A Review on the Biosurfactants: Characteriszation and Applications

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Abstract
In recent years, with the industrialization of societies, population growth, and pollution around the world, the tendency to the use of biosurfactants has increased. Microorganisms produce a wide range of surface-active compounds called biosurfactants, which are amphiphilic compounds with hydrophilic heads and hydrophobic tails. These compounds are mainly classified according to their molecular weight, physico-chemical properties, and microbial origin. Low molecular weight biosurfactants reduce the surface tension of water/air or water/oil, while bioemulsifier with high molecular weight are effective in stabilizing emulsions. Biosurfactants, due to their properties and potential advantages over chemical counterparts such as low toxicity, high biodegradability, critical micelle low concentration and tolerance of temperature, ionic strength and pH, are widely used in various industries such as petroleum, food, medicine, cosmetics, detergent, ariculture and environmental bioremediation. However, due to the high cost of production, their large-scale production and applications are limited. That's why industries and researchers are looking for methods such as using low-cost substrates such as molasses, vegetable oils, and whey to reduce the high cost of these green products in the industrial scale. In this study, several important aspects of biosurfactants, such as classification, characteristics, factors affecting production, evaluation indicators and test methods, and their application in various industries have been discussed.

Keywords: Biosurfactant, Bioemulsifier, Surface Tension, Characterization, Industrial Application.

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Mass Transfer Modeling in the Process of Thyme Essential Oil Extraction and Evaluation of Physico-Chemical Properties

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Abstract
Thyme (Thymus vulgaris L.) is a medicinal plant which its essential oil has been widely used due to its unique properties. Different extraction methods have been utilized to extract plant essential oil and in the present study, hydro distillation glass-Clevenger apparatus was used for extraction of thyme essential oil for 2 h. Obtained result indicated that thyme essential oil extraction yield was 2.32% (v/v). Furthermore, a mathematical model to predict and model the thyme essential oil extraction curve by Fick's second law was utilized. This model was established based on difference of the concentration of points and the diffusion coefficient of 4.54×10^{-11} m^2/s. The result of the curve obtained by the proposed mathematical model, fitted very well (98%) with the observed experimental results. Chemical composition assessment of the extracted thyme essential oil using GC-MS technique indicated that thymol and carvacrol are two main bioactive compounds of thyme essential oil. Antioxidant activity of the extracted thyme essential oil was also 95.1%.

Keywords: Antioxidant, Mass Transfer, Modeling, Thyme Essential Oil.

Experimental Study of Extraction of Valuable Materials of Carob Plant with Use of Supercritical Fluid Combined with Ultrasonic Waves

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Abstract

In any plant, there are hundreds chemical compositions with composition of percent and different properties. Correct separation of chemical compositions in plant and making relationship between medicinal properties of plant with effective composition can make mass production of useful drugs and likewise can prevent effects of compositions directly medicinal plant that due from other harmful compositions in plant, sometimes it can prevent. In this research, extraction of effective substance from carob plant using supercritical carbon dioxide combined with ultrasonic waves, was investigated. The supercritical fluid extraction yield was increased with increasing of pressure and particle size reduction. The use of ultrasonic wave increased the efficiency of the extraction. The best experimental conditions were obtained at pressure 210 bar, temperature 35 ℃, particle size 0.4 mm and frequency 37 kHz. In this condition, the amount of extraction efficiency is 3.7825. The gained essential oil by Clevenger and by extraction with supercritical fluid analyzed by GC and GC-Mass. After the analysis of the extracted essential oil, Acetamide, Nerolidol, Pyrrolidine, and Stigmast was selected as effective materials. Also, extraction yield (3.7825) by supercritical fluid was better than Clevenger method (1.02).

Keywords: Extraction of Supercritical Fluid, Essence, Carob Plant, Frequency Waves.

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A Review of Lithium Ion Adsorbents for Extracting of Lithium from Low-Concentration Soluble Sources

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Abstract

Due to the applications of lithium in various industries, the demand for it has increased. Seawater is a great source of lithium, but its lithium concentration is very low. Conventional separation methods are not effective in such low concentrations. Using the absorption method adopted for extracting lithium from seawater and brines with low concentration, is promising. The main problems for the practical application of lithium-ion sieve include excessive solution use, loss of adsorption pressure, difficulty in recycling powder adsorbents and poor recycling performance. Therefore, powder adsorbents have been modified for practical application by surface modification, add magnetic properties and preparing composites of them. In this review paper, different types of lithium-ion adsorbents, including types of ion sieve, crown ether, activated carbon, zeolite, and lithium aluminium layered double hydroxide chloride (Li/Al LDH) have been investigated. Various methods that improve the performance of each sorbent in practical applications have been provided.

Keywords: Lithium, Adsorption, Lithium Ion Sieve, Adsorption Capacity, Brine.

Improvement of the Performance of an Adsorption Desalination System with Regenerated Bed Heat Recovery

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Abstract

This study aims to propose a method for the thermal recovery of regenerated bed in a two-bed adsorption desalination system. It investigates the affection of thermal recovery, heating water temperature, and cooling water temperature entering the bed and condenser on the performance of the system. The analysis demonstrated that at a constant temperature of cooling water, the amount of water that is produced increases by raising the temperature of hot water and the energy consumption does not change significantly. For example, at a cooling water temperature of 20 °C, by increasing the temperature of heating water from 50 to 90 °C, the water that is produced is 3.75 times more and the energy consumption is reduced by 7.4 %. Heat recovery reduces the energy consumption of the system. As the temperature of the hot water increases, the effect of thermal recovery increases. As a result of heat recovery at a heating water temperature of 50 and 90 °C, the energy consumption of the system decreases by 10.9 % and 37.6 %, respectively. Increasing the temperature of the inlet cooling water to the bed and the condenser reduces the production of water and increases the energy consumption of the system. The effect of the temperature of cooling water entering the condenser on the water that is produced and the energy consumption is greater than that of the cooling water entering the bed. As the cooling water temperature increases, the energy-saving as a result of thermal recovery decreases. For example, At a cooling water temperature of 10 °C, thermal recovery reduces the energy consumption of the system by about 47 %, while at 23°C it is about 12 %. Again the effect of cooling water temperature that enters the condenser is more than that enters the bed. By increasing the temperature of cooling water entering the condenser from 15 to 35°C, energy savings due to the heat recovery reduces from 53.7 to 9.3 %.

Keywords: Desalination, Adsorption, Heat Recovery, Silica gel-Water, Isotherm.

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Application of Genetic Algorithm to the Calculation of Interaction Parameters of Activity Coefficient Models in Liquid-Liquid Extraction

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Abstract

Recently, optimization methods have been extensively applied in phase equilibrium calculations. Among these methods, Genetic Algorithm (GA) can be used to calculate the interaction parameters of activity coefficient models in equilibrium systems. In this study, based on the genetic algorithm, the interaction parameters of 5 activity coefficient models (2-suffix Margules, 3-suffix Margules, Wilson, NRTL and UNIQUAC) have been calculated for 20 ternary extraction systems (water + carboxylic acids + organic solvents) including 126 tie-lines. The values of binary interaction parameters of these models along with the root mean square deviations (RMSD) are reported. The mean values of RMSD of the systems in the order of the mentioned models have been calculated 0.0298, 0.0067, 0.0114, 0.0025 and 0.0052, respectively. The results show that all models except 2-suffix Margules model have relatively good accuracy. By comparing the RMSD values in literature and the values determined by GA for NRTL and UNIQUAC models, the RMSD values of the models improved from 0.0124 and 0.0181 to 0.0025 and 0.0052, respectively.

Keywords: Liquid-Liquid Extraction، Genetic Algorithm, Binary Interaction Parameters, Activity Coefficient Model, Carboxylic Acid.