Optimization of Rotary Cement Kiln Using Genetic Algorithms

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Abstract

Rotary cement kiln as heart of a cement production plant plays an important role in overall energy consumption and product yield. Therefore, the process behavior and physical parameters affecting the final production need to be investigated. Modeling and simulation of the rotary cement kiln have been done by several researchers considering dynamic and steady state behavior of the process. In this research, different models presented by other researchers were evaluated and their advantages and disadvantages were studied. Next, a general and comprehensive model was developed with the aim of optimization of the process. Due to the complexity of the Differential and Algebraic Equations (DAE's) constructing the model, a powerful method should be employed in order to solve the complex system. Simulation results were compared to the result from a case study presented in the literature. Moreover, Genetic Algorithms (GA) was used as a strong tool to find optimum parameters and operating conditions for production of different cement types. Having maximum production as objective function, different values for the parameters and conditions were resulted from the numerical optimization of the process. It was found that for some fixed plant geometries, different optimum values exist for production of a specified cement type.

Keywords: Rotary Cement Kiln, Modeling, Simulation, Optimization, Genetic Algorithms

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Evaluation of Cyclones Design Models and Determination of Characteristics of Cyclones in FCC Unit of Abadan Refinery

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Abstract

Separation efficiency of cyclones is affected by various parameters such as pressure drop, particle size, structural dimensions and operational conditions. This paper compare the separation efficiency of Abadan refinery FCCU's cyclones with results of standard designing cyclone models. Initially standard cyclone designing models of Muschelnautz, Lapple and Barth were discussed, and then experimental data of Abadan refinery were compared with the results of the models. Comparison results confirmed that Muschelnautz model has been more accurate than the other studied models in evaluation the cyclones' pressure drop and efficiency.

Keywords: Cyclone, Pressure Drop, Efficiency, Barth Model, Lapple Model, Muschelknautz Model

Kinetic Study on the Leaching of Spent Catalysts of Steam Reforming Plant in Sulfuric Acid Medium

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Abstract
The kinetics of the spent nickel oxide catalyst (NiO/Al_2O_3) leaching in sulfuric acid solutions was investigated. The effects of spent catalyst particle size, acid concentration and reaction temperature on Ni extraction rate were determined. The results obtained show that extraction of about 96% of the Ni is achieved using 200 mesh spent catalyst particle size at reaction temperature of 100-120oC for 360 min reaction time with 60% sulfuric acid concentration. The solid/liquid ratio was maintained constant at 1:5 g/ml. The leaching kinetics indicates that chemical reaction at the surface of the particles and shrinking sphere is the rate-controlling process during the reaction for H2SO4. The activation energy was determined as about 33.65 kJ/mol.

Keywords: **Spent Catalyst, Nickel Recovery, Leaching, Sulfuric Acid, Chemical Reaction Kinetic, Steam Reforming**

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Modeling of Baker's Yeast Bioreactor in Batch and Fed-Batch Culture

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Abstract
A structured unsegregated cybernetic model is able to describe diauxic growth phenomena of cells colony in aerobic condition. This model shows that the metabolic activity of the cells is regulated by internal cellular controls which direct the micro-organism towards the most convenient metabolic pathway able to optimize the use of available resources. In this paper, for proving this reality, a structured unsegregated cybernetic model have been used for describing of the growth stages of Saccharomyces cerevisiae on mixed substrates. The results of simulation of baker's yeast in batch and fed-batch bioreactor show that agreements are quite satisfactory between experimental data and simulation results. And it well performs in the simulation of the lag-phases and the diauxic growth. Finally, for preventing of oxygen starvation that causes ethanol production, oxygen mass transfer coefficient is simulated on the function of impeller speed and air flow rate and the effect of this parameter on biomass yield have been discussed.

Keywords: **Industrial Fed-batch Bioreactors, Glucose Fermentation, Saccharomyces Cerevisiae**

Investigation of Ammonia Storage Consequence Modeling in Kermanshah Petrochemical Complex

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Abstract

Safety plays an important role in all phases of chemical processes design. In order to ensure the safety and environmental issues and also to minimize the future changes in process and equipments due to safety problems, safety should be considered in preliminary studies of designing.

Ammonia is a highly toxic gas and it forms an explosive combination when exposed to air. moreover, risk potential increases in ammonia production units due to high pressure and temperature operating conditions. All the mentioned problems indicate the importance of safety and process hazards investigation in such a unit.

In order to manage risks in process units, it is necessary to identify and evaluate hazards. The next step will be calculating the probability of accurance, intensity and consequences of undesirable accidents so that they can be used in risk evaluation. Investigating the intensity of the consequences of probable accidents is known as "Consequence Modeling". In fact, consequence modeling is the third step of the four-step risk evaluation.

The main purpose of this paper is the implementation of new methods of consequence modeling in order to analyse and identify the outcomes of release, dispersion, firing and explosion in ammonia storage tank in Kermanshah petrochemical complex using ALOHA software. Improper location of emergency and exit doors, inappropriate location of ammonia storage tank, unsafe place of central control room, laboratory and adjacent villages and cities within a radiuse of 10 Km, are some results of this modeling.

Keywords: Safety, Ammonia Storage, Risk Management, Risk Evaluation, Consequence Modeling

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MFI Zeolite Membranes and Their Modification Methods

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Abstract

*Zeolites are crystalline microporous materials of mineral hydrates that their structure is formed by three-dimensional framework of tetrahedral SiO_4 and AlO_4 with nanometric dimensions (0.3-1.3 nm). MFI zeolite is one of the most important zeolites that consist of two different channels, straight and sinusoidal, whose pore sizes are 5.3 * 5.6 and 5.1 * 5.5 ˚A, respectively. When zeolite crystals are intergrown to form continuous layers, the resulting membranes can separate gas mixtures with high selectivities because their pore sizes are comparable to the molecular dimension. Because MFI-type membranes can separate mixtures of molecules with similar physical properties, such as chemical isomers, significant effort has been devoted to modify and improve these membranes in order to improve separation performance. In the current study, two methods: creating diffusion barriers (coking treatments) and ion exchange used to improve membrane properties were investigated based on the previous works results in the literature. In the membranes synthesized using barriers, n-butane flux and n-butane /i-butane selectivity were1.6 and 4 times as large as those of membranes prepared without using of barriers, respectively. Ion exchange is another method to modify zeolites, and exchange should be tunable by the proper choice of the ion and Si/Al ratios to improve separation performance.*

Keywords: MFI Zeolite Membranes, Hydrocarbons Separation, Modification Methods of Zeolite Membranes

A Review on Fire Behavior of Traditional and Dense Concretes

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Abstract
Fire behaviour of ordinary (traditional), dense and SCC concretes is reviewed. Concrete is usually known as a material with good fire resistance. However, the mechanical resistance of concrete reduces with rising temperature because of chemical and dimensional changes, which can result in failure of the concrete element. Concrete has considerable amounts of water, which with high thermal capacity and low thermal conductivity of concrete can result in a low heat transfer rate from hot surface to bulk of concrete and hence delay the failure of component in fire. In contradictory, these characteristics can result in producing high vapour pressure in regions near the surface and spalling of concrete, which reduces the fire resistance of element, especially when the cover of reinforcing bars fails. The risk is much higher in dense concretes, like HSC and HPC. During the expose of concrete to fire, simultaneous heat and mass transfer phenomana cause that humidity trnsfers into internal layers. The vapor pressure will be rised in a region near the surface and reached to a maximum in a distance, which depends upon heating rate, moisture content, porosity, properties of materials, environment conditions, etc. The spalling will be occurred, if tensile strength is less than this pressure. Dense concrets may suffer from spalling in conditions that is not a risk for normal concretes. Self-compacting concretes also show different behaviour from other concretes at high temperatures. This is due to different compounds and high content volume of powders. The powders may result in a consirable decrease in fire resistance of concrete, because of low thermal stability or rise of packing of system, which can cause spalling in early stages of fire.

Keywords: Concrete, Self-compacting Concrete, High-performance Concrete, Fire, Fire resistance

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Reviewing the Effective Parameters on MTO Process and their Influence

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Abstract
In recent years the methanol to olefins (MTO) process has received wide attention as it provides an indirect route in reaching to market demand for the production of light olefins, mainly ethylene and propylene. This paper is aimed to review the effects of parameters such as, temperature, particle size, acidic strength, catalyst structure and modification made with some metals and also their effectiveness on activity and selectivity which conducts the process towards light olefins. In addition the different types of reactors and the effect of temperature, pressure and feed composition are reviewed in this process.

Keywords: Methanol to Olefin, Ethylene, Propylene, Catalyst, Reactor

Study of the Separated Bacteria Performance from Soils Polluted by Hydrocarbon in an Experimental Model for Using in Enhanced Oil Recovery

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Abstract

In this study, an experimental column model was designed and used for study about microbial enhanced oil recovery. From twelve soil samples polluted by crude oil, gasoline and airplane fuel, bacteria species were isolated and screened. It is found that 16 species can produce bioemulsifier, 5 species can produce gas from sucrose and 3 species can produce gas from lactose. The behavior and characterization of these species were studied in presence of various concentrations of salt, temperature, nitrogen and phosphor rich broth. At least four species that could produce bioemulsifier and gas were chosen to utilize in experimental columns. The test was shown that M35 specie was the best for oil recovery and three other species of bacteria were better than synthetic surfactant.

Keywords: Bioemulsifier, MEOR, Microorganism, Polluted Soils