Influence of H_2SO_4 Concentration on Lead-Acid Battery Performance H-Type and P-Type Batteries

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Abstract

The present investigation determines the initial capacity performance and the changes in battery capacity on cycling of 12 V/32Ah batteries with six different electrolyte concentrations between 1.15 and 1.33 s.g. H_2SO_4. The batteries are cycled with two discharge currents, 3.2 and 8A. The utilization of PAM is 50% against 37% NAM utilization. The utilization of H_2SO_4 varies between 38 and 88%, depending on the concentration of H_2SO_4 in the electrolyte. At $C_{H2SO4} = 1.24$ g cm−3, $\eta_{H2SO4} \approx \eta_{PAM}$.when $C_{H2SO4} < 1.24$ g cm−3 (H-region) in which H2SO4 limits the capacity of the battery (H-type batteries), and $C_{H2SO4} > 1.24$ g cm−3 (P-region) in which the lead dioxide plates limit the capacity of the battery (P-type batteries) At $CH_2SO_4 < 1.24$ s.g., the H_2SO_4 concentration limits the capacity of the battery, whereas at $CH_2SO_4 > 1.24$ s.g., the capacity of the battery is limited by PAM. It has been established that in the P-region of H_2SO_4 concentrations, the initial capacity of the battery is higher than the rated value (C^0), but the life of the battery is short and require high charge voltages. In the H-region of H_2SO_4 concentrations, the initial capacity is lower than C0, but the cycle life is considerably longer than 100 cycles and depends on the discharge current and the H_2SO_4 concentration and allow to be charged at lower voltages. The voltage of charged cells on open circuit declines with decrease in H_2SO_4concentration, which allows charging of batteries at lower voltages, as is the case with IT batteries, and reversible sulfation of the plates is avoided as well. The obtained results of the present investigation suggest that lead-acid batteries can be divided in two types depending on the concentration of H_2SO_4 in them: H-type batteries with $CH_2SO_4 < 1.24$ s.g., and P-type batteries with $CH_2SO_4 > 1.24$ s.g

Keywords: Lead-Acid Batteries, Cycle Life, Capacity, Active Masses, H2SO4, Charge.

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A Review on Applications of Forward Osmosis Membrane Process

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Abstract

The process of osmosis is a physical phenomenon where the membrane structure and concentration gradient of solute cause, water flow through the membrane. Forward osmosis is one of the osmotic processes that attracted more attention in recent years. There are still some problems against the commercialization of the process, due to some constraints such as access to an appropriate draw solution and optimum membrane structure. According to some studies, this process can be use in various industries, including food processing, water desalination, wastewater treatment, pharmaceutical industry and power generation. In this paper, the industries where forward osmosis has shown an appropriate productivity or the industries, which have the potential for using this process, have been considered.

Keywords: Osmotic Membrane Processes, Forward Osmosis, Water Desalination, Wastewater Treatment, Pretreatment.

A Review on Fabrication and Use of Graphene as Adsorbent in Dye-Containing Industrial Wastewater Treatment

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Abstract

Today's, discharge of toxic industrial effluents into the environment is one of the major problems of societies. Recently, graphene as member of carbon allotropes have attracted researcher's attention to color removal due to high surface area. Graphene is a monolayer of sp^2-hybridized carbon atoms arranged in a two dimensional lattice. Dyes contain aromatic rings in their chemical structure that can be adsorbed well by grapheme through the π- π interactions. Several researches have been investigated on the use of dispersed graphene nanosheets as an efficient adsorbent for removal of dyes. The results indicated graphene can adsorb dyes very well but their performance has been limited by extend of dispersion. Now, the high cost of production is the major obstacles to its industrial using. In this paper, the commonly used methods for the synthesis of graphene and its application in the removal of color compounds from industrial wastewater have been reviewed.

Keywords: Graphene Nanosheets, Color Wastewater, Color Removal, Adsorption.

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Metronidazole Degradation from Contaminated Water Using TiO_2/Fe_2O_3/Clinoptilolite Nanophotocatalyst

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Abstract

In this study, TiO_2/Fe_2O_3/zeolite as catalyst was synthesized by co-precipitation method. Synthesized catalyst was characterized by XRD, XRF, FT-IR and FE-SEM analysis. XRD and FT-IR analysis confirmed the presence of TiO_2 and Fe_2O_3 on the zeolite surface. FE-SEM photographs indicated that TiO_2 and Fe_2O_3 nanoparticles deposited on zeolite surface and the size of nanophotocatalyst was approximately 45nm. The investigation of the synthesized catalyst was performed for metronidazole removal from contaminated water and results were analyzed by response surface methodology (RSM). Results indicated that at optimal conditions containing of metronidazole concentration (100mg/L), pH (4), radiation time (90min), nanophotocatalyst concentration (1g/L) and hydrogen peroxide concentration (50mg/L), the contaminant degradation efficiency was about 70%.

Keywords: Metronidazole, AOP, Nanophotocatalyst, TiO_2/Fe_2O_3, Clinoptilolite.

Investigating of Biomass Production and Lipid Content of Indigenous Microalgae in Wastewater

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Abstract

The objective of this study was to evaluate biomass production and lipid content of indigenous microalgae in wastewater. Biomass production, lipid content, biomass productivity and lipid productivity were measured in different phases of indigenous microalgae growth. Maximum biomass production, lipid content, biomass productivity and lipid productivity of indigenous microalgae were respectively 980 mg/lit, 25%, 271.4 mg/lit.d and 53 mg/lit.d. Therefore, the results of this study suggested that wastewater and indigenous microalgae were suitable due to the cost reduction in biodiesel production.

Keywords: Indigenous Microalgae, Wastewater, Biomass, Lipid Content.

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Introduction of Antifreeze Proteins and their Application in the Food Industry

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Abstract

Application of ice structuring proteins (ISPs) as a food preservative has shown great potential to enhance the quality of frozen foods and desserts during frozen storage, transport, and thawing. The major role of these proteins is controling and preventing the formation of larger ice crystals and ice recrystallization, which eventually damage the cell wall and result in drip loss of the sap from the tissue during thawing. Another important point about these proteins is that they are active in very low amounts for the food industry. They have been discovered in many cold tolerating biological systems such as fishes, plants and insects, which all have ice recrystallization inhibition and some cases exhibit, thermal hysteresis and ice nucleating activities. The aim of this study was to introduce antifreeze proteins, mechanisms of their action and potential applications for them in the food industry.

Keywords: Antifreeze Proteins, Ice Structuring Proteins, Recrystallization, Thermal Hysteresis.

Developing a Model to Estimate Hydrogen Consumption of Vacuum Gas Oil Hydrocracking Plant

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Abstract
Due to the growing demands for light oil products such as gasoline and diesel, and also increasing heavy fractions of crude oil, processes such as vacuum gas oil (VGO) hyrocracking are significant in modern refineries to achieve clean fuel without sulfur. Therefore, in this study, based on pilot tests using vacuum gas oil feed taken from an Iranian Isomax unit and commercial catalysts, a model for estimating flow rate of light and heavy products, hydrogen sulfide and ammonia, the amount of aromatic content of product and hydrogen consumption is provided. The results showed that the model can predict the mentioned hydrocracking variables with absolute average deviation (AAD%) of 10.75%, 4.1%, 1.4%, 27.71%, 6.54% and 7.99%, respectively. Additionally, the sensitivity analysis performed by the proposed model shows that increasing the space velocity, hydrogen pressure and temperature on product have a great impact on the quality and quantity of hydrocracking products.

Keywords: Hydrocracking, Hydrogen Consumption, Model, Vacuum Gas Oil.

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Investigation into Kinetic Relations and Operating Conditions on the Performance of Titanium Recovery Unit for Production of High-purity Titanium dioxide Nanoparticles under Sulphate Process

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Abstract
This study explored the impact of kinetic relations and operating conditions on the dissolution rate of titanium slug to production of TiO_2 powders in the size distribution of 50-100 nm. To reach powder with 98% purity, dried and grinned titanium slag in the size distribution of 45-160 µm react with sulfuric acid based on sulphate process. The effect of operating parameters such as acid concentration, digestion temperature, digestion time, and initial particle size of dried slag is studied. By optimizing the digestion factors in dissolution process, and using sonochemical technique in dissolution reactions, the maximum extraction efficiency of TiO_2 and maximum weight fraction of removed iron is obtained. Regression analysis showed that that results of shrinking core theory including control diffusion and especially control chemical reaction model applied in this study is in agreement with the experimental data. Based on the kinetic studies, the activation energy of dissolution process is determined to 38.12 $kJ.mol^{-1}$ and the reaction order was assumed to be first order mechanism with respect to acid concentrations.

Keywords: Titanium Eioxide, Nanoparticles, Kinetic Otudy, Dissolution Pate, Dried Yitanium Olag.

Investigation of Carbon Dioxide Hydrate Formation Kinetics in Stirred Reactor at Isochoric Conditions

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Abstract

There are two approaches to study the gas hydrates, thermodynamics and kinetics. Although considerable studies have been conducted on the thermodynamic of gas hydrates, the kinetics of gas hydrates is still ambiguous and different researchers have proposed different approaches. In this work, carbon dioxide gas hydrate formation has been studied at isochoric and isothermal conditions in a stirred reactor. Based on experimental data, mass transfer coefficients were calculated for each experiment using the mass transfer approach model. The results illustrated that in the growth stage of hydrate crystals, gas consumption rate is almost constant. It was shown that mass transfer coefficient is directly affected by the pressure. It can be concluded that the mass transfer approach, can be used to model or predict the formation of CO_2 hydrate in such experimental system. The benefit of the mass transfer approach is simplification of governing equations and avoiding from sophisticated modeling as it can be found in literature.

Keywords: Gas Hydrates, Kinetics, Mass Transfer Coefficient, Carbon Dioxide, Stirred Reactor.