Study of Reducing the Amount of Green Oil in the CCR Plant of Oil Refinery Unit

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Abstract

Crude oil refining is performed to produce more high valuable cuts. In the meantime, gasoline cuts are considered as one of the suitable value-added products. Naturally, the production of gasoline has become a vital issue due to various issues in the country. Today, some CCR plants are under the control of green oil generation. Green oil is a viscous fluid that has a high boiling point which sediments inside pipes, compressors and reactors, disrupting the process operation. It also poisons the catalysts of various units. Green oil is a combination of long-chain polymerized molecules that generated via polymerizing hydrocarbon chloride compounds or polymerizing these compounds with unsaturated compounds. In this study, the purpose is to investigate ways to reduce green oil production using a hierarchical analysis process. The process of hierarchical analysis is a decision-making method based on various criteria for achieving logical results, which has been done with the help of Expert Choice software. Cost, technical feasibility study, efficiency and availability have been chosen as criteria for this process. Also, three activated alumina adsorbents, enhanced alumina and the hybrid of carbon fiber and activated carbon were selected as hierarchical analysis processes alternatives. The paired comparison of criteria and three possible alternatives indicated that the hybrid of carbon fiber and activated carbon alternative was selected as the best adsorbent with 35.3% priority over other adsorbents. Also, the cost and availability criteria had 32.6% and 28.4% priority, respectively.

Keywords: Green Oil, Adsorbent, Alumina, CCR Plant.

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Simulation and Optimization of Thermal Management in L-Shaped Tubes Coated with Phase Change Material Nanofibers

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Abstract

In this study, the phase change materials (PCMs) nanofibers (polyethylene glycol as the PCM and polyamide-6 as the supporting matrix) in an L-shaped tube at various conditions were simulated with COMSOL software. In this regard, water at 100˚C is placed in the L-shaped tube, which is coated with a thin layer of polyethylene glycol-polyamide nanofibers on the outside. In the following, the thermophysical properties of composite nanofibers PCMs were investigated. The effect of varying temperature, velocity, density, viscosity and thermal conductivity on the composite nanofibers PCMs with different weight percentages were compared. The results showed that the most proper system for thermal management is related to the PCM nanocomposite with a maximum weight percentage of polyethylene glycol. Also, using nano-PCMs for improving the thermal management and temperature controlling is so effective, and therefore they can be applied to store and transport energy.

Keywords: Nanofiber, Phase Change Materials, COMSOL, Composite, Thermal Management.

Simulation of Release of Vitamin B_{12} on Hydrogel Drug Delivery Systems

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Abstract

In this paper, the production and release of vitamin B12 on the hydrogel carrier of hydroxyethyl methacrylate polymer were simulated by using COMSOL software. Three parameters were investigated in the simulation: system boundary velocity, initial concentration of drug loaded on carrier, and thickness of the hydrogel membrane. The provided results of the simulation revealed that in order to control optimal drug release from carrier into body, the thickness of the hydrogel carrier should be increased; In addition, the concentration of drug on the carrier increased more than the desired amount of over a period of time; Also the boundary layer's velocity of the system is proportional to the velocity of water infusion into the hydrogel. The optimal simulation outcomes were obtained by initial concentration of 1000 mole/m^3 for vitamin B_{12}, thickness of 0.0004 mm for hydrogel membrane, and constant velocity of 2×10^{-11} m/s. In this study, the time required to reach equilibrium concentration for the constant boundary of system is 120000 s, while this figure for a moving boundary with the constant velocity of 2×10^{-11} m/s is 210000 s, and also for a moving boundary with variable velocity which is depended on time is 210000 s.

Keywords: Release of Drug, Vitamin B_{12}, Hydrogel Carriery Simulation, COMSOL.

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Two-Phase Flow Analysis in the Recirculation Region of a Gas Turbine Combustion Chamber by Changing Effective Geometrical Parameters

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Abstract

The purpose of this study is to analyze the two-phase flow in the recirculation region of a gas turbine combustion chamber by changing the effective geometrical parameters of its swirler. The natural and forced rotational flows caused by the geometry of the combustion chamber and flow field conditions have significant effects on combustion and air-fuel mixing. In this study, finite volume method and unstructural meshing are used in a commercial computational fluid dynamics software package in order to investigate the effects of rotational flow injection in combustion chamber and to carry out a parametric study. The obtained results show the volume of the recirculation zone in the primary area of the combustion chamber increases as the swirl number rises. This increases the turbulence intensity and improves air-fuel mixing.

Keywords: Two-Phase Flow Simulation, Gas Turbine, Combustion Chamber, Swirler, Recirculation Region.

Investigation of the Roughness Effects of Heat Transfer Surface in the Pool Boiling in Acetone-Isopropanol Solution

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Abstract

In this laboratory study, the effect of increasing the surface roughness of heat transfer surface on the heat transfer coefficient in the pool boiling was investigated in two-part solutions of acetone and isopropanol with constant volume percent (% 30 acetone and% 70 isopropanol as well as solution of 70% acetone and 30% isopropanol). The experimental set up consists of an insulated glass cube, a bronze metal cylinder as a heat transfer surface, a pencil light bulb connected to auto transformer as a thermal source. The tests were carried out with four different roughness of the heat transfer surface. The range of heat fluxes is from 5.1 to 88 kW/m^2 and in atmospheric conditions. The results show that by increasing roughness, the surface of the bubble production in the solution is increased, which leads to promote of mixing and, consequently, increase in the heat transfer coefficient. The optimal model with maximum overlapping with the experimental results revealed that the Vinayak model with a mean error of 15% has the least error, and Tome model with a mean error of 27% has the most error among other models.

Keywords: **Boiling Heat Transfer Coefficient, Bubble Nucleation Sites, Binary Solution, Surface Roughness.**

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Thermodynamic Modeling Of Municipal Solid Waste Thermal Plasma Gasification Process

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Abstract

Thermal plasma gasification is a new and innovative method of waste management. In this study, the process of gasification of municipal solid waste in thermal plasma reactor has been simulated using Gibbs free energy minimization method with the help of Aspen Plus software. And validated with data from scientific sources. Most of the operational parameters such as air to waste ratio, reactor temperature, pressure to waste ratio and lower calorific value of gas have been studied by describing the manufactured syngas. The highest hydrogen content was 67%, which was calculated for gasification with steam plasma, And the lowest calorific value of the gas compared to 11/6 (MJ/Nm^3) was calculated. Due to the very high temperature created by plasma, many pollutants that are a big problem for conventional methods do not affect this process.

Keywords: **Gasification, Aspen Plus, Thermal Plasma, Synthesis Gas, Modeling.**