A Review on Parameters Influencing Dark Fermentative Biohydrogen Production

F. Boshagh[1], Kh. Rostami[2*]
1- Ph. D. Student of Chemical Engineering, Iranian Research Organization for Science and Technology
2- Associate Professor of Chemical Engineering, Iranian Research Organization for Science and Technology
Email: Rostami2002@yahoo.com

Abstract
Dark fermentative biohydrogen production is a complex multiproduct process and is affected by many parameters. In the present review, effect of a wide range of parameters such as inoculum, temperature, pH, hydraulic retention time, bioreactor configuration, hydrogen partial pressure, substrate type and concentration, nutrient type and concentration in dark fermentative biohydrogen production is addressed. Most of the studies on dark fermentative biohydrogen production have been conducted in batch mode using glucose and sucrose as substrate, thus future studies in continuous mode using organic wastes and inexpensive substrates are desirable.

Keywords: Biohydrogen, Dark Fermentative, Hydraulic Retention Time, Hydrogen Partial Pressure, pH, Substrate Concentration, Temperature.

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Biodiesel Production (Methyl Ester) from Castor Oil and Effect of Main Parameters on its Production

R. Foroutan[1], H. Esmaeili[2*]
1- Young Researchers & Elite Club, Bushehr Branch, Islamic Azad University, Bushehr, Iran
2- Assistant Professor of Chemical Engineering, Department of Chemical Engineering, Bushehr Branch, Islamic Azad University, Bushehr, Iran
Email: esmaeili.hossein@iaubushehr.ac.ir

Abstract
Nowadays, due to increasing global population, increasing environmental pollution, rising oil prices and declining reserves, many studies have been conducted to find suitable and biocompatible fuel sources. Biodiesel is one of the best fuel sources that can be used instead of fossil fuels such as oil, diesel and coal. Fossil fuels resources are limited and causing environmental pollution while biodiesel is produced from renewable and biocompatible sources and the amount of greenhouse gases emitted from biodiesel is negligible compared to fossil fuels. Different sources can be used to produce the biodiesel. Today, to produce the biodiesel, often, the process of esterification is used in the presence of various alkaline, acidic and enzymatic catalysts and an alcohol (ethanol, methanol, propanol and butanol). In this review study, main parameters on biodiesel production such as temperature, time, ratio of alcohol to oil, catalyst percent in the presence of alkaline catalysts using castor oil are investigated.

Keywords: Biodiesel, Tran-Estrification Process, Castor Oil, Alkalyne Catalysts.

Investigation of Structure, Performance and Application of Photoreactors Based on Titanium Dioxide

P. Kazemi[1], Sh. Salem[2*]

1- M. Sc. Student of Chemical Engineering, Urmia University of Technology

2- Associate Professor of Chemical Engineering, Urmia University of Technology

Email: s.salem@che.uut.ac.ir

Abstract

Photocatalyst is made of combination of two words; photo as the light and catalyst. Among the materials with photocatalytic properties, titanium dioxide (TiO_2) is more interested due to wide band gap, non-toxic properties, light and chemical stability, easy to access and relatively low cost. In recent years, the use of TiO_2 for water treatment, air purification and hydrogen generation has been widely reported, either as a powder in slurry systems or immobilized to various supports. Beyond that, the by-products during these processes appear to be non- toxic. Chemical vapor deposition, Physical vapor deposition, Sol-gel and Hydrothermal processes are some examples of methods employed to obtain TiO_2 films supported in inert surfaces. One of advantage on the application of immobilized catalyst is the fact that it can be re-used for several treatment cycles while keeping its stability. Photoreactors depends on application of photocatalyst, have several categories such as: Slurry, Fluidized bed, Fixed bed, Optical fibers and Photoelectrochemical reactors. Among these categories, generally the slurry reactors have the highest efficiency but imply a post-filteration step to retain the photocatalyst. Monolithic fixed bed reactors in comparison with other reactors show better performance in all aspects. Therefore, the purpose of this article is to study structure and performance of listed photoreactors and present the results of some new researches.

Keywords: Photocatalyst, Titanium Dioxide, Support, Photoreactor, Monolith.

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Performance Evaluation of Automated Well-to-Well Correlation Approach Based on Hausdroff Parameter and Mean Value of Well Logs Signal

S. M. Amin Partovi[1], S. Sadeghnejad[2*]

1- M. Sc. in Petroleum Engineering, Tarbiat Modares University

2- Assistant Professor of Petroleum Engineering, Tarbiat Modares University

Email: sadeghnejad@modares.ac.ir

Abstract

Accurate knowledge of the stratigraphic sequences and their possible discontinuities is so important for the characterization of reservoirs. The purpose of stratigraphic correlation is detecting geological boundaries to construct a three-dimensional model of the reservoir. This process is usually done manually, therefore, depends on interpreter's experience, multiple interpretation is not unexpected. Using automatic algorithm to detect geological boundaries in addition to facilitating correlation and removing multiple interpretation will lead to save money and time. In this work, Fractal and statistical features are implemented to extract well-logs pattern. Wavelet transform analysis is used to determine fractal dimension. Detection of the pattern in observation well which is similar to the pattern obtained in witness well (a well which depths of all boundaries are available) around the selected boundary is the basis of this novel approach. Automatic Stratigraphic correlation algorithm is implemented on well-logs of 4 wells in one of the oil fields in southwest of Iran. For this purpose, one of the geological boundaries in witness well is selected and the aim is to find the depth of the corresponding boundary in the other wells. The approach was able to detect the depth of the boundary in all the wells. The deviation of the results of the automated approach from the manual ones is about 1.07 meters which confirm effectiveness and capability of this approach.

Keywords: Wavelet Transform, Fractal, Geological Boundary, Well-Log.

Investigating on the Effect of Multi-Wall Carbon Nanotubes on the Formation of Natural Gas Hydrates

A. Ghozatloo
Assistant Professor of Chemical Engineering, Research Institute of Petroleum Industry
Email: ghozatlooa@ripi.ir

Abstract

In this research, Multiwalled carbon nanotube (MWNT) was synthesized by chemical vapor deposition (CVD) method and the crystalline structure and dimensions were analyzed by XRD, FTIR and SEM analyzes. Then MWNT was used for formation of gas hydrates process to study of its effect. For this purpose, MWNT nanofluid of 1%wt. was prepared, which was used to obtain long-term stability of 1.5 g SDS surfactant. The obtained nanofluid was used for formation of natural gas hydrates containing 92.7% methane under the conditions of 1000 psi and 277K. A blank sample of 100 g distilled water and 1.5 g SDS was used to compare the results. The results show that use of MWNT in water induces natural gas hydrate formation by 57.5% and increases the storage capacity by 12.5%. This facilitates the conditions for the economics of hydrate technology in natural gas storage. In addition, the hydrate decomposition rate was reduced to 23.1%, which allows gas to be transported over longer distances.

Keywords: Multiwalled Carbon Nanotubes, Gas Hydrates, Storage Capacity, Stability, Induction Time.

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The Effect of Different Components in Formulation on Properties of Adhesives Based on Epoxy

M. Aliakbari[1], O. Moini Jazani[2*], M. Jouyandeh[3]
1- M. Sc. Student of Chemical Engineering, University of Isfahan
2- Assistant Professor of Chemical Engineering, University of Isfahan
3- Ph. D. Student of Chemical Engineering, University of Isfahan
Emial: o.moini@eng.ui.ac.ir

Abstract

Epoxy resins can be used as coating or adhesive under different environmental conditions because of high adhesion, good chemical and heat resistance, excellent mechanical properties and very good electrical resistance. Epoxy adhesives have relatively complex formulation of components with unique features. Different components of adhesive formulation are set depending on material of adherents, operating conditions, costs, and required properties. The properties of epoxy adhesives can be improved for diverse applications with the change in the components of the adhesive formulation such as blending epoxy resin with other polymers, choossing appropriate curing agent, adding reinforcements, organic and inorganic fillers, and tougheners. In this paper, various components of epoxy adhesives formulation will be discussed, and their relationship with final properties of adhesives are studied.

Keywords: Epoxy Adhesives, Formulation Component, Curing Agent, Filler, Toughener.

Removal of Nitrate from Water Using the Electrocoagulation Process

M. Moradi[1*], T. Amani[2]
1- M. Sc. in Chemical Engineering, University of Kurdistan
2- Assistant Professor of Chemical Engineering, University of Kurdistan
Email: mahtabmoradi.eng@gmail.com

Abstract

In this research, removal of nitrate from water resources was investigated with a comprehensive survey of affecting factors on electrocoagulation process including electrolysis time, the electrodes distance, the initial concentration of nitrate and the pH of the solution. Also, stainless steel and iron were used as anode and cathode. The results of this study showed that, by increasing the voltage and decreasing the variables such as the initial concentration of nitrate and the electrodes distance, efficiency of nitrate removal will increase. Also, the maximum efficiency of nitrate removal was obtained 88% with the SS-Fe arrangement under optimum condition: electrolysis time= 180 min, pH=8, initial nitrate concentration= 150 mg/l, voltage = 25 v and electrodes distance = 4 cm.

Keywords: Nitrate Removal, Electrocoagulation, Stainless Steel Anode, Water Resources.

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Process Modeling of Catalyst Free Direct Methane Conversion into Formaldehyde Using Micro Reactors

H. Abbasi[1], M. Mahdi Moshrefi[2], F. Rashidi[3*]
1- M. Sc. Student of Chemical Engineering, Amirkabir University of Technology
2- Ph. D. Student of Chemical Engineering, Amirkabir University of Technology
3- Professor of Chemical Engineering, Amirkabir University of Technology
Email: rashidi@aut.ac.ir

Abstract

Conventional technology for the conversion of methane to formaldehyde involves three expensive and complex stages; reforming of methane to syngas, conversion of syngas to methanol and the oxidation of methanol to formaldehyde. This process suffer from a severe need for a catalyst and costly and energy-intensive intermediate step of syngas production as well as implementation of its operational units which are only economically feasible for a large scale of natural gas. Although there are several small scale natural gas resources available in the remote and abandoned areas which can be used for syngas-based technologies. The catalyst free direct conversion of methane to formaldehyde is a possible option for using the natural gas resources, specifically small-scale ones, economically and integrally. In this study, the catalyst free direct conversion of methane to formaldehyde in an annual micro reactor by finite element method was modeled and the impacts of several operating parameters including temperature, residence time, oxygen / methane ratio and NO2 concentration were comprehensively analyzed. To simulate the process, the extended mechanism of GRI-Mech 3.0 as reaction kinetic, was selected and a relatively good agreement between the simulation results with experimental data in various terms of conversion of methane and formaldehyde concentration were obtained. One of the results of this study was attainment and development of a valid and flexible mathematical model to predict the behavior of complex reaction kinetics. Reaching the single-pass yield of 10% of formaldehyde is also one of the most promising results of this study.

Keywords: Direct Methane Conversion; Catalyst Free; Formaldehyde; Micro Reactor; Yield; Modeling.

Synthesis & Characterization of Zinc-Tin Oxide Multilayer in Core-Shell Structure & Studying its Response to Ethanol Vapors

F. Sheikhshoaei[1], M. Mehran[2*], I. Sheikhshoaie[3]

1- M. Sc. in Electronics Enineering, Shahid Bahonar University of Kerman

2- Assistant Professor of Electronics Enineering, Shahid Bahonar University of Kerman

3- Professor of Chemistry, Shahid Bahonar University of Kerman

Email: m.mehran@uk.ac.ir

Abstract

In this paper, zinc oxide nanowires with a thin layer of tin(II-IV) oxide p-n multilayer Core–Shell structure are synthesized on the silicon substrate. Synthesized nano-structures were characterized by XRD and FE-SEM methods. Studying X-ray diffraction pattern of the multilayer core–shell structure shows that Sn(II) and Sn(IV) are formed in this composition. FE-SEM image of the core–shell structure shows that a thin film of tin oxide with 50 nm thickness is formed on the ZnO nanowires. In addition, the sensing behavior of the synthesized nano-structures to ethanol vapors and CO is studied. Results reveals that Core-Shell structure shows up to 3.5 times higher sensitivity to 500 ppm of ethanol vapors in compared with the simple ZnO nanowires. Moreover synthesized Core-Shell structure has negligible responses to CO.

Keywords: Gas Sensor, Metal Oxide Semiconductor, Sensitivity, Selectivity, Zinc Oxide, zinc-Tin Oxide Multilayer, Nanostructure, Core-Shell.