Modeling of Microfiltration Membrane for Oily Wastewater Treatment Using Hermia Model and Neural Network

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Abstract

In this paper, results of the oily wastewater treatment by ceramic membranes in microfiltration process are simulated using neural network and hermia model. The process simulation by neural networks is written using MATLAB software program. The network input consisted of oil concentration (Coil), cross-flow velocity (CFV), temperature (T), trans-membrane pressure (TMP), and filtration time (t) and the network output consisted of permeation flux. The operational data is divided in three categories: training, validation and testing. In this study, three modes (20-20-60 and 15-15-70 and 10-10-80) are investigated for training the network. Also formation of precipitate is modeled using hermia model includes four different behavior in obstruction. In all states are observed prediction of permeation flux using neural network is better than hermia model.

Keywords: Modeling, Microfiltration, Oily Wastewater, Hermia Model, Neural Network

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Effect of pH on Photocatalytic Degradation of Cypermethrin in a Column Reactor Using Immobilized TiO_2

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Abstract

Advanced oxidation process was used to remove both Cypermethrin and COD burden from the agricultural wastewater. It was shown that the normalized concentration of the pesticide was decreased to nearly zero during 3 hours. Operational conditions were pH=7 and 25℃ with the initial concentration of 75 ml (EC 40%) pesticide per 1000 liter water. Rate of concentration decrease was considerably faster through the first 30 minutes rather than final 30minutes. Additionally, in this research the amount of COD load in the neutral medium was reduced to 78% of its initial (COD_0=7100gm/lit). The effect of pH on COD and concentration removal rate was studied. It was revealed that pH increase could grow the rate constant. COD and concentration removal was appropriately fitted with the pseudo first order kinetics model. Immobilization of TiO_2 (Degussa, P-25) on the steel sieve plates has done by an low-cost and simple method. Uniform and proper distribution of TiO_2 was proven by XRD analysis. Furthermore, insignificant rinse of photo-catalyst was displayed by SEM Image. Immobilized particles of titanium dioxide were exposed to UV radiation (Philips 15W – Wave length: 300-450nm) through the column reactor. Sampling was performed every 15 minutes during the experiment.

Keywords: UV/TiO_2, Photocatalytic Degradation, Advanced Oxidation Processes, Cypermethrin, Pesticide Removal

Modelling of Olefin Units by Engineering-Short Cut Correlations

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Abstract

Due to the importance of olefin units in the country and their complexity, optimization the operating & productivity conditions for these big plants seems very important. Since modelling and simulation some parts of the plant need complex mathematical relations and equations, so usage a simple and accurate method will be very useful. Practically, by using this method, a lot of design and operating parameters can be studied and commented about changes and optimizations. In this research study and modelling of olefin plant of Jam Petrochemical Complex which is the world's largest olefin unit, has been studied. Cooling and separation units modelled and simulated by relationships and methods of estimation and approximation (Rules of thumb) and it's results provided. Finally, further evaluation of this technique, was examined by six different operating conditions and calculations performed by these relationships. Results in many cases was acceptable & close to the design conditions.

Keywords: Olefin, Modeling, Engineering-Short cut Correlations

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Ash and Sulphur Removal from Bitumen

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Abstract

Flotation and leaching methods were used to remove ash and sulphur from bitumen by sulfuric acid. The bitumen samples had sulphur content of 9.6% (6.74% in the pyrite sulphur form) and 30% ash. All the experiments were done under aeration rate of 4L/min using pine oil and gasoline as frother and collector agents, respectively. The factors studied were including the amounts of collector and frother agents, pH, and the solid weight percentage in the pulp, stirrer speed, and particle size. The bitumen samples with dimensions less than 0.5 mm were crushed. The flotation experiments were performed in a 3-liter Denver laboratory flotation cell to ease the ash and sulphur removal. The optimum condistion obtaind from the results were; foaming amount of 50gr/t, collector amount of 1kg/t, impeller speed of 1200rpm, pH=7, pulp containing 5% of solid, particle size of 100mesh, and flotation time of 3 mins. In these circumstances, 52.9% of pyrite sulphur (e.g.; 36.45% of total sulphur) and 43% of ash were removed. With the approach of leaching with sulfuric acid, the organic and pyrite sulphur removal were 7% and 13%, repectively. Combination of these two methods (in optimal conditions), removed up 47% of the total sulphur and 61% of ash through bitumen sample.

Keywords: Desulphurization, Ash removal, Bitumen, Flotation

Evaluation of Gas Retention Time Effect on Removal of Ethanol from Contaminated Air Using Bio-trickling Filtration

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Abstract
Volatile organic compounds are dangerous for human health. Ethanol is a member of this group that can decrease the air quality. In this study a bio-trickling filter was applied to treat air contaminated with ethanol which in this study it calls reactor. In this study to determine ethanol concentration in air, it was transferred from gas phase to aquatic phase (distillated water). Then, the chemical oxygen demand (COD) of aquatic phase was measured. Results of this research elaborate that the bio-trickling filter reactor can remove 100% of ethanol from polluted air. Results of this research shows that, although, operation of bio-trickling filter is complex, it is environmental friendly and very efficient to treat air contaminated with ethanol.

Keywords: Bio-Trickling Filter, Methanol Removal, Treatment of Contaminated Air

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Investigation of some Pore Size Distribution Measurement Methods for Porous Material and Determination the Best Method for Four Industrial Adsorbent

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Abstract
Reliable prediction of the heterogeneous solid adsorbents pore size distribution (PSD) is the key element in the design and operation of all adsorption processes. At first in this work a brief investigation about formulation of some PSD measurement techniques (BJH,NLDFT,HK and SHN1) have been done.
In order to make comparison between the performance of these methods, computational methods have been employed to determine the PSD of four specific adsorbents(SBA-15, ZSM-5, MCM-41/A and Activated carbon).results showed that BJH and NLDFT method has been successfully applied to adsorbents covering a wide range of pore diameter. Using of HK and SHN1 had a suitable response for micro-pores adsorbent. In addition SHN1 method requires less mathematical calculations and physical information and hence can be easily employed for determining PSD for micro-pores adsorbents. NLDFT method in comparsion with SHN1 method, present a more accurate result for meso-pores material.

Keywords: Pore Size Distribution (PSD), SHN1, BJH, NLDFT, HK

Analysis of Heat Transfer Enhancement in Shell and Helical Tube Heat Exchangers Using CFD Modeling

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Abstract
In this paper, CFD modeling of heat transfer enhancement in a shell and helical tube heat exchanger is presented. Hot and cold water have been used as working fluids in the tube side and shell side, respectively. Effects of some important parameters such as hot and cold mass flow rates, baffles and pitch distance, on heat transfer are investigated numerically. The results showed that by increasing the helical tube pitch, heat transfer rate and velocity offset increases. By using the horizontal baffles, the Nusselt number in tube side increases to 8.3%. In a constant tube pitch, by increasing the cold water mass flow rate, the Nusselt number increase up to 11% and increasing the helical pitch increases the 16.9% in Nusselt number through the shell side. The CFD predictions were compared with the experimental data and good agreement was observed.

Keywords: **Computational Fluid Dynamics, Heat Transfer, Shell and Helical Tube Heat Exchangers**

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Modeling of Carbon Dioxide Solubility in Pz-CO_2-H_2O System

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Abstract
In this research, a thermodynamic model based on the Pitzer and Virial equations was presented for modeling of carbon dioxide-water-Piperazine equilibrium system. The model was constructed based on electrolytes principles including mass balance, electroneutrality, chemical equilibrium and phase equilibria. In the model, activity coefficients of liquid species were determined using Pitzer equation whereas fugacity coefficients of gas species were calculated using Virial equation. The modeling equations of carbon dioxide-water-Piperazine system including a set of linear and nonlinear equations were solved simultaneously using Newton method. The simulation results were compared with other researcher's experimental data. The mean absolute error for 376 experimental data was obtained 7.18 percent. Also comparison of the model results with other thermodynamic model results showed that the model has high accuracy for prediction of carbon dioxide solubility than the other models.

Keywords: **Piperazine, Equilibrium Data, Thermodynamic Model, Pitzer, Carbon Dioxide**

Study the Role of Catalysts in Biodiesel Production Processes

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Abstract

Decreasing fossil resources and increasing air pollution have made scientists thought of substituting fossil fuels with renewable and clean fuels. Biodiesel is one of such fuels produced through transesterification reaction between a type of alcohol and oil in presence of an acidic or a basic catalyst. Currently production of biodiesel engages with considerations and problems while it has been producing with high cost. Using heterogeneous catalysts are among the measures can be done to reduce biodiesel production cost. Therefore, to better understand the aspects and problems of utilizing other catalysts in this article, different types of catalysts used in biodiesel production have been addressed. Meanwhile, important factors and variables associated with synthesis and application of heterogeneous catalsysts were presented with detail. This includes the introduction and performance evaluation of homogeneous base catalysts, homogeneous acid catalysts, heterogeneous base catalysts, heterogeneous acid catalysts and enzymes. Homogeneous base catalysts have shown better performance than acid catalysts in terms of reaction rate and biodiesel production. Heterogeneous catalysts have the potential of being recovered and reused and so leading to elimination of neutralization and washing steps and therefore reducing waste water and above all reducing the expenditures. Acid catalysts are insensitive to free fatty acids and water and are able to catalyze both transesterificationa and esterification reactions however, the reaction time is much greater than base catalysts. In spite of unique features of enzymes such as insensitivity to free fatty acids or mild reaction conditions, they have not been used very much due to their high prices.

Keywords: Biodiesel, Transesterification, Homogeneous Catalyst, Heterogeneous Catalyst, Nanocatalyst