

Experimental Investigation of the Forced Convective Heat Transfer Coefficient of Nanofluid in the Double-Pipe and Plate Heat Exchangers

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Abstract

Nanofluids are suspensions of nanoparticles in base liquid and can be employed to increase heat transfer rate in various applications. In this work forced convective heat transfer coefficient of Al₂O₃/Ethylene Glycol nanofluid have been investigated experimentally in the double-pipe and plate heat exchangers. Experimental results indicate that heat transfer coefficient increases with nanoparticles concentration as well as operating temperature. Considerable deviations for high operating temperatures and nanoparticles concentration were observed from comparison of experimental and semi-empirical correlations' results. The nanofluid Nusselt number for different nanoparticles concentrations as well as various operating temperatures was obtained and shown the enhancement up to maximum 50% using nanoparticles.

Keywords: Nanofluid, Alumina, Copper oxide, Heat Transfer Coefficient



Introduce a New Equation to Predict Amount of Adsorption

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Abstract

The purpose of this study is mathematical investigation of aggregation adsorption isotherm models in a five parameter equation. This equation can cover Langmuir isotherms, Freundlich, Hill, Redlich-Peterson, Sips, Toth, Koble-Corrigan, Khan and Radke-Prausnitz in the form of an equation. The mentioned equation were fitted with experimental data using some common numeric analytical software and the results were compared with the corresponding values other forms of nonlinear isotherms.

In order to find the best isotherm for better matching with the experimental data, the error analysis methods such as sum of squares and the correlation coefficient were used. The experimental data used in this study, the best results were for experimental data of the adsorption of aniline, phenol, methylene blue, and cadmium. The mentioned equation with having the lowest sum of squared errors and the highest correlation coefficient is an appropriate equation for fitting the experimental results. The results confirm that increasing the number of parameters in an equation lead to the better fitting of experimental data.

Keywords: Adsorption, Adsorption Isotherm, Physical Adsorption, Chemisorption

Investigation on the Effect of Additive on the Pour Point of Waxy Crude Oils

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Abstract

In this work, the influence of substituted fullerene on the pour point and rheological behavior of a waxy crude oil sample was investigated. The compositional analysis of crude oil was performed and then the influence of the substituted fullerene on the viscosity and pour point of waxy crude oil was evaluated. The results show that the substituted fullerene reduces the pour point of the waxy crude oil in all concentrations. Also, the results indicate that viscosity reduces by increasing the concentration of substituted fullerene at constant temperature and shear stress. While viscosity increases by decreasing the temperature of crude oil. It is obvious that by increasing the shear rate the viscosity decreases dramatically. Results show that the shear rate has considerable effect on decreasing viscosity particularly at temperatures below the pour point.

Keywords: Substituted Fullerene, Crude Oil, Pour Point



Agglomeration Phenomena of Aluminum Nanoparticles in Polymer Matrix Composite During Combustion

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Abstract

Improving the combustion efficiency is influenced by reduction of Metal particles agglomeration. Due to particles size dependent properties, many studies have been done on nanoparticles and their applications including the energetic composites. Studies show that the agglomeration mechanism does not depend on the individual properties of initial particles but related to temperature of metal fuel ignition comparing with the decomposition temperature of carbonaceous elements. Therefore metal nanoparticles due to their low ignition temperature and very small particle size influence on quality and quantity of agglomeration respectively.

Keywords: Agglomeration, Combustion Product, Nanoaluminum, Polymer Composite

Application of Surfactant Modified Magnetic Nanoparticles to the Extraction, Preconcentration and Determination of Pollutants in Water Samples

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Abstract

Analysis of pollutants in water samples is very important. In recent years, separation technology based on magnetic materials has received considerable attention. These magnetic nanoparticles are not target selective and are unsuitable for samples with complicated matrices. Therefore, a suitable coating is essential to overcome such limitations. Surface modification stabilizes the nanoparticles and prevents their oxidation. This article dealing with the application of surfactant modified magnetic nanoparticles, to the separation and the preconcentration of pollutants in water samples. The magnetic extraction method is not only convenient, economical and highly efficient, but it also overcomes problems with conventional solid-phase extraction such as packing of sorbent into the column and time-consuming loading of large volume samples.

Keywords: Magnetic Nanoparticle, Magnetite, Surfactant, Micell, Cetyltrimethylammoniumbromid



CFD Simulation of Phthalic Anhydride Reactor Performance in Farabi Petrochemical Company

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Abstract

In this paper, multitube reactor with a fixed bed catalyst to produce Phthalic anhydride using Computational Fluid Dynamics (CFD) has been studied. Therefore, based on the reaction kinetics, phthalic anhydride conversion and temperature changes during reactor length have been modeled in FEMLAB software by applying the appropriate boundary conditions. The CFD simulation results show good agreement with operation data in Farabi petrochemical company for conversion to the desired product as well as the formation of hot spot locations along the reactor. Phthalic anhydride conversion rate and temperature distribution along the reactor for different operating parameters such as feed flow rate, feed concentration, inlet temperature and wall temperature has been studied. The results show that the hot spot due to high rate of reaction has been located nearby the entrance of reactor. Salt bath temperature is an important factor in the operation of o-xylene oxidation reactor. So that, even 1°C increasing in salt bath temperature, create higher reaction rate, result in enhancement in o-xylene conversion.

Keywords: Phthalic Anhydride, Computational Fluid Dynamics (CFD), Multitubepacked Bed Reactor, Hot Spot, Bath Salts

An Introduction to the MARKAL Energy Systems Modeling

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Abstract

Primary energy supplies and their limitations, environmental protections and respective effects upon climate variations are the major challenges the future world energy is faced with. Routes to carbon emission control are indeed the most important issues needed to be considered. In this venue, modelling of systems predicting the current trends as well as; considering long term effects of applying different related policies might be utilized as a major quantifying tool. Amongst different models developed for this purpose, MARKAL is a model capable of evaluating such policy makings in energy sector on international, national or local levels. Moreover, this model understudied in the present research is able to provide complex relationships for an energy system under the competing states of resources and technologies upon conversion and consumption as well as; considering their environmental impacts.

Keywords: Energy Systems Modeling, MARKAL Model, Optimization, Environmental Impacts



The Impact of Application of Heat Transfer Enhancement Technologies on Design of Shell and Tube Heat Exchangers

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Abstract

Shell and tube heat exchangers are widely used in various industries. This article seeks a quantitative approach to assess the impact of application of heat transfer enhancement technologies on design of shell and tube heat exchangers. Therefore, at first the thermal characteristics (i.e. Nusslet Number) and friction factor of pure fluid, Water- Aluminum oxide nanofluid in a tube equipped with twisted tape turbulator calculated. Then to avoid lengthy trial and error procedure, which commonly applied in heat exchanger design procedures, MATLAB code based on rapid design algorithm is developed. In this paper, the impact of using the heat transfer enhancement techniques in individual and hybrid format on design parameters has been studied.

Keywords: Heat Exchanger, Heat Transfer Enhancement, Twisted Tape Turbulator, Water- Aluminum Oxide Nanofluid, Rapid Design Algorithm

Nanodiamond and its Polymeric Nanocomposites, A Review

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Abstract

Improving mechanical, thermal and abrasion resistance of different polymer nanocomposites with nanodiamond particles have been interested for researchers in recent years. This review article is focused on nanodiamond, its production and preparation from nature briefly, synthesis and preparation of its polymer nanocomposites. In most of these nanocomposites, thermal, mechanical and abrasion resistance properties were improved by use of nanodiamond in polymer matrix. As an example: tensile strength of poly vinyl alcohol based nanocomposite with 5% nanodiamond increased from 95 MPa to 124 MPa and its tensile modulus from 3.7GPa to 10.6GPa. The tensile strength is also increased by 20% in epoxy resin/nanodiamondnanocomposites. Thermal degradation temperature of polypropylene and ethylene-propylene dien monomer elastomeric blend was increased about 46°C by using of 5% nanodiamond in their composition. Obvious increasing in mechanical,thermal and abrasion properties were also observed forpolyurethane elastomer and rubber compoundsby applying only 1% and 3%nanodiamond respectively.

Keywords: Nanodiamond, Nanocomposites, Mechanical Properties, Thermal Stability, Abrasion Resistance