Investigation on the Effect of Non-Ideal Conditions in Modeling of Gas Separation Process by Hollow Fiber Membrane Modules

J. Aminian Dehkordi[1], S. S. Hosseini[2*]
1- M.Sc. in Chemical Engineering, Tarbiat Modares University
2- Assistant Professor of Chemical Engineering, Tarbiat Modares University
Email: Saeid.Hosseini@modares.ac.ir

Abstract

Hollow fiber membrane permeators due to their particular features have attracted attentions in the industry and especially for gas separation applications. Several mathematical models have been proposed by researchers for the analyzing and interpretation of this process as well as for gaining a better understanding of gas separation by means of asymmetric hollow fiber membrane modules. The most important index for the validity of the models is the accuracy of their predictions compared to the real conditions. Investigations indicate that considering non-ideal conditions in the mathematical models can lead to more accurate predictions. The aim of the present study is to investigate the extent and effect of several non-ideal conditions in the modeling of gas separation hollow fiber membrane modules. Accordingly, non-ideal conditions are being investigated in three categories of: non-ideal conditions related to the process, permeation through the membrane and those related to the membrane structure. Discussions in the present manuscript constitute an important step in process modeling toward improving predictions on the performance of hollow fiber membrane modules for gas separation applications.

Keywords: **Gas Separation, Hollow Fiber Membranes, Mathematical Modeling, Non-Ideal Conditions.**

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CFD Analysis of Twisted Tube Heat Exchangers

M. R. Jafari Nasr[1*], M. Shafighi[2]
1- Professor of Chemical Engineering, Science and Research Branch,
Islamic Azad University, Tehran, Iran
2- B. Sc. in Chemical Engineering, Science and Research Branch,
Islamic Azad University, Tehran, Iran
Email: drnasr50@yahoo.ca

Abstract

Using of twisted tubes is one of the most promising technique to increase heat transfer between hot and cold fluids. In this study, the ratio of oval cross sections and number of twists in the Reynolds range of 1000 to 15000 were analyzed by computational fluid dynamics tools. The ratio of oval cross sections between 1 and 2.5 and the number of twists between 0 and 3 are considered for a case study. Basically, increasing the Reynolds number, increasing the cross section diameter ratio, and increasing the number of twists increase the Nusselt number and the friction factor simultaneously. In this case study, the ratio of oval cross sections 1.67 and the length of the twisted of 3 (0.6 m), reveal the best performance to achieve the optimal pressure drop and Nusselt number, respectively.

Keywords: **Heat Exchangers, Twisted Tubes, Computational Fluid Dynamics, Pressure Drop, Heat transfer Coefficient.**

Optimization of the SO_3 Content of an Algerian Portland Cement: Study on the Effect of Various Amounts of Gypsum on Cement Properties

Siline Mohammed, Omary Safiullah
Laboratory of Materials and Mechanic of Structures (LMMS), University of M'sila, Algeria
ICube, UMR CNRS 7357, INSA de Strasbourg, France

Translated into Farsi by S. Mansouri
B. Sc. in Chemical Engineering, Khash Cement Company
Email: Smansouri.eng@gmail.com

Abstract

Portland cement CEM I is obtained from (95–97%) of clinker and (3–5%) of gypsum, according to EN 197-1 (2011) standard. Sulfur trioxide SO_3 is the main component of gypsum (Calcium Sulfate Dihydrate CaSO4_2H_2O), it may also originate from clinker, the previous standard has limited its content in cement at 4%. It is known that the gypsum acts as a cement setting regulator, however, an appropriate gypsum quantity (optimum) may improve other properties such as: mechanical response, dimensional variations and hydration process. This optimum gypsum content is related to several parameters, namely: SO_3 %, cement SSB (specific surface Blaine), C_3A % and alkali %. The aim of this work is to find, through an experimental protocol, the optimum gypsum content of an Algerian Portland cement CEM I. 10 variants containing various % of gypsum were formulated, where properties of anhydrous cements, cement pastes and normalized cement mortars were studied. Results show that when gypsum is added below or above the optimum, water demand for normal consistency, setting times, compressive strength, heat of hydration, swelling, drying shrinkage and hydration degree were adversely affected. It has been experimentally demonstrated that this optimum gypsum content is 5.5% by weight.

Keywords: Cement, Gypsum Content, SO_3, Optimum, Hydration.

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Effect of Operating Parameters on Performance of Industral Reverse Smosis Membane with Emphasis on Carbonate and Bi-Carbonate Rejection

A. Ehsani[1], A. Soleimani Mehr[2*], D. Hajian Nejad[3], H. Bataghva[1], M. Zanganeh[4]
1- M.Sc. in Chemical Engineering, Shahid Hasheminejad Gas Processing Co.
2- M.Sc. in Gas Processing & Trasnsfor Engineering, Shahid Hasheminejad Gas Processing Co.
3- M.Sc. in Electronic Engineering, Shahid Hasheminejad Gas Processing Co.
4- B.Sc. in Chemical Eingineering, Shahid Hasheminejad Gas Processing Co.
Email: Petro.amin@gmail.com

Abstract

Concerning the importance of distilled water chemical specification, studying operational condition effect on product quality is extremely important in Utility Areas. Considering geographical locating of many chemical and petrochemical units in Iran, these facilities are forced to consume brackish water as feed for their utility. Hence, different challenges are formed compared with coastal units use sea water instead. Our sample during this study imports brackish water with E.C≈ 2500, T.H≈550 into the softener resin beds for feed water softening. Then the first R.O. unit is employed to produce DM water with E.C≈ 25, T.H≈0. Finally, the most valuable part of our production chain is another R.O. unit which supplies high purity Distilled water as the feed of Utility. There are several important parameters to evaluate permeate quality or the last unit's performance including Anions concentration (Na, Ca, Mg, K) and Cations concentration (CO32-, HCO3-, Cl-, SO42-). Clearly. The most important parameter is supposed to be chlorine, Carbone and bicarbonate concentration which was studied during operational tests. Hence, the sensitivity of product quality with process variables such as feed pH, retention time, R.O. element pressure and temperature were examined and adjusted rigorously.

Keywords: Distilled Water, Reverse Osmosis, Caustic Injection, Alkalinity, Membrane, Carbonate.

Experimental Study and Mathematical Modeling of Starch Extraction from Pollen Rice by Alkali Solvent

A. Noori Veshkasoogheh[1], K. Movagharnejad[2]
1- Master of Chemical Engineering, Babol Noshiravani University of Technology
2- Professor of Chemical Engineering, Babol Noshiravani University of Technology
Email: movagharnejad@yahoo.com

Abstract
In this study, leaching during extraction of starch from pollen rice using sodium hydroxide as the solvent was investigated. Leaching experiments were carried out at 20, 30, 40 ºC and 50 ºC and amount of starch extracted from the samples were evaluated at different process duration times. The effect of temperature and time on the concentration of extracted starch has been studied. According to the results, increasing the temperature and time of the leaching increased the amount of starch extracted from the rice, and also the concentration of starch extracted by the multilayer perceptron network is predicted. Three-layer neural network structure 2-13-1 consists of input data and an intermediate layer and an outlet layer with 13 neurons in the middle layer, which is the most suitable structure for optimizing the neural network. The total data regression is 0.99646, which focuses on the 45 ° line of data well-defined. The mean square error (MSE) for the total data is 0.000066047 and the root error square (RMSE) for the total data is 0.0081269.

Keywords: Mathematical Modeling, Leaching, Pollen rice, Perceptron Multi-Layer Neural Network.

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Spray Dryer Design for Tomato Powder Production

V. Ghaleh Khondabi[1], A. R. Fazlali[1*], M. Zolfaghari[2]
1- Department of Chemical Engineering, Faculty of Engineering, Arak University, Arak, Iran
2- Department of Mechanical Engineering, Faculty of Engineering, Arak University, Arak, Iran
Email: a-fazlali@araku.ac.ir

Abstract
In this investigation, the principles of designing spray dryers and the effect of process parameters on dryer performance were discussed. To obtain preliminary design data, from the results of previous research and experiments were carried out with a laboratory spray dryer on tomatoes were used. Following a large study, a pilot spray dryer equipped by a conical bottom chamber was designed with powder production capacity of 50 kg/h, evaporation capacity of 293 kgH_2o/h and feed rate of 343 kg/h. The co-current rotary atomizer for feed spray and the cyclone for powder separation from exhaust air were selected. An indirect heater for heating the airflow and a backward-centrifuge fan to provide air flow rates were proposed.

Keywords: Design, Drying, Tomato Powder, Spray Dryer.