ion Adsorbents**

- Lisa Nakajima , Nor Nadia Mohamad Yusof , Takaomi Kobayashi

**Abstract:**

Calixarene host–guest membranes were prepared with hybridization of calixarene and poly(ethersulfone) (PES) by phase inversion process. Herein, the calixarene, 2,18,14,20-tetra(3-hydroxy-4-methoxybenzyl)calix[4]resorcinarene-4,6,10,12,16,18,22,24-octol, was successfully synthesized from resorcinol and vanillin. The phase inversion process was carried out in phase change of the solution of *N*-methyl-2-pyrrolidone containing both PES and the vanillin calixarene to solid membrane in water coagulation. The composited membranes having different loading amounts of the vanillin calixarene were prepared with 10, 25, 50 and 60 wt% loading. The observation of SEM pictures indicated porous morphology in the PES scaffold. The porous morphology in the cross section of the membrane caused high water content in the range of 371–375 %, meaning easy accessibility of aqueous solution in the membrane. The adsorption behavior of aqueous heavy metal ions: Pb(II), Ni(II), Cu(II) and Cd(II), was examined for the composited membranes containing 10, 25, 50 and 60 wt% of the calixarene host. It was evidenced that each composited membrane adsorbed effectively Pb<sup>2+</sup> ion, as the solution was permeated at  $4.0 \times 10^4$  Pa applied pressure. When the calixarene was loaded at 50 and 60 wt% in the membranes, the Pb<sup>2+</sup> capacity was 13 and 15  $\mu\text{mol/g}$ –membrane, respectively, for the batch experiment. In addition, when the quarterly mixture of the aqueous heavy metal ions was permeated through the membrane, the composited membrane having 50 and 60 wt% of the calixarene loading maintained high retention of the Pb<sup>2+</sup> ion.

**New Green Dielectrics Related to Calcium Titanate: Synthesis and Characterizations**

- Laldja Taïbi-Benziada , Tahar Kerdja , Karim Henda

**Abstract:**

The main purpose of the present work is the preparation of green dielectrics by solid-state reaction between two perovskites:  $\text{CaTiO}_3$  (CTO) and  $\text{KMgF}_3$  (KMF). Calcium titanate and potassium magnesium fluoride powders were previously synthesized, respectively, at 850 °C and 700 °C. Several chemical compositions  $(1-x)$  CTO +  $x$  KMF were then prepared and dry-milled. The mixtures were pressed into pellets and sintered in free air at 950 °C for 2 h. The obtained ceramics were investigated by X-ray diffraction (XRD), scanning electron microscopy (SEM), differential scanning calorimetry (DSC), thermogravimetric analyses (TGA, DTGA) and dielectric measurements (DE). The XRD study revealed the formation of a fluorinated perovskite solid solution with general formula  $\text{Ca}_{1-x}\text{K}_x(\text{Ti}_{1-x}\text{Mg}_x)\text{O}_{3-3x}\text{F}_{3x}$  (CKTMOF) in the initial composition range  $0 \leq x \leq 0.20$ . The diffraction peaks of CKTMOF oxyfluorides were indexed in an orthorhombic lattice, and no significant change was observed in the unit cell parameters with increasing KMF amount. On the other hand, the addition of KMF to CTO allowed the ceramic's densification at low temperature. The shrinkage increased from 1.9 % ( $x = 0$ ) to 9.5 % ( $x = 0.20$ ), and the grain's size of the various ceramics was in the range 0.5–5  $\mu\text{m}$ . Several thermal phenomena were detected by DSC and DE. No weight loss and no peak were depicted on the TGA and the DTGA curves over all the temperature range investigated; therefore, the phenomena observed by DSC and DE could be ascribed to phase transitions. These dielectrics could be of interest for the fabrication of class I capacitors; however, the losses have to be improved.

**Electrospun PET/PEG Fibrous Membrane with Enhanced Mechanical Properties and Hydrophilicity for Filtration Applications**

- Li Na Wang , Chang Zheng Xin , Wen Tao Liu , Xue Lian Xia , Su Qin He , Hao Liu , Cheng Shen Zhu

**Abstract:**

In this study, polyethylene glycol (PEG)-reinforced polyethylene terephthalate (PET) fibrous membranes were fabricated by electrospinning technique. The PEG was incorporated into the PET matrix at fixed ratios (1/1, 2/1, 4/1, 6/1, 8/1, 10/1, w/w) to significantly improve the conductivity and reduce the viscosity of the solution, which would result in a novel morphology and high hydrophilicity of the composite fibrous membranes. Water contact angle tests show that the membranes exhibit super hydrophilic properties only when the ratio of PET/PEG is 10/1. The 6/1-PET fibrous membrane exhibits uniform and smooth morphology, while the flat fibers are formed in 4/1-PET fibrous membrane. Furthermore, incorporation of PEG can also significantly improve the mechanical properties of PET membranes. The tensile strength is increased about two times in 6/1-PET membrane compared with pure PET membrane. Additionally, the 6/1-PET membrane has the best porosity and NaCl rejection due to the uniform and thinner fibers. This work finds that PEG can effectively improve hydrophilic and mechanical properties of electrospun PET fibrous membranes, which plays a vital role in filtration field.

**A Novel Strategy for the Synthesis of CeO<sub>2</sub>/CeF<sub>3</sub> Composite Powders with Improved Suspension Stability and Chemical Mechanical Polishing (CMP) Performance**

- Zongtao Zhang , Gongdong Yu , Ying Zhou , Lin Dong , Qiuxia Sun , Xiaolin Jia , Guosheng Shao

**Abstract:**

CeO<sub>2</sub> is one of the most promising materials applied in chemical mechanical polishing industry. However, due to the high hardness of CeO<sub>2</sub>, a further surface modification is usually required, especially when polishing a soft substrate, such as fused quartz and optical disk. In this work, we reported a novel process for the synthesis of CeO<sub>2</sub>/CeF<sub>3</sub> composite powders which showed improved suspension stability and CMP properties. Ce<sub>2</sub>(CO<sub>3</sub>)<sub>3</sub> and HF were employed as the precursor materials for Ce and F, respectively, which were simply milled and annealed at different temperatures to get the composite powders. The results showed that the morphology of the powders changed from microrods to grape-like shapes which had a smaller particle size. And the XRD results confirmed the formation of CeO<sub>2</sub>/CeF<sub>3</sub> composite phases after the HF addition. The suspension stability and CMP property measurements indicated that the change of particle morphologies and the formation of composite structure benefited the polishing process for fused quartz substrate, and a more planar surface was obtained. All these results indicated that the current processing was of great potentials for the synthesis and practical applications of ceria-based CMP slurries.

**Facilitating the Phase Transformations of Boron Nitride Nanoparticles at Mild Conditions by Solvothermal Hot-Press Route**

- Lingling Zhu , Ying Zhou , Juan Ma , Guotian Ye , Deliang Cui

**Abstract:**

For preparing wurtzite and cubic boron nitride (wBN, cBN) under moderate conditions, here we developed a solvothermal hot-press method, by which the phase transformation of  $sp^3$ -bonded BN in boron nitride (BN) nanoparticles was realized at quite low temperature and pressure. The results reveal that the transformation of aBN/rBN $\rightarrow$ cBN is highly dependent on the temperature, pressure and solvent promoting effect; and chlorobenzene seems to have a stronger effect on facilitating the phase transformation of  $sp^3$ -bonded BN as compared to pyridine and aniline. Besides, the decrease in particle size and crystallinity as well as the existence of structural defects plays great roles on the phase transformations of  $sp^3$ -bonded BN. On the basis of analyzing the experimental results, we proposed a simple model used for explaining the phase transformation process.

**Comparative Study of Electrical Conductivity on Activated Carbons Prepared from Various Cellulose Materials**

- T. Adinaveen, J. Judith Vijaya, L. John Kennedy

**Abstract**

The objective of this study was to calculate the electrical conductivity of the activated carbons obtained from various cellulose materials (sugarcane bagasse, rice straw, cotton cloth and waste newspaper) by a two-stage process. The DC conductivity was calculated by a two-probe method. Scanning electron microscopy and X-ray analysis confirmed the surface morphology and formation of graphene multilayer, respectively. The carbonization temperature has a distinct effect on the electrochemical performances of the cellulose materials. The activated carbon compressed at 750.12 kPa offered the highest electrical conductivity for all the other samples. It may be due to the dense packing of the material, collapse of the pores and decrease in air gap between the carbon particles as well as a combination of multilayer graphene, which could be the factors accountable for the increase in conductivity with compression pressures. The conductivity increases with an increase in the temperature. In addition, all the carbon samples showed a good electrochemical property and the specific capacitance at the scan rate of 2–3 mV/s.

**Synthesis and Surface Activity of Nonionic Surfactants Derived from Gallic Acid**

- Nabel A. Negm, Sayed A. Ahmed, Ali A. Abd-Elaal, Tarek Ashraf

**Abstract**

A series of nonionic surfactants were synthesized from gallic acid and polyethylene glycols with different molecular weights. Chemical structures of the surfactants were confirmed using elemental analysis, infrared and nuclear magnetic resonance ( $^1\text{H-NMR}$ ) spectroscopy. Surface activities of the surfactants in their solutions were determined by surface tension measurements. Increasing the polyethylene glycol chain length increased the surface activity of the surfactants in solutions. Measurements of interfacial tension between surfactants solutions and substrates with different polarity showed that the type of substrates plays functioning role on the interfacial properties. Thermodynamic properties of adsorption and micellization processes showed their tendency towards adsorption at solution interface and micellization in their solutions. Results showed reasonable surface activities compared to conventional nonionic surfactants.

**Corrosion Inhibition Study of Brass in Simulated Cooling Water by Triazole Derivatives, Cetyltrimethylammonium Bromide and Their Mixture**

- M. El Bakri, R. Tourir, A. Tazouti, N. Dkhireche, M. Ebn Touhami, A. Rochdi, A. Zarrouk

**Abstract**

The effect of triazole (TR), 3-amino-1,2,4-triazole (ATA) and cetyltrimethylammonium bromide (CTAB) on the inhibition of brass corrosion in simulated cooling water system has been studied using electrochemical measurements, scanning electron microscopy (SEM) observations and energy dispersive X-ray (EDX) analysis. The potentiodynamic polarization study reveals that these inhibitors inhibit both cathodic and anodic reactions, indicating a mixed-type control of inhibition and their inhibition depend on the nitrogen number in their structure. It shows that the ATA is the best inhibitor. The interference between CTAB and TR derivatives against corrosion has been also studied. So, a large passive current plate is observed directly from the corrosion potential in the presence of formulation. In addition, the operational parameters effect on the performance of this formulation is also investigated. It shows that its inhibition efficiency increases with pH, immersion time and the presence of corrosion products and takes its performance by increasing in temperature. The SEM/EDX data confirm that the formulation is a corrosion and scale inhibitor.

**Preparation, Characterization of Graphite Oxide Loaded with  $K_2CO_3$  as Heterogeneous Catalyst and Its Transesterification Application**

- Chuanjia Sun, Fengxian Qiu, Dongya Yang

**Abstract**

A novel heterogeneous solid base catalyst was prepared by graphite oxide loaded with  $K_2CO_3$  compound and successfully applied to transesterification of soybean oil with methanol to biodiesel (fatty acid methyl esters). The prepared catalyst was characterized using techniques such as Fourier transform infrared spectroscopy, X-ray diffraction, scanning electron microscopy, energy dispersive X-ray spectrometer, transmission electron microscopy, differential scanning calorimetry, thermogravimetry analysis, and the Hammett indicator methods. The effect of various parameters such as methanol/oil molar ratio, reaction temperature, catalyst amount, reaction time on the prepared catalytic activity was investigated. The optimal transesterification conditions obtained by this experiment were: methanol/oil molar ratio of 15:1, reaction temperature of  $65^\circ C$ , catalyst amount of 3.0 wt%, and reaction time of 3h. The prepared heterogeneous solid base catalyst has longer lifetime, and biodiesel yield could be still over 87.1% after being used for five cycles.

**Surface Reforming of Diamond Particles by the Dispersion Enhancement in Common Liquids**

- Mirza Nadeem Ahmad, Khalid Mahmood Zia, Sohail Nadeem, M Anjum, Tahir Farooq, Khurram Shehzad, Adnan Mujahid, Tajamal Hussain, Mohammad Zuber, Yang Wantai

**Abstract**

The dispersibility of diamond has been improved by reforming its surface with 2-propanol-2-yl  $[(CH_3)_2C \cdot OH]$  radicals. These radicals were produced by the photochemical breakdown of 1-[4-(2-hydroxyethoxy)-phenyl]-2-hydroxy-2-methyl-1-propane-1-one (HPHMP) under ultraviolet (UV) radiations. The diamond particles were mixed with HPHMP in acetone and were placed under UV rays for the generation of required free radicals which were in situ reformed the diamond surface. Fourier transform infrared, nuclear magnetic resonance spectroscopy and scanning electron microscopy (SEM) confirmed the structural and surface reforming of diamond. The thermogravimetric analysis, thermogravimetric analysis–mass spectrometry spectrogram confirmed the surface reforming of diamond with 2-propanol-2-yl radicals. The dispersion behavior of the diamond after reforming was observed by SEM analysis and revealed an improvement in dispersibility in common solvents.

**Synthesis, Characterization and Thermal Studies of Poly(4-Vinylpyridine) Composites of Rare Earth Metals**

- Abida Kalsoom Khan, Rehana Rashid, Majid Hussain, Uzma Yunus, Zareen Akhtar, Saqib Ali, Atiya Zahra, Sadullah Mir, Muhammad Tayyab Ansari, Zahid Mehmood, Ashif Sajjad, Ghulam Murtaza

**Abstract**

Sol–gel method has been adapted to synthesize the composites of poly(4-vinylpyridine) with different rare earth inorganic metal salts. These salts have been incorporated into polymer for enhancing the thermal stability. The resulting products were characterized through Fourier Transform Infrared Spectroscopy, X-ray diffractometry (XRD), and thermogravimetric analysis. The XRD data show that amorphous character of polymer is enhanced by incorporating inorganic metal salts. Thermal degradation data depict thermal stability of the synthesized composites. Additionally, thermal degradation data depict that thermal stability of synthesized composites is enhanced and are more thermal stable than P4VP itself, which makes them suitable for coatings.

**Solubilization of Crude Oil by Extended and Other Anionic Surfactants**

- Soufiane Rahal, Razika Khalladi, Nadji Moulai-Mostefa

**Abstract**

In the present study, the solubilization efficiency of an Algerian crude oil in the presence of three different anionic surfactants was investigated. The studied surfactants are extended surfactant sodium linear alkyl-polypropylene oxide-polyoxyethylene sulfate (X-AES), sodium dodecyl sulfate (SDS) and sodium dodecylbenzene sulfonate (SDBS). The three crude oil/surfactant systems were characterized in terms of micelle–water partition coefficient ( $K_m$ ) and weight concentration of solubilize named weight solubilization ratio (WSR). The obtained results showed that the critical micelle concentration (CMC) of X-AES determined experimentally is lower than that of SDS and SDBS. The experiments show that X-AES is better than SDS and SDBS in terms of efficacy of solubilization. The order of solubilization improvement of the crude oil is  $SDS < SDBS < X-AES$ , and the extent of solubilized oil is linearly proportional to the surfactant concentration.

**Synthesis and Characterization of a Novel Series of Cross-Linked (Phenol, Formaldehyde, Alkyldiamine) Terpolymers for the Removal of Toxic Metal Ions from Wastewater**

- Othman Charles S. Al Hamouz

**Abstract**

A novel series of cross-linked terpolymers synthesized from phenol, formaldehyde and four alkyldiamines via Mannich reaction in *n*-hexane at 90 °C is introduced for the removal of lead(II) ions in the concentration range of 50–136 mgL<sup>-1</sup> from aqueous solutions. The synthesized terpolymers were characterized by spectroscopic techniques such as <sup>13</sup>C-NMR, FT-IR and elemental analysis. The surface morphology, composition and crystallinity were investigated by scanning electron microscopy and powder X-ray. The adsorption of lead(II) ions was studied by batch equilibrium technique. The experimental data for the adsorption of lead(II) ions fitted Freundlich and Temkin isotherm models. The maximum adsorption capacity of lead(II) ions was found to be 222.2 mg g<sup>-1</sup> for Ph–Buta with a removal of 98 % within 4 h of adsorption. Adsorption kinetics for Ph–Buta were investigated and fitted pseudo-second-order kinetic model. The adsorption mechanism was studied by intraparticle diffusion model and found to follow film diffusion and intraparticle diffusion simultaneously. The adsorption of lead(II) ions was spontaneous and endothermic in nature with an increase of adsorption capacity as temperature increased. Ph–Buta terpolymer showed high efficacy in the removal of toxic metal ions from spiked [1 mg L<sup>-1</sup> solution of lead(II) ions] and unspiked wastewater samples with ~100 % removal of lead(II) ions. The excellent adsorption capacity of Ph–Buta provides a new, efficient adsorbent for treatment and separation of lead(II) ions from contaminated aqueous solutions and wastewater solutions.

**An Electrochemical Sensor Based on Reduced Graphene Oxide and ZnO Nanorods-Modified Glassy Carbon Electrode for Uric Acid Detection**

- Li Fu, Yuhong Zheng, Aiwu Wang, Wen Cai, Bo Deng, Zhi Zhang

**Abstract**

In this paper, reduced graphene oxide–ZnO (RGO–ZnO) nanorods composite was prepared via a simple one-pot hydrothermal approach. The synthesized RGO–ZnO nanorods composite has been successfully applied for glassy carbon electrode (GCE) surface modification. The RGO–ZnO nanorods composite-modified GCE was applied for sensitive and selective determination of uric acid (UA). The biosensor exhibited a linear dependence on UA concentration ranging from 1 to 800  $\mu\text{M}$  with a detection limit of 0.312  $\mu\text{M}$  ( $S/N = 3$ ). The proposed UA sensor also showed an excellent stability, reproducibility and anti-interference property.

**Study the Effects of Xanthan Gum and Aluminium Stearate on the Properties of Oil-in-Water Emulsion Drilling Fluids**

- Praveen Kumar Jha, Vikas Mahto, V. K. Saxena

**Abstract**

This research article investigates the effects of xanthan gum and aluminium stearate on the rheological and filtration properties of oil-in-water emulsion drilling fluids. In addition, the stability of emulsion drilling fluids was analysed by measuring interfacial properties such as zeta potential, interfacial tension, contact angle and microscopic properties to estimate the effects of xanthan gum and aluminium stearate on the shape and size of emulsion droplets. The rheological and filtration properties were measured using API recommended standard procedures. Xanthan gum worked as viscosity modifier, aluminium stearate worked as filtrate loss-controlling agent, and both additives also worked as perfect stabilizer for the emulsion systems. The steady-state shear stress–shear rate measurement technique was applied to examine the shear thinning (pseudoplastic) behaviour of the emulsion drilling fluids. The fluids followed strong shear thinning (pseudoplastic) behaviour with increasing concentration of diesel oil and xanthan gum which is a desirable parameter for drilling fluids. It was also found that rheological and filtration properties are stable at 80°C temperature. By optimizing the concentrations of the additives in emulsion system, favourable drilling fluids can be developed which may be used for oil and gas well drilling.

**Regeneration of Carbon Nanotubes Exhausted with Humic Acid Using Electro-Fenton Technology**

- Ali Naghizadeh

**Abstract**

Among the adsorbents, carbon nanotubes (CNTs) are relatively new nanomaterials which are frequently used for water purification. In this work, experiments were carried out to study the feasibility of regeneration of humic acid-exhausted CNTs using electro-Fenton process. The results showed that electro-Fenton process has high efficiency at pH equal to 3. The results also clearly indicated that the regeneration efficiency at lower molarities of  $\text{H}_2\text{O}_2$  such as 0.05 is higher than at higher molarities. The results also implied that the regeneration efficiency at current density equal to 0.1 mA was 98.32 % and with increasing current density, the regeneration efficiency decreased. The regeneration efficiency at molar ratios of  $\text{Fe}^{2+}:\text{H}_2\text{O}_2$  as 0.03:10 was higher than other examined molar ratios and after five cycles of regeneration decreased to 87%. The results of the present study indicated that electro-Fenton process has high efficiency for the regeneration of CNTs exhausted with humic acid.

**A Novel Polymer Gel-Loading Phantom for Magnetic Resonance Imaging**

- Kai-Yuan Cheng, Sih-Ying Chen, Jiunn-I Shieh, Yi-Ying Wu, Ling-Ling Hsieh

**Abstract**

A novel magnetic resonance imaging (MRI) polymer gel-loading phantom, called “ $\kappa$   $\kappa$  CNIPAM” in this study, was obtained by grafting *N*-isopropylacrylamide monomers onto  $\kappa$   $\kappa$ -carrageenan. Here, ammonium persulfate was used as a free radical initiator in the presence of *N,N'*-methylene-bis-acrylamide, which was used as a crosslinker. The macroscopic and morphological features of the gels were observed under a computer-controlled CCD camera and scanning electron microscope. Polymer gel structures were confirmed by Fourier transform infrared spectroscopy. Syneresis in the polymer-loading phantom was also explored. The polymer gel-loading phantom was used to evaluate enhancements in MRI quality using a practical MRI scanned image of a human palm. Results showed enhancements in signal-to-noise ratio.

**Inhibitive Effect of Pantoprazole Sodium on the Corrosion of Copper in Acidic Solutions**

- M. Saadawy

**Abstract**

The effect of pantoprazole sodium (PAN) on the corrosion of copper in aqueous solutions of 0.5M $H_2SO_4$ , 1M HCl and 1M $HClO_4$  was investigated at 30°C using potentiodynamic polarization and electrochemical impedance spectroscopy techniques. The results obtained showed that PAN could serve as an effective inhibitor for the corrosion of copper in the three tested acid solutions. The order of increasing the value of binding constant calculated for PAN in the three tested acid solutions from the application of different models was perchloric acid > hydrochloric acid > sulphuric acid.

**Green Polymerization of 4-(Oxiran-2-ylmethyl)morpholine**

- S. Seghier, M. Belbachir

**Abstract**

Synthesis and cationic polymerization of a new monomer 4-(oxiran-2-ylmethyl)morpholine (OMM) is reported. The monomer was prepared by the reaction of morpholine with epichlorohydrine followed by treatment with sodium hydroxide. The green polymerization of OMM was performed in bulk under suitable condition at temperature 40 °C using an activated smectite clay catalyst, known as Maghnite-H<sup>+</sup> (Mag-H<sup>+</sup>) as proton source. The products are proven by infrared spectroscopy (IR) as well as by nuclear magnetic resonance spectroscopy (<sup>1</sup>H NMR, <sup>13</sup>C NMR), and characterized by intrinsic viscosity.

**Protonated Montmorillonite Clay Used as Green Non-toxic Catalyst for the Synthesis of Biocompatible Polyglycidol**

- A. El-Kebir, A. Harrane, M. Belbachir

**Abstract**

Hyperbranched polyglycidol is a biocompatible and biodegradable polymer used as a drug delivery system and emulsifier in the biomedical and food industry. This polymer is synthesized by ring-opening polymerization of glycidol using acids or Lewis bases as catalysts. For biomedical applications, the presence of small traces of metallic catalysts in the body due may disastrous and dramatic problems. Therefore, rigorous and expensive purification methods were required to eliminate traces of catalyst from the polymer. In this work, we propose a new synthesis method to obtain polyglycidol using an Algerian montmorillonite clay, as catalyst. Finally we obtained a clean hyperbranched polyglycidol by simple filtration.

**Synthesis and physicochemical evaluation of hydroxyapatite gel biosorbent for toxic Pb(II) removal from wastewater**

- R. Morsy

**Abstract**

The agglomeration of hydroxyapatite (HAp) nanoparticles is the main challenge when it used as an adsorbent for removing toxic trace elements from aqueous solutions. In the present study, HAp gel was synthesized and evaluated as a potential bioadsorbent for treatment and sorption Pb(II) from polluted water. HAp gel was prepared by co-precipitation method and its physicochemical ability to remedy Pb(II) was tested by batch experiments under changing initial parameters such as pH and contact time. XRD, FTIR, and TEM techniques were used to characterize HAp gel, and ICP technique evaluated its physicochemical property to adsorb and remove Pb(II) from aqueous solutions. The adsorption equilibrium of Pb(II) on HAp gel was analyzed at room temperature using conventional Freundlich and Langmuir adsorption isotherm models. The synthetic HAp gel showed a pure nanocrystalline phase and well-dispersed nanorods. The HAp gel exhibited high sorption capacity at 344.8 mg/g for Pb(II) removal at a short equilibrium contact time of 10 min. The synthetic HAp gel is a promising efficient bioadsorbent to alleviate the problems accompanied conventional dried HAp agglomerates in particular for industrial and environmental applications that need an economic and eco-friendly non-agglomerated adsorbent.

**Investigation of Deoxygenation of Rapeseed Oil over Raney Nickel and Ni/SiO<sub>2</sub>–Al<sub>2</sub>O<sub>3</sub> Catalysts**

- Raimonds Murnieks, Lauma Apseniece, Valdis Kampars, Zane Shustere, Kristaps Malins

**Abstract**

The objective of this research program was to develop a method of removing oxygen from rapeseed oil in order to prepare the petroleum-comparative hydrocarbons under relatively mild conditions. Rapeseed oil was deoxygenated at various temperatures (220–300 °C) and pressures (15–70 bar) using different amounts of 66 % Ni/SiO<sub>2</sub> – Al<sub>2</sub>O<sub>3</sub> and Raney Ni catalysts (2–20 %) in a laboratory batch reactor over the time period between 1 and 6 h. Reaction products contained hydrocarbons, saturated mono-, di- and triglycerides, and carboxylic acids as the main components. The yield of hydrocarbons increased significantly with the increasing amount of the catalyst and/or reaction duration. The influence of temperature and pressure was also investigated.

**Functional Modification of Poly Vinyl Alcohol/Acrylic Acid Hydrogels Prepared by  $\gamma$ -Radiation Through Some Amine Compounds**

- Hala M. Aly, H. L. Abd El-Mohdy

**Abstract**

Radiation-induced poly vinyl alcohol/acrylic acid (PVA/AAc) hydrogels were modified through condensation reaction with various aliphatic and aromatic amines to form amine-treated polymers. The amine compounds are 2-amino-3-(4-hydroxyphenyl) propanoic acid (**P1**), propane-1,2-diamine (**P2**), 4-amino-1,5-dimethyl-2-phenyl-1,2-dihydropyrazol-3-one (4-aminoantipyrine) (**P3**), 2-aminothiazole (**P4**), 4-amino-*N*-(1-phenyl-1*H*-pyrazol-5-yl) benzene sulfonamide (**P5**) and 4-amino-*N*-(4-methoxy-1,2,5-thiadiazol-3-yl) benzene sulfonamide (**P6**). The degree of swelling of amine-modified polymers increased with increasing AAc contents in the PVA/AAc copolymer and lowered irradiation doses, reaching its maximum at PVA:AAc composition, 50:50 wt%. The characterization of all synthesized polymeric compounds was carried out by using IR, NMR and UV spectral analysis, in addition to thermal studies which predicted by thermal gravimetric analysis and differential scanning calorimetry. Thermal studies display that the amine-treated polymers have more thermal stability than untreated ones. All the newly synthesized polymeric compounds were evaluated for their antibacterial and antifungal activities in vitro against two gram-positive bacteria and two gram-negative bacteria as well as two fungi by the disk diffusion method. In general, the newly synthesized polymeric compounds exhibited higher promising biological activities and can be used in medical applications.

**Removal of Oxidation Fragments from Multi-walled Carbon Nanotubes Oxide Using High and Low Concentrations of Sodium Hydroxide**

- Khalid I. Kabel, Ahmed A. Farag, Elsayed M. Elnaggar, Abdalrhman G. Al-Gamal

**Abstract**

Modification of multi-walled carbon nanotubes surface (MWCNT) using the mixture of  $\text{HNO}_3/\text{H}_2\text{SO}_4$  is widely employed for MWCNT surface oxidation, but it also leads to shortening and thinning of the CNT layers causing fragmentation. The carbonaceous fragments adsorbed on the surface is not removed from the sample in conventional treatments; however, the addition of NaOH successfully cleans the oxidized material. In this article, MWCNT was functionalized using  $\text{HNO}_3/\text{H}_2\text{SO}_4$  as oxidizing agent and evaluate the impact of using high and low concentrations of NaOH to purify CNT oxide. The presence of oxidized groups as hydroxyl and carboxyl has been demonstrated by FTIR. The thermal stability of MWCNT and MWCNT-O after and before purification was studied by TGA, and the degree of its crystallinity was examined by XRD. The defect degree occurs during the oxidation process was confirmed by Raman spectroscopy. TEM images showed the presence and the absence of wrinkles and the adsorbed carbonaceous fragments.

**Rheology of Cross-Linked Poly(Sodium Acrylate)/Sodium Silicate Hydrogels**

- Joanna Mastalska-Popławska, Piotr Izak, Łukasz Wójcik, Agata Stempkowska

**Abstract**

Transparent hydrogels consisting of poly(sodium acrylate) and sodium silicate were synthesized by free-radical polymerization of sodium acrylate (ANa) in an aqueous solution of sodium silicate (i.e. water glass) with the silicate modulus ( $M$ ) 2.50 and the Midafen R-102 polymer filler, in the presence of sodium thiosulphate/potassium persulphate (NTS/KPS) as the redox initiators and  $N,N'$ -methylenebisacrylamide as the cross-linking monomer. The hydrogels, obtained in this way, were rheologically tested, and also the gelling point, dependence of shear stress on shear rate, and oscillation constants were determined. The results indicated that during the cross-linking reaction, which is associated with a gradual building of the three-dimensional gel structure, the reaction mixture changes its rheological behaviour from pseudo-thixotropic at the beginning of the reaction to pseudo-anti-thixotropic in the end. Both elasticity modulus  $G'$  and viscosity modulus  $G''$  during the reaction and for the cast samples after 24 h have practically the same values and the phase shift angle  $\delta$  is below  $20^\circ$  which means that we obtained a highly elastic material. It was also found that the elasticity modulus  $G'$  values increase with the content of sodium silicate in the sample.

**Arsenic and Boron Removal by Electrocoagulation with Aluminum Electrodes**

- Berrin Zeliha Can, Recep Boncukcuoğlu, Alper Erdem Yılmaz, Baybars Ali Fil

**Abstract**

Some boron deposits in Turkey contain considerable amounts of arsenic. Arsenic in the boron deposits can create a great risk due to its environmental effects on surface and underground waters. Water sources containing more than a certain concentration of boron and arsenic have negative effects on plants, animals and human beings. Thus, their removals are necessary. In this paper, the removal of arsenic (As) and boron (B) from aqueous solutions by electrocoagulation using aluminum (Al) electrode material was investigated. Specifically, the effects of initial pH, initial arsenic and boron concentrations and operating time on the performance of EC were investigated. Experiments were carried out with different pHs ranging from 2 to 8. Results showed that initial pH was highly effective on the efficiency and high removal efficiencies were observed at initial pH of 4.0 for both arsenic and boron. Initial arsenic and boron concentration affected the removal efficiencies. Arsenic removal efficiency decreased with increasing boron concentration, and boron removal efficiency decreased with increasing arsenic concentration. The results also showed that boron ions prevented to arsenic removal and boron ions competed with arsenic ions. This situation led to the low arsenic and boron removal.

**Chemical Modification of Silane-Based Coating with Inhibitor for Anticorrosive Application**

- Aarti P. More, Shashank T. Mhaske

**Abstract**

A silane-based coating was prepared by sol–gel method using (3-glycidoxypropyl) trimethoxysilane and tetraethyl orthosilicate as precursor. Aluminium isopropoxide was used as a chemical modifier; the concentration was varied on molar basis as 0.2, 0.4 and 0.6 moles. With the addition of aluminium isopropoxide, hardness properties and anticorrosive properties were observed to be improved. The corrosion inhibitors were added to improve the performance further. Efficiency of the two corrosion inhibitors was compared, i.e. benzotriazole (BT) and 2-mercaptobenzothiazole (MBT), in the system where they get added to the silane backbone through their functional groups. MBT shows better anticorrosive properties over BT, which is evaluated by salt spray and electrochemical impedance spectroscopy. Improvement in hydrophobic nature is also observed with MBT in the system. Mechanical performance of the coating also improves with the addition of MBT as compared to BT. The presence of sulphur linkage in MBT as compared to the BT is the key component for the improvement in the performance.

**A Benign Approach for Synthesis of Silver Nanoparticles and Their Application in Treatment of Organic Pollutant**

- Henam Sylvia Devi, N. Rajmuhon Singh, Th. David Singh

**Abstract**

A facile fabrication of silver nanoparticles was carried out using tannic acid in the presence of sodium hydroxide in aqueous medium. This method of preparation is completely a green approach; free from harsh chemicals, only environmental benign solvents and nontoxic chemicals were utilized. The fabricated particles were characterized using various techniques including TEM, SAED, UV–visible spectroscopy, IR, XRD, and TGA. The estimated size of the prepared particles is of the range 7–15 nm with spherical shape exhibiting a prominent surface plasmon resonance band at 412.7 nm. The ensuing nanoscaled silver particles play a significant role in treatment of organic pollutants such as chlorpyrifos and methylene blue. Degradation of chlorpyrifos in the presence of silver nanoparticles was monitored successfully. Moreover, role of silver nanoparticles as catalyst in the degradation of methylene blue in the presence of sodium borohydride has been demonstrated in this work. The degradation reaction followed first-order kinetic, and the catalysis rate constant is  $0.149 \text{ min}^{-1}$  which is about 75-fold times than that of uncatalyzed reaction.

**Synthesis and Characterization of SAPO-37 Molecular Sieve**

- Chia-Ming Chiang, Ikai Wang, Tseng-Chang Tsai

**Abstract**

Several synthesis parameters including silica precursor, alumina precursor and composition of reactant gel, during hydrothermal synthesis of SAPO-37, were studied. It was found that silica species is one indispensable component for the formation of SAPO-37. SAPO-37 could be synthesized only in a very narrow range within weak basic condition of pH = 8 ~ 9. In the use of no silica starting gel even SAPO-37 seeding,  $\text{AlPO}_4\text{-5}$  and SAPO-5 dominated the zeolite product without SAPO-37 formation. A new ion exchange procedure was developed for the removal of tetrapropyl ammonium (TPA) template from SAPO-37 with enhanced thermal stability by which the structure damage in SAPO-37 caused by the excessive steam during TPA burning could be avoided.