A Review on Polymer-Clay Nanocomposites and Models Governing Their Permeability

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Abstract

Specific characteristics of nanocomposite materials, as a most applicable class of materials in the field of nanotechnology, are due to the presence of nanosclae particles in their structures. The types of filler nanoparticles and the polymeric matrix of the nanocomposites are two important parameters affecting the properties of the nanocomposites, specially their permeability. In this article, polymer-clay nanocomposites were reviewed in brief and models governing the permeability of this kind of nanocomposites summarized. Furthermore, the effects of the characteristics of the clay nanoparticles on the permeability of the polymer-clay nanocomposites have been investigated on the basis of the mathematical models. The models show that the impermeability in polymer-clay nanocomposites could be achieved by maximizing the aspect ratios of nanoparticles, creating a perpendicular orientation of clay layers with respect to the diffusion path, enhancing the interaction between the nanoparticles and polymeric matrix and increasing the volume fraction of the nanoparticles.

Keywords: Nanocomposite, Clay, Permeability, Mathematical Model.

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Improving the Efficiency of Rotary Dryer of the Sarcheshmeh Copper Complex

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Abstract

At the Sarcheshmeh copper complex, two rotary dryers are used to decrease the moisture content of the final concentrate. One of the most challenging problems was the blockage of hot gas chamber by the wet concentrate. This reduced the operational time and significantly increased the repair and maintenance costs. It was found that the main causes of blockage of hot gas outlet chamber was an excessive moisture content of the feed and the splashing of material into the chamber. The latter was due to the contact of the material with the body of the dryer and the underlying materials. In order to prevent the blocking of the hot air, the angle of the lifter plates was reduced from 90 to 75˚, the elbow angle of the hammer body increased from 135 to 155˚, and the ceiling of the hot air chamber was extended 70 cm into the dryer rotating section. After these modifications, in order to monitor the blockage process of the hot air chamber, the images of blockage level of the hot air chamber were captured and analyzed daily. Furthermore, the temperatures of the beginning and end of the combustion chamber was recorded and compared with the profiles before modifications. On account of these modifications, the operational period increased from 7 to18 days. In addition, the temperature of the dryer end point, which is an important indicator in determining the drying performance and moisture content of the product, was kept constant at about 90 °C. The temperature at this point before modifications was 50 °C which showed a significant increase in the drying performance.

Keywords: Dryer, Concentrate, Combustion Chamber, Chamber Blockage.

Artificial Wetland Performance in Removal of Cadmium and Lead from Oil Effluent with Vetiver Plant

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Abstract

Since in region of Khuzestan, different industrial wastewater, which mainly contain heavy metals, this research was carried out to investigate the efficiency of the artificial forging system under the cultivar of Vetiver, with vertical flow In the removal of lead and cadmium from industrial wastewater. In this study, culture mediums with a diameter of 60 and a height of 100 cm were used. The input concentration of cadmium and lead of waste water in the system was 20 and 50 mg/L, respectively. In this study evaluated, the effects of two depths of 45 and 70 cm, as well as remaining time of 5, 10 and 15 days and also removing efficiency, Bioconcentration factor and Translocation factor were examined in three replication and Duncan test. The results showed that concentrations of lead and cadmium metals were high in underground tissues of plant rather than aboveground tissues via accumulation in plant tissues, which could be due to the low mobility of these elements from root to aboveground tissues such as shoot and leaf. Also, the cadmium transfer index was more than lead, which indicates the high ability of the transfer of this metal in the plant.

Keywords: Artificial Wetlands, Vetiver, Cadmium, Lead, Phytoremediation.

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Computation of Gaseous Chemical Equilibrium of Reforming Reaction Using Numerical Methods

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Abstract

In most chemical processes quantitative determination of chemical species is of significant importance. The phase equilibrium modeling for multi-component systems is essential in the design, operation, optimization and control of separation schemes. Phase equilibrium calculations are usually executed in process simulators of the chemical, petroleum, petrochemical, pharmaceutical and other process industries where separation units are the core of process performance. Hence, these calculations must be performed reliably and efficiently, to avoid uncertainties and errors in process design. While molecular weights, specific heats and heat quantity of gaseous systems is a function of species concentration, knowing chemical composition in computation of heat transferred and total pressure of gaseous systems is important in chemical process control. In the past decades computational methods of chemical compositions has been investigated. In the presents study two general approach for computation of chemical composition including equilibrium methods and minimum Gibbs free energy methods has been discussed. Lagrange multiplier method as an optimization method has been used for chemical equilibrium calculation of methane reforming and change in reacting species composition has been obtained as a function of temperature. Results of computation shown as the reaction temperature increase from 800 to 1200, the amount of H2 and CO_2 increased. This is due to the nature of the endothermic reactions and the selectivity of H2 and CO_2 as final products at high temperature.

Keywords: Chemical Equilibria, Gaseous Mixture, Lagrange Multiplier, Reforming.

Feasibility of Reducing Waste in Old Gasoline Production Unit of Tabriz Oil Refining Company Using Material Flow Cost Accounting (MFCA)

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Abstract

Due to the environmental issues and problems caused by excessive waste production in the oil industry, environmental protection agencies impose some rules and restrictions on various industrial activities that require accounting, environmental assessment, and problem detecting and solving. In the present article old gasoline production unit of Tabriz Oil Refining Company has been investigated using the Material Flow Cost Accounting (MFCA). The results showed that only 73% of the unit output is positive products which comprises gasoline and hydrogen, and the rest, which equals to 27% of outputs, is negative products, which costs 1350 billion Rials per year. In order to reduce costs in this unit, the heat stored in exhaust gases in furnace chimneys was reused and it was found that this would prevent the loss of 562 million Kilojoules of energy and heat to the atmosphere per minute. Other suggested methods include the use of variable speed electric drives in unit's electromotors, which showed that by using variable speed drives, the cost of energy consumption would decrease by 30%, which is equivalent to 763 million Rials per year.

Keywords: Material Flow Cost Accounting, Gasoline Production Unit, Tabriz Oil Refining Company.

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Biodiesel and Biohydrogen Production from Organic Waste

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Abstract

Biofuels are a new priority to reduce fossil fuel consumption, its contamination and the problem of waste disposal, hence extensive research has been done on biofuels production, effective factors, and optimization of the process. Production of biodiesel and bioethanol from organic waste is possible on an industrial scale. Volatile fatty acids can be produced from organic waste and then turn to biogas, biohydrogen, and biodiesel. In this paper, the production of biodiesel fuel, biohydrogen, volatile fatty acids and its conversion to biodiesel are discussed. Biodiesel production by transesterification in the presence of a catalyst is an appropriate method. Moreover, dark fermentation produces the most amount of biohydrogen and it needs the lowest volume reactor among other biological methods. In this paper, firstly different methods of biodiesel production and effective parameters and then, biohydrogen production and effective parameters have been discussed.

Keywords: Biofuels, Organic Waste, Biodiesel, Biohydrogen, Volatile Fatty Acid.