Simulation and Optimization of Ethanol Amine Production Plant

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Abstract
In this study a Ethanol Amine (EA) production plant was simulated and optimized. Due to the lack of accurate reaction rate information, the first step was obtaining reliable kinetic data from the SRI (Standford research institute) International industrial database and calculation using the error minimization method. By implementing the resulted reaction kinetics then the whole plant was simulated using Hysys software. The simulation results were compared with the SRI data and concluded that there is acceptable agreement between the simulation and the measured industrial data.
Finally using the Gradient Search (GS) optimization technique the plant was optimized using the followings as optimization variables: input ammonia to Ethylene Oxide (EO) molar ratio, input water flow rate, and reactor temperature. Employing process profit as the objective function the optimal operating conditions were found to be: ammonia to EO ratio of 5 (mol/mol), water flow rate of 52.59 kg mol/hr, and reactor temperature of 85°C.

Keywords: **Simulation, Optimization, Ethanol Amine Production, Ethylene Oxide, Ammonia**

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Review of Copper Nanopowder Synthesis by Chemical and Electrochemical Reduction Methods

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Abstract
Among metal nanopowder, copper nanopowder has a variety of application because of its special catalytic, electrical and thermal conductivity and optical properties. The convenient synthesis methods of this material with controlling particle size and crystal structure are chemical and electrochemical methods. In chemical method, the nanopowders are synthesized via reduction of a salt of the metal catione. In the electrochemistry method, the metal nanopowder is prepared on the cathode surface using an appropriate current density in the electrolyte. The literatures show that the effective synthesis parameters in the chemical methods are reductive material, stabilizer, temperature, kind of metal salt and solvent. These parameters in the electrochemical method are temperature, current density, kind of electrolyte and electrodes. In this work, a literature review is done on mechanism of these synthesis methods and specifications of operating conditions on the structure of nanopowders.

Keywords: **Chemical Reduction, Electrochemical Reduction, Copper Nanopowder, Reduction Agent, Current Density**

The Choice of the Most Accurate Equations of State and Kinetic in Methanol Synthesis Reactor Simulation

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Abstract

The methanol synthesis reactor operates in the pressure rang of 50 to 100(bar) and the temperature of 200 to 240°C. Because of not knowing enough about the mechanisms of methanol production reactions, different kinetics equations have been introduced by researchers. Methanol is an important strategic product; there for, the simulation of methanol synthesis reactor has been attended by researchers. The different equations of state and kinetic equations have been used in all simulations. Some simplifies such as, ignore of mass diffusion resistance in gas bulk, catalyst pellet and ideal assumption of operation conditions have been seen nearly in all simulations. In this paper, the methanol synthesis reactor simulation with mass diffusion resistance in gas bulk and catalyst pellet was done. Also; some different equations of state with tow different kinetic equations were used in calculations. With comparison of the simulation results with the industrial results of Shiraz petrochemical methanol reactor, the most accurate equation of state and kinetic equation were chosen. Then the effect of operation parameters such as, the reactor shell temperature, the inlet feed temperature, the inlet feed pressure and the inlet feed concentration, by using of chosen equation of state and kinetic equation on the performance of the reactor and their optimum amount were investigated.

Keywords: **Equation of State, Simulation, Methanol Synthesis Reactor, Kinetic Equation, Catalyst, Heterogeneous**

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The Effects of Different Parameters in the Synthesis of MFI Zeolite Membrane Via Hydrothermal Method

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Abstract

Zeolites are crystalline aluminosilicates with pore size between 0.3 and 1.3 nm. Unique specification of MFI zeolite such as suitable pore size, good selectivity, thermal stability, chemical resistance and high lifetime makes this type of material a suitable candidate for membrane top-layer. In-situ crystalization is the most common preparation method of zeolite membranes that can be synthesized by direct hydrothermal treatment on porous supports. Because of large number of variables such as batch composition, alkalinity (pH) and the nature of reactants have important effects on the crystallization of zeolites; in this paper the effects of key factors in the synthesis of zeolite MFI membrane were investigated based on the obtained results in the previous works. Also, the influence of calcination time on the final properties of the synthesized MFI membrane was investigated and based on the obtained results in the literature, it can be concluded that zeolite MFI membrane, calcined at 673 K for 30 hr has an optimum quality.

Keywords: **MFI Zeolite Membrane, Hydrothermal Method, Different Synthesis Parameters**

A Review on Composition and some Properties of Self-Compacting Concrete (SCC)

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Abstract

Self Compacting Concrete (SCC) was developed to eliminate the need to compact by mechanical means and to improve the durability of concrete. After its introduction, it found an unusual interest and rapidly was developed throughout the world. For achieving SCC, it is required to make a proper equilibrium between viscosity and deformability in both paste and mortar, so a reasonable resistance to segregation with a high deformability can be acquired. The key to this equilibrium, is limiting coarse aggregates, use of chemical additives and high content of powders. High content of powders, which are used in SCC, has considerable influences on its properties. Limestone powders can increase the heat of hydration and a considerable decrease in resistance to sulfate attacks. The powders may also result in a considerable decrease in fire resistance of concrete, because of low thermal stability of powder or high packing of system, which can cause spalling in early stages of fire.

Keywords: Self-Compacting Concrete (SCC), Powder, Durability, Compressive Strength, Fire Resistance

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Experimental Study of Archie Parameters Under Capillary Effect for Asmari Rock Samples

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Abstract

Formation resistivity depends on the Resistivity factor and Resistivity index and is useful in interpretation of well logging, evaluation of porosity and water saturation. Archie equation for the relationship between formation resistivity factor and porosity, also resistivity index and saturation are presented by use of parameters Cementation factor and Saturation exponent. The Archie equation is valid only when the rock is strongly water-wet and clay free, and may not be applicable to carbonate rocks. Investigating the effects of confining pressure, temperature, wettability and capillary pressure can lead to correct use of Archie equation. In this paper, series of experiments are performed in order to find influence of imbibitions and/or drainage on Archie parameters by changing wettability, for carbonate rocks of one of Iranian petroleum reservoir. The results show that the saturation exponent value is decreased by wettability alteration of rock samples from oil wet to water wet.

Keywords: Resistivity Factor, Resistivity Index, Cementation Factor, Saturation Exponent, Capillary Pressure, Wettability

Mathematical Modeling of Mass Transfer During Osmotic Dehydration of Cylindrical Green Bean

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Abstract

In this study, mass transfer during the osmotic dehydration of cylindrical cut green beans in salt solution was investigated. The osmotic salt solution concentrations used were 10%, 20% and 30% NaCl, and osmotic solution temperatures were 30ºC and 50 ºC, fruit to solution ratio was lower than 1:20 (w/w) and the process duration varied from 0 to 6hr. A two-parameter mathematical model was used for describing the mass transfer in osmotic dehydration of green bean samples and estimation of equilibrium moisture loss and solid gain. Effective radial diffusivity of water as well as solute was estimated using the analytical solution of Fick's law of diffusion in the cylindrical coordinates. For above conditions of osmotic dehydration, the effective diffusivities of water and solute were found to be in the range of 1.776×10^{-10}–2.707×10^{-10} m^2/s and 1.126×10^{-10}–1.667×10^{-10} m^2/s, respectively. Average moisture and salt concentrations as a function of time and also moisture and solute distributions as a function of time and location in the radial direction were plotted by using the estimated equilibrium moisture and solute concentrations and also moisture and solute diffusivities. Moisture and solute distributions show that the change of moisture and salt is mainly confined in the region of the surface and slowly progresses to the interior.

Keywords: Osmotic Dehydration, Mass Transfer, Diffusivity, Concentration Profile, Green Bean

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A Short Review on Spouted Beds: Properties, Applications, Experimental Studies and Hydrodynamic Modeling

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Abstract

This study is performed to review previous attempts presented on the hydrodynamic behavior of the spouted beds from the viewpoint of experimental efforts as well as mathematical modeling and simulations. Various configurations of spouted beds and their applications are first described following by a precise review of papers and reports presented on the performance of this effective apparatus form the time of invention (in 1955) until now. A number of studies have been carried out in order to determine the flow patterns of both gas and solid phases and/or to present empirical correlations for key parameters including the minimum spouting velocity, pressure drop and drag force. From the literature review it may be deduced that the dominant force in the gas- and solid-phases momentum balances is the two-phase interaction force which may be determined on the basis of empirical correlations. A Conclusion has been reached in the present study that while an interphase model may be appropriate for some spouted bed applications, it may lead to large errors in case of certain other configurations. This study may help the researchers to recognize the applicability and weakness of the available models and to apply proper correlations.

Keywords: Spouted Beds; Numerical Simulation; Discrete Element Method, Eulerian Method

Smart Fluids, Their Properties and CFD Simulation of ElectroRheological Fluid Between Two Cylinders

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Abstract

Smart fluids are a type of fluids that their rheological properties (Viscosity, yield stress, etc.) change quickly (less than one milisecond) in the presence of an external actuator. These fluids are divided to two types: sensitive to electric and magnetic field, named electrorheological and magnetorheological fluids respectively. Smart fluids are mixture of an insulated fluid that micron-size particles are suspended therein. When electric or magnetic field is applied, particles form clusters which change fluid from liquid to quasi solid. This type of fluids can extremely used in the different industries like automotive, buildings, industrial valves, robotic, military industries and medical engineering. In this article, smart fluid's structures, their clustering and properties have been discussed. Behavior of an electrorheological fluid (ERF) between two cylinders that inner cylinder rotates with constant angular velocity has been studied with FEMLAB V2.3 software. This software solves the governing equations by finite element method.

Keywords: Smart Fluids, CFD Simulation, Electrorheological Fluid, Electric Field