Retrofit of Atmospheric Heat Exchanger Network in Shiraz Petroleum Refinery

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Abstract

In order to reduce the cost of production, reduction in energy consumption is one of the most important priorities. Distillation unit at the Shiraz refinery is one of the most energy consuming units. This section consists of atmospheric distillation, vacuum distillation, stabilizer and visbreaker. Several valuable works have been done in this regard, however, due to energy wise, actually some of these proposals have failed to solve the problems of heat exchanger networks. Nevertheless suggestions were presented in this paper for distillation section is practical and feasible. Due to restrictions such as constraint match, replacement pump and other engineering problems, two scenarios have been proposed assuming constant pressure drop and α. The results show that, 313,000 Euros and 696,725 Euros will be invested in order to reduce energy consumption of 13.7% and% 15.6 %, respectively.

Keywords: Heat Exchanger Network- Retrofit of Heat Exchanger Network- Atmospheric Unit.

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Investigation and Analysis of Concentration Polarization and its Consequences in Modeling the Performance of Polymeric Gas Separation

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Abstract

Concentration polarization in the membrane processes refers to the phenomena caused as a result of increasing the concentration of less permeable component at the close boundary of the membrane surface. This leads to the concentration gradient in between the surface and the bulk phases with negative effects on the permeation driving force as well as selectivity and process performance. Upon emergence of the new generation of polymeric membranes possessing accelerated flux and permeability, concentration polarization and its effects have gained more attentions in process modeling and performance evaluation. Accordingly, numerous mathematical models have been proposed by various researchers aiming to shed lights on the role and effects of concentration polarization in gas separation membranes. In-depth investigations and analysis of the subject toward reaching comprehensive and concluding remarks are necessary considering the complexities involved in the subject. The main purpose of this study is to provide an overview on the key principles of concentration polarization, to review and analyze the most important research studies carried out in this field in the past few years and to reinvestigate the governing equations associated to the concentration polarization and its effects on the performance of polymeric gas separation membranes.

Keywords: Concentration Polarization, Polymeric Membrane, Modeling, Supporting Porous Layer, Gas Separation.

Study of Grease Interceptors in Mashhad City and Presenting an Appropriate and Efficient Design

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Abstract

In this study, strengths and weaknesses of installed or under installation grease interceptors in Mashhad city were identified. A new grease removal system was then designed and built to resolve these weaknesses. The system was an 800 L cylinder (1 m diameter and 1 m height) from galvanized metal coated with two layers of composite at both sides. A cubic basket (20 × 20 × 20 cm) was installed at the system inlet to prevent entering trashes into the system. Removability of the basket and two baffles installed on the system facilitates discharge and cleaning process. A grease remover bridge of 50 cm length equipped with a gearbox motor (12 V, 3 rpm), discharges accumulated grease automatically in adjustable time periods. The system was designed based on retention of 30 min. This system offers several advantages including low volume and weight, easy and quick installation, safety and low costs. The oil concentration in the outlet stream is below 100 ppm which meets the standards for discharge to the sewage network.

Keywords: Fat, Oil and Grease, Grease Interceptor, Sewer Lines Blockage, Mashhad City.

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Novel Design for Plate Heat Exchanger in LNG Liquefaction Cycle

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Abstract

LNG project is intrinsically a complex process that accompanied with liquefaction section. It almost dedicates the 50% of total project costs. Liquefaction section is the key point of this process and designers are commonly interested to keep the costs in lowest level and affect the process activeness. The most important elements in liquefaction process are heat exchangers that made by Plate Fin or Spiral Wounded types. In this paper, as a first step, a LNG liquefaction cycle with triple mixed refrigerator is simulated and then a new procedure for designing of plate fin heat exchanger is developed. A method also for selection of the best secondary surface based on volume performance index is presented. As a result the designed heat exchangers gives lowest volume and lower heat exchanger surface would have important role in reduction of investment costs. As a case study, a feedstock, belonging to pre-cooling unit of Iran LNG project, was used. The calculated surfaces by traditional simulation of cold and hot ends surfaces of heat exchanger and overall heat transfer coefficient (OHTC) are 3001 m^2, 1933 m^2 and 425 $W/m^2.K$ respectively. After designing an optimum geometry with new developed rapid design algorithm (RDA), the obtained surfaces for cold and hot ends and the overall heat transfer coefficient were 575 m^2 and 842 $W/m^2.K$ respectively. The outcomes of this study revealed that a great significant reduction in design an industrial compact heat exchanger with cold and hot end surfaces about 5.2, 3.3 times lower respectively and about 50 percent increase in OHTC.

Keywords: Liquefied Natural Gas, Volume Performance Index (VPI), Rapid Design Algorithm.

Modification of Heat Transfer Surfaces to Reduce Crystallization Fouling Based on Polar Component of Surface Energy

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Abstract

Deposit formation in heat exchangers causes increased pressure drop, flow non-uniformity, energy loss and deterioration of efficiency. A novel, efficient, and environmentally friendly approach to mitigate deposition in heat exchangers, is surface treatment. Surface energy and its polar and dispersion components are modified by coating of surfaces to mitigate fouling. In this study surface energy and its polar and dispersion components are calculated by Wu and OWRK approaches. The determination of surface energy and its polar and dispersion components for crystallization fouling showed that formation of precursor on substrates reduces by increased polar component of surface energy. Comparison with experimental data points associated with $CaSO_4$ crystallization fouling confirm this propensity.

Keywords: Heat Exchanger, Fouling, Surface Energy, Polar Component of Surface Energy.

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2-D Simulation of Natural Gas Leakage from Town Border Distribution Gas Pipelines

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Abstract

In this paper by using Fluent software, is paid to numerical simulation of natural gas leakage from a small hole located on the lateral surface of the urban distribution gas pipe lines. The geometry is designed and meshed by Gambit software and methane with Ideal-gas assumption considered as natural gas and flow is turbulent. The results indicate that for small hole diameters, discharge speed reaches the sound speed and at the so-called, choking occurs in the flow. The volumetric flow rate of leaked gas has a second order relation with hole diameter and linear relation with pressure of initial point. Finally a simple useful correlation is developed to calculate the volumetric flow rate of leaked gas. Also data analysis shows that in most of the investigated cases, the percentage of relative error is below 10% which implies high accuracy of the presented correlation.

Keywords: Natural Gas Leakage, Distribution Gas Pipelines, Two-Dimensional Simulation, Fluent.

Economic Analysis and Evaluation of Process of Co-Generation of Dydrogen, Methanol, and Power from Biomass

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Abstract

Using bio-fuels in energy intensive sectors not only has the potential to increase the efficiency of utilization of resources but also helps to have secure resources and to speed up sustainable development. In this paper a process to co-generation has been designed and its performance has been evaluated. In this regard, the effect of change of some of operational parameters has been presented on the process performance. The rates of methanol and hydrogen production in the base case are 16 and 4 tonne per hour, respectively. Besides, the process has the potential to generate 45 megawatts power and the net profit is calculated to be 360 million dollars that may have economic attractiveness. Considering the costs of the base case process (41 million dollars) regardless the profit due to sale of products, the costs of producing methanol, hydrogen, and power are 300 dollars per tonne, 2 dollars per kilogram, and 3 cent per megajoules, respectively. These costs are attractive in comparison with the market prices which are 549 dollars per tonne methanol, 10 dollars per kilogram hydrogen, and 3 cent per megajoules power.

Keywords: Co-Generation of Methanol, Hydrogen, and Power; Biomass; Alternate Fuels.

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Nanocomposites in Drug Delivery

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Abstract

During recent years, nanocomposites as drug carriers for effective drug delivery has been extensively used in both academic and industrial research and development. This new type of composite materials frequently displays considerable improvements of material properties when compared to the matrix solid alone, or to conventional microcomposites. These outstanding characterisitcs include mechanical properties, molecular permeability and the control of drug release, as well as properties related to engineering points of view, such as thermal stability, chemical resistance, surface appearance, electrical conductivity, and optical clarity. The controlled release of drugs from nanocomposite systems aims at their delivery at optimum amount for long periods, at increasing the efficacy of the drug, and at improving patient satisfaction. This review paper has been discussed to introduce some nanocomposite systems and to state their application for drug delivery.

Keywords: Nanocomposites, Drug Carriers, Drug Delivery.

A Review on the Hydrogen Production Process by Photocatalytic Water Splitting

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Abstract

Today, because of safety and environmental reasons, the necessity to find the alternatives to fossil fuels is obvious. Hydrogen is a suitable and potentially alternative energy to fossil fuels and various technologies have been developed to produce this fuel source. Conventional technologies for hydrogen production cause large amount of the greenhouse carbon dioxide gas that are associated with environmental problems. Due to the importance of renewable energy, the use of photocatalyst and sunlight for water splitting and hydrogen production is a favorite method. In this process, water as a raw material and sunlight as an energy source are used. In this review paper, the process of water splitting to produce hydrogen by photocatalytic process will be studied and types of used photocatalysts in this process and also the ways to improve the efficiency of this process will be investigated and also recent researches in this field to develop this process will be discussed.

Keywords: Water Splitting, Photocatalyst, Sunlight, Hydrogen, Fossil Fuels.