

Optimization of Biodiesel Production from Rice Bran Oil Through Alkali-Catalyzed Transesterification

A. Alijanzadeh Roshan¹, F. Talebnia Roshan^{2*}, H. Shaki³

1- Chemical Industry Department, Technical College of Shahid Chamran, Technical & Vocational University, Corgan, Iran

2- Biotechnology Department, Chemical Engineering Faculty, Noshirvani University of Technology, Babol, Iran

3- Biotechnology Department, Chemical Engineering Faculty, Tarbiat Modares University, Tehran, Iran

Email: F.Talebnia@nit.ac.ir

Abstract

Biodiesel production from vegetable oils showed to have a great potential as a substitute of fossil fuels. The oil content of rice bran can be used as a raw material for biodiesel production. In the present work, biodiesel was produced from rice bran oil through transesterification where methanol and KOH were used as alcohol and catalyst, respectively. The effects of process variables including Alc./Oil molar ratio, catalyst concentration, temperature and reaction time were investigated. A central composite rotatable experimental design (CCD) was applied to evaluate the effects of the aforementioned variables on the process. The investigated response variables were biodiesel and glycerol yields. Under optimum condition, a biodiesel yield of 90% was obtained at the following conditions: Alc./Oil molar ratio 12:1, KOH concentration 0.75% of oil, temperature 52.4 °C and time 45 min. This result was verified by conducting an experiment under optimal condition where a yield of 85.07 % was achieved.

Keywords: Rice Bran Oil, Biodiesel, Transesterification, Biofuel, Optimization



Optimization of Pre-Treatment Operation of Industrial Water Using Artificial Neural Network and Genetic Algorithm

M. Yousefi*, M. H. Yassin

Department of Chemical Engineering, Abadan Branch, Islamic Azad University, Abadan, Iran

Email: Mohammad_59_y@yahoo.com

Abstract

Coagulation process is of vital importance for achieving good performance in water pre-treatment units. It usually implements optimum operating conditions that results in highest turbidity removal. The choice, dosage, pH and rate of mixing of coagulant and coagulant-aid are the variables that define optimum operating conditions. In this research, coagulation process of Fajr petrochemical company has been studied. Several jar tests are conducted to determine performance of Alum, Ferric chloride and Poly aluminum chloride as coagulants and anionic poly electrolyte and wheat starch as coagulant-aids at different pH and mixing rates. Optimum operating conditions data obtained in jar tests are used in developing a Neural Network model. This model allows operators to have an estimation of the operating conditions. The success of water pre-treatment depends on fixed feed water quality without frequent need to run jar tests. The predicted result of this network for operating parameters, presented the high consistency with operating data of industrial unit. The maximum relative error for prediction of turbidity is 0.6 % and for total hardness is 2.3 %. The number of neurons of Neural Network hidden layer is optimized and the developed model is validated and tested using a fraction of data that was not utilized in network training. The estimated operating condition for a given feed water quality is implemented in practice and the result of pre-treated water quality matched the expected quality.

Keywords: Pre-Treatment Industrial Water, Coagulation, Artificial Neural Network, Genetic Algorithm

Influence of Bone Ash on Physical and Optical Properties of Bone China Body

A. Arasteh Nodeh

Chemical Engineering Department, Islamic Azad University, Quchan Branch, Quchan, Iran

Email: aliarastehnodeh@yahoo.com

Abstract

In this paper, the effect of various amount of bone ash in bone china bodies while the firing temperature is constant has been investigated. The samples were characterized by XRD, XRF and SEM. It was observed that increasing the bone ash content leads to more intense β -tricalcium phosphate (β -TCP) and anorthite peaks but less intense SiO_2 peaks. It was also observed that bone china bodies with higher amount of bone ash have a more glassy structure than bodies with lower amount of it. In bodies with low amount of bone ash and consequently high amount of milled mix, quartz cannot be melted completely and remains as crystals in the structure of body which leads to a body with less glassy structure and a less translucence body. By increasing the bone ash content of bone china bodies, shrinkage, bulk density, module of rupture and thermal expansion coefficient increase while no change can be observed in water absorption. As phosphate has a bleaching effect, increasing the bone ash content in the bone china bodies resulted in a brighter and white body with less colorful tint on the appearance of samples.

Keywords: Bone Ash, Bone China, Tableware, Phase Composition



Investigation of Plasticizers Diffusion and its Effect on Mechanical Properties of Composite Solid Propellants

J. Allahverdizade¹, M. A. Dehnavi^{2*}

Chemical Engineering Department, Engineering Faculty, Imam Hossein University, Tehran, Iran

Email: mdehnavi@iust.ac.ir

Abstract

In this paper, various affecting parameters on plasticizer migration and mechanical properties of propellant in the composite solid propellants have been investigated. The plasticizer migration phenomenon in steady and unsteady state was also investigated by Fick law's. Several methods to prevent liquid species migration in the composite solid propellants are described. A computer program based on the mathematical model of Fick's second Law of diffusion was developed to perform the calculus from the concentration data obtained by experiments. The agreement between the simulated and experimental values obtained from current work validates this model.

Keywords: Composite Solid Propellant, Plasticizer, Diffusion and Fick's Laws, Migration of Plasticizer

Combined Heat and Power Production from Heavy Refinery Products; Using Integrated Gasification and Molten Carbonate Fuel Cell Cycle

M. Astaneh, F. Golzar, R. Roshandel*

Department of Energy Engineering, Sharif University of Technology, Tehran, Iran

E-mail: Roshandel@sharif.edu

Abstract

The aim of this study is to develop a model for producing combined heat and power from heavy refinery products. To do this aim, two scenarios are developed and analyzed. In the first scenario Integrated Gasification Combined Cycle (IGCC) is investigated as the base case and its related carbon dioxide emitted to atmosphere. In the second scenario molten carbonate fuel cell is added to the cycle in order to improve the performance and reduce carbon dioxide emissions. In the second scenario by reducing 1.5% of net electrical efficiency and 0.97% of cogeneration efficiency with respect to the first scenario, 70% of carbon dioxide emission rate is reduced. Finally sensitivity analysis is performed to investigate the effect of fuel utilization factor on system operational specifications.

Keywords: Cogeneration, Refinery, Gasification, Combined Cycle, Molten Carbonate Fuel Cell, Carbon Dioxide



An Overview of New Methods for Removing Hexavalent Chromium from Industrial Wastewater in the Last Decade

M. Akbari Binabaj¹, S. M. Nowee^{1*}, N. Ramezani²

1- Chemical Engineering Department, Ferdowsi University, Mashhad, Iran

2- Science Faculty, Chemistry Department, Ferdowsi University, Mashhad, Iran

Email: nowee@um.ac.ir

Abstract

In this century water pollution has become a global issue. Heavy metals including Cr(VI) as common environmental contaminants, could be found in different industrial wastewater. Along with the expansion of industry and the increase in the contaminated wastewater, several methods have been proposed for removing contaminants from aquatic environment. Accordingly in this study various methods for the removal of Cr(VI) are presented and in some cases, the removal mechanism of Cr(VI) and the optimum conditions for the process are described. Also the advantages and disadvantages of each technique are presented. So this paper gives the reader a clear direction to find the most suitable separation method for a defined condition.

Keywords: Cr(VI), Treatment, Industrial Wastewater, Removal Methods

A Review of Synthesis Methods of Carbon Nanotubes Yarn

H. Eshghi^{1*}, M. Shanbedi², A. Amiri², S. Zeinali Heris²

1- Chemistry Department, Science Faculty, Ferdowsi University of Mashhad, Mashhad, Iran

2- Chemical Engineering Department, Engineering Faculty, Ferdowsi University of Mashhad, Mashhad, Iran

Email: heshghi@um.ac.ir

Abstract

Recently, carbon nanotubes (CNT) have been investigated by scientific and research centers as well as industrial sections due to the promising electrical, thermo-physical and biological properties. Also, powerful strength and toughness, excellent tensile strength, Young's modulus and low density of CNT play key roles to select above-mentioned structure as a good candidate for production of strong CNT -base yarn. Despite the above-mentioned properties, short length and non-continuous yarn were introduced as a main challenge of researchers to achieve a yarn without defect. In the present work, experimental methods for producing CNT yarn were investigated. The main methods for synthesizing CNT yarn that have been published recently were investigated completely to reach good solution spinning as well as solid-phase spinning. Also, other methods such as electrophoretic and dielectrophoresis spinning have been investigated in terms of performance and compared completely.

Keywords: Carbon Nanotubes, Yarn, Spinning, Strength, Toughness



Prediction of CO₂ Mass Transfer Flux in Amine Solutions Using Neural Networks

E. Etemad, A. Ghaemi*, M. Shirvani

Process Design Laboratory, Chemical Engineering Department, Iran University of Science and Technology, Tehran, Iran

Email: aghaemi@iust.ac.ir

Abstract

In this work, multilayer perceptron network are used to predict the mass transfer flux of CO₂ in Piperazine solution. The effective parameters on the absorption flux of CO₂ such as interfacial and bulk concentration, CO₂ loading, ratio of diffusion coefficient of gas to liquid of CO₂, ratio of the CO₂ partial pressure to the total pressure, ratio of film thickness of gas to liquid and the film parameter as input variables and mass transfer flux of CO₂ as output variables were selected. Experimental data presented in the literature were used for training and evaluating the multilayer neural network of Perceptron. A total of 104 experimental data were used and total concentrations of piperazine were 2-8 mol/lit. The predicting results of neural network indicated that the mean square error for mass transfer flux was 8.61%. In addition, the results of neural network were compared with the predictions of other researchers and the findings revealed that the artificial neural network computes the mass transfer flux of CO₂ more accurately and quickly.

Keywords: Mass Transfer Flux, CO₂, Piperazine, Neural Network, Perceptron

Industrial Waste Management Utilizing Microwave Heating

A. Aghababaei, L. Vafajoo*

Chemical Engineering Group, Graduate Studies Faculty, Islamic Azad University,
Tehran South Branch, Tehran, Iran
Email: vafajoo@azad.ac.ir

Abstract

Waste materials are being generated around the world every year. Some of these are effectively collected and recovered for use as an energy source or chemical feedstock, while others are simply discarded or burned which in many ways polluting the environment. The improper disposal of these waste materials may constitute an environmental hazard due to the presence of undesirable species such as metals, soot and polycyclic aromatic hydrocarbons. New technologies are being investigated to develop systems which shall support the safe handling, transportation, storage, disposal and destruction of the hazardous constituents of these wastes. The recent interest in microwave technologies due to the extent of the treatments and assisted applications promoting a specific technology has been highlighted against conventional methods, and appears to offer the best alternative to waste management. This paper discusses the potential use of microwave as an energy-efficient mean to current heating technologies employed in the processing and treatment of wastes. The process applications considered are the treatment and control of specific and often problematic waste-streams including; electrical and plastic as well as; industrial and municipal sludge and automotive industry wastes. Moreover, it presents an extensive review of the scientific literature associated with various microwave pyrolysis applications in waste to energy engineering.

Keywords: Microwave, Waste Recycling, Pyrolysis