Membrane Fouling in Membrane Bioreactor: Mechanism, Types, Effective Factors and Mitigation Strategies

E. Abdollahzadeh Sharghi*, L. Davarpanah
Assistant Professor of Chemical Engineering, Materials and Energy Research Center, Karaj, Iran
Email: e.abdollahzadeh@merc.ac.ir

Abstract

During the past three decades, membrane bioreactors (MBRs) have been widely used for treating different municipal and industrial wastewaters. However, membrane fouling and the high cost of the membrane are the main barriers for widespread applications of MBRs. Hence, a better understanding of membrane fouling is not only the key to solve the problem but also is one of the main factors for further use of membrane processes in future. Over the last decade, considerable researches have been conducted over understanding the membrane fouling in MBR. In this study, with the aim to control and reduce the membrane fouling in MBR systems, firstly the fouling mechanisms and different types of fouling in terms of removable, irremovable and irreversible as well as biological, organic, and inorganic fouling was discussed. Then, factors affecting membrane fouling including membrane physical properties, substrate and biomass characteristics and operating conditions was fully investigated and finally, methods for mitigating MBR fouling was outlined.

Keywords: Membrane Bioreactor (MBR), Membrane Fouling, Fouling Mechanism, Soluble Microbial Products (SMP), Extracellular Polymeric Substances (EPS), Mitigation of MBR Fouling.

❐❐❐❐

Investigation of Plate Heat Exchangers Fouling Used in Food Industries

N. Nanva Kenari[1], M. R. Jafari Nasr[2*]
1- M. Sc. in Chemical Engineering, Department of Chemical Engineering, School of Engineering, Science & Research Branch, Islamic Azad University, Tehran, Iran.
2- Professor of Chemical Engineering, Department of Chemical Engineering, School of Engineering, Science & Research Branch, Islamic Azad University, Tehran, Iran.
Email: nasrmrj@ripi.ir

Abstract

Plate heat exchangers have recently widely used in most of the industries especially in food industry. Some factors on efficiency of this equipment such as fouling are so important in design. In this study the crystal sedimentation of calcium sulphate from cane water on the sole plate heat exchanger is simulated. In order to validate the determined sedimentation rate, the designed was compared with the available experimental data. Moreover, the effect of fouling on the velocity, temperature, and the amount of heat exchanger duty factors were studied. However, the temperature and duty will be decreased during the time of process by sedimentation. In this paper, Rapid Design Algorithm (RDA) was utilized to analyze the design. The result showed that amount of heat transfer was so dependent on the rate of fouling. For instance, for flow 0.08 (kg/s), the amount of required heat transfer surface is increased from 0.12 to 0.65 (m^2) when the deposition of fouling on surface is considered.

Keywords: Plate Heat Exchangers, Simulation, Fouling Calcium Sulfate, Sugar cane Juice, Coconut Milk, Rapid Design Algorithm, Fluent.

Preparation of Organic Thin Films by Using Spin Coating and Langmuir-Blodgett

S. Raeisi[1], H. Rouhani Nejad[2], A. Molaei Rad[3*]

1- Ph.D Student of Biochemistry, Malek-Ashtar University of Technology
2- Assistant Professor of Microbiology, Malek-Ashtar University of Technology
3- Associate Professor of Biophysics, Malek-Ashtar University of Technology
Email: Molaeirad@gmail.com

Abstract

A thin film is a organic substances layer with nanometer to micrometer thickness. The controlled synthesis of thin films is an important issue in its applications. Organic thin films with nanometer thickness are useful structure for applying in sensors, detectors and electronic circuit components. Spin coating and Langmuir-Blodgett are one of the applicable techniques in thin films preparation. In spin coating centrifugal force drives the liquid radial outward and the viscous force and surface tension causes a thin film to be produced on the flat substrate. Langmuir-Blodgett films are ultra thin organic films with interesting properties such as controllable thickness, uniformity of surface and a high degree of oriented order, which make them possible options for sensors applications. In this article were investigated various aspects of spin coating and Langmuir-Blodgett based thin films.

Keywords: Thin Film, Deposition, Spin Coating, Langmuir-Blodgett, Surface Tension, Molecular Sensors.

❐❐❐❐

Investigation of the Precious Elements in the Angouran Lead and Zinc Complex

E. Kashi[1*], R. Habibpour[2]

1- Assistant Professor of Chemical Engineering, Iranian Research Organization for Science and Technology (IROST)
2- Assistant Professor of Physical Chemistry, Iranian Research Organization for Science and Technology (IROST)
Email: Kashi@irost.ir

Abstract

Metals such as cadmium, germanium, cobalt, and indium are important materials which are used in semiconductors, catalysts, batteries, glass, ceramic, abrasives, and magnets. The problem is that these metals do not generally form the primary product of mines (attractor metals or major industrial host metals), such as aluminum, copper, zinc, and lead but they are only available as byproducts or sometimes co-products of the mining and refining of primary ores. For this reason, they are called "hitchhiker" or "companion" metals. Due to the necessity of using these metals, it is beneficial to estimate the potential sources in the existing mines. In this paper, possible sources of hitchhiker metals in the Anguran lead and zinc ores were described. Research showed that extraction of elements such as cadmium, silver, arsenic, germanium, cobalt and indium were affordable. The average grade of these elements in similar mines were 1500, 78, 500, 12, 500 and 1 ppm respectively. The average grade of these elements varied in different zones of Anguran lead and zinc complex. Also in the most of the cases, they were bigger than the average grade of these elements in the similar active mines. So, more studies need to be done on the separation of these elements.

Keywords: Valuable Elements, By-Products, Lead and Zinc, Anguran.

Microalgae and Necessary Characterization in their Culture: A Review

M. Arshadi[1], S. Yaghmaei[2*], S. M. Zamir[3]
1- Ph.D Student of Biotechnology, Sharif University of Technology
2- Professor of Chemical Engineering, Sharif University of Technology
3- Assistant Professor of Chemical Engineering, Tarbiat Modares University
Email: Yaghmaei@sharif.edu

Abstract

Microalgae use of sunlight energy and by reducing carbon dioxide; convert it to biomass with a high thermal value. One of the important characteristics of microalgae is capable of photosynthesis each of microalgae cells. Microalgae growing very fast and can be compared to terrestrial plants. They can trap sunlight 10 to 50 times more than other plants and produce a lot of mass Index. In recent decades many applications for microalgae expressed. In this study, microalgae, benefits, importance, industrial applications and cultivated varieties have been studied. Also an important part of this paper examines the factors contributing to their growing. Carbon, oxygen removal, the balance between oxygen and carbon dioxide and gas exchange, nitrogen, micro nutrient, mixing, light, temperature, pH, pressure, salinity, sterilization and cleaning capabilities are the factors which affect microalgae cultivation, with detail were introduced.

Keywords: Microalgae, Types of Microalgae Cultivation, Culture of Microalgae, Microalgae Growth Conditions.

❐❐❐❐

Synthesis and Characterization of GelMa Hydrogel: A Review

K. Rahimi Mamaghani[1], S. M. Naghib[2*], A. Zahedi[3]
1- M. SC. in Nanomaterials Engineering, Iran University of Science and Technology (IUST)
2- Assistant Professor of Nanobiomaterials Engineering, Iran University of Science and Technology (IUST)
3- Assistant Professor of Energy Systems Engineering, Iran University of Science and Technology (IUST)
Emial: naghib@iust.ac.ir

Abstract

Gelatin methacryloyl (GelMA) hydrogels are one of the recent developed biocompatible and biodegradable hydrogels which have been widely applied for various bioengineering applications. The accurate understanding of synthesis parameters effect on the final GelMA properties could be helpful in designing a biomaterial with suitable biological properties and tunable physical characteristics. Generally, GelMA is synthesized through direct reaction of gelatin and methacrylic anhydride (MA), however, buffer type and polarity, initial pH, gelatin and MA concentration, stirring rate, reaction temperature and time have essential effects on the synthesized GelMA properties. GelMA could crosslink and form hydrogels by exposing to the ultraviolet irradiation. Although, GelMA hydrogel mechanical properties could be affected by ultraviolet irradiation parameters, initiator, and GelMA concentration. These variations in physical, mechanical and biological properties of GelMA candidate it in biomedical applications like tissue engineering, cell signaling, biosensing, and drug and gene delivery .

Keywords: Biocompatible Polymers, Gelatin, Methacrylic Anhydride, Synthesis Parameters, GelMa, Hydrogel .

The Effect of Starch Coating on Stabilization of Bimetallic Fe/Ni Banoparticles

R. Nikroo[1], I. Alemzadeh[2*]
1- M. Sc. of Chemical Engineering, Sharif University of Technology
2- Professor of Chemical Engineering, Sharif University of Technology
Email: alemzadeh@sharif.edu

Abstract

A Comparative study of starch stabilized Fe/Ni nanoparticles and non-stabilized Fe/Ni nanoparticles was performed. The Fe/Ni nanoparticles were synthesized by reduction method in 25oC and Ar atmosphere. The effect of starch as stabilizer of nano scale Zero Valent Iron (nZVI) particles on solution stability and size of particles were investigated. Starched-Fe/Ni nanoparticles and non-coated Fe/Ni nanoparticles was characterized by scanning electron microscope (SEM), Dynamic light scattering (DLS) and pictures of solutions in various time which indicate settling time of suspensions. Results demonstrated that using water soluble starch solution for coating the Fe/Ni nanoparticles, reduced the particles diameter from about 80 nm (related to non-coated Fe/Ni nanoparticles) to 30 nm and also increased settling time of the nanoparticles suspension, so the solution of starch coated bimetallic nanoparticles was stable.

Keywords: Bimetallic Nanoparticle, Starch, Stability .

❐❐❐❐

Water Consumption Optimization Methods in Wet Cooling Towers

M. Fotouhi[*], N. Rezakhani
M. Sc. of Chemical Engineering, Iranian Research and Development Center for Chemical Industries (ACECR)
Email: fotouhi.mostafa@gmail.com

Abstract

One of the most commonly used systems for cooling are Wet Cooling Towers (WCTs) which can be implemented in a wide range of weather. In the cooling process, a portion of water is recycled after cooling a heat source through the packing where it is partially evaporated, this results in water loss. Other phenomena like blowdown, leakage, splash-out, overflow, windage and drift contribute to this loss as well. Avoiding water loss is an essential aspect to efficiently operate WCTs especially in regions like Iran with high water scarcity. In present study different methods of water loss control in WCTs are investigated and were tested on a counter flow WCT in Alborz region. Results indicated that by employing simple strategies and a minimal expense a loss of approximately 1300 cubic meter of water could be prevented.

Keywords: Wet Cooling Tower, Water Loss Prevention, Optimization.

Dibenzothiophene (DBT) Oxidative Desulfurization Using Supported Ionic Liquid on γ-Al_2O_3

H. Azimzadeh[1], A. Akbari[2*], M. R. Omidkhah[3]

1- M. Sc. of Chemical Engineering, Chemistry and Chemical Engineering Research Center of Iran

2- Assistant Professor of Chemical Engineering, Chemistry and Chemical Engineering Research Center of Iran

3- Professor of Chemical Engineering, TarbiatModares University

Email: a.akbari@ccerci.ac.ir

Abstract

Recently, the use of ionic liquids (ILs) as new catalysts for oxidative desulfurization (ODS) has been interested for researchers. The main disadvantages of the use of IL in ODS process were their high cost and separation problems. In the present study, NMP.$FeCl_3$ IL was immobilized on γ-Al_2O_3 for lower IL consumption and easier separation of it from oil. The immobilization was confirmed by XRD and FTIR characterization; then the catalyst was examined in ODS of model oil consisted of dibenzothiophene (DBT) in n-octane (sulfur concentration: 500 µg/g). The GC-FID results showed more than 98% DBT removal at temperature of 40 °C, catalyst/oil of 0.2 g/mL, oxidant/sulfur molar ratio of 4, during 90 min.

Keywords: Oxidative Desulfurization, Ionic Liquid, Catalyst, Thiophene, Fuel, Immobilization.