# Review of Three Phase Reactor CFD Simulations and Existing Challenges

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## Abstract

*With respect to crucial role of chemical reactors in different chemical units such as, oil, gas and petrochemical industries, survey and define of optimum operating conditions is important. Analysis and evaluation of mixing and transport phenomena in different operational conditions and for variety of reactor type is very useful and effective. With presence of side equipments such as baffle, agitator (impeller), turbine and gas distributor (sparger), especially .In this paper, CFD simulation of three phase reactor which was perfomed two recent decades has been reviewed. Most of the previous studies have been directed towards the understanding the complex hydrodynamics, and its influence on the phase holdup and transport properties. Recent research on three-phase reactors focuses on two topics, flow structure quantification, flow regime identification. Most of these CFD studies are based on steady state, 2-D axisymmetric, Eulerian multi-fluid approach. But in general, three phase flows in reactors are intrinsically unsteady and are composed of several flow processes occurring at different time and length scales. Even though a large number of experimental studies have been directed towards the quantification of flow structure and flow regime identification for different process parameters and physical properties, the complex hydrodynamics of these reactors are not well understood due to complicated phenomena such as particle–particle, liquid–particle and particle–bubble interactions. For this reason, computational fluid dynamics (CFD) has been promoted as a useful tool for understanding multiphase reactors for precise design and scale up. Also, there is scarcely any report focusing on hydrodynamic studies related to 3-D transient simulation with high solid content on fluidised bed reactors in literature.*

**Keywords:** **Three-Phase Reactors, Computational Fluid Dynamics, Hydrodynamics, Multi-Phase Flow, Turbulence Models**

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# Technology Trends in the Field of Gas Hydrates: A Patent Analysis

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## Abstract

*Natural gases hydrates are crystalline solids composed of water and gas that are categorized in the clathrate family. Although gas hydrates have been discovered since 200 ago gas hydrate resources have only been discovered under see beds and frozen ocean zones only some 50 years ago. Since the 1979's extensive work has been focused on regasification of gas hydrates, due to the large resources of these materials as well as the limitations and costs of the others. Governmental initiatives have hence been developed in countries of high demand and limited resources. On the other hand, blocking of gas pipelines due to the formation of gas hydrates has embarked on an independent series of research experiments to inhibit the formation of the compounds, leading to the current status in which different companies perform research on diverse aspects of this field.*

*The present work focuses on the technology trends and policy makings in this area through the search, retrieval and analysis of the patents and applications filed in the different fields (including hydrate formation, production, dissociation, degasification etc.). The results contain priceless information of the technology trends and research orientations in the field and can be of benefit to R&D planners, as well as researchers.*

*The aim of this study is to investigate the hydrate technology trend by mining the patent information in the field of gas hydrates including "Inhibition of hydrate formation, hydrate production, hydrate dissociation and regasification, gas hydrate resources exploitation, and some hydrates applications" and analysis thereof in strategic and competitive levels. The analysis of the acquired information is of great value to determine the research and technology orientation in the field and to recognize the inventors active in the field.*

**Keywords:** **Hydrate, Natural Gas, Technology Intelligence, Patent Analysis**

# A Review on Modified Silica- and Polymer-Based Adsorbents Used for the Removal of Pollutants from Water and Wastewater

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**Abstract**
*Modified adsorbents have been introduced by researchers to overcome the shortcomings of conventional ones. These are including a wide range of adsorbents prepared from combination of organic, inorganic and polymeric materials. Most widely used modified adsorbents for removal of pollutants from aqueous solutions, classified as silica and polymer-based adsorbents. The present review focuses on synthesis, applications and adsorption performance of these modified adsorbents. In a comparative look, using functionalized silica is a simple and effective method for removal of heavy metals, while the functionalized polymeric adsorbents can be used to remove organic compounds. Also polymeric chelating adsorbents and polymeric/inorganic adsorbents mainly used for removal of heavy metals.*

**Keywords:** **Modified Adsorbent, Functionalized Mesoporous Silica, Polymer-Based Modified Adsorbents, Water and Wastewater Treatment**

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# Hydrogen Production from Biomass by Pyrolysis Method

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**Abstract**
*Pyroliysis is a good method for conversion of biomass to hydrogen rich gases. This route will be a technology till the end of $2^{nd}$ century. In this paper advantages and disadvantages of Pyroliysis and its position in the world is reported. Economical investigations show that over to the high potentional of biomass production in our country, the expenses of biomass conversion to hydrogen rich gas can be minimized using a technical program. Cost of pyroliysis with technical program will reduse from 3/60$/ Kg $H_2$ to 2 $/ Kg $H_2$ until 2015.*

**Keywords:** **Hydrogen Production-Biomass Pyrolisis**

# Overview of the Anion Exchange Membranes for Solid Alkaline Fuel Cells

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## Abstract

*Fuel cells due to their particular properties are on the verge of creating a vast revolutionary change in the field of electricity. By definition, fuel cell is an electrochemical apparatus that the chemical energy of fuel without fuel combustion turned into electrical energy. They are widely thought of as the environmentally friendly energy sources for the 21st century. Generally, it is common that fuel cells are classified and nominated based on the nature of used electrolyte in the fuel cell. Therefore, based on this classification, fuel cells include the following different types: alkaline fuel cells (AFC), phosphoric acid fuel cells (PAFC), polymer electrolyte membrane fuel cell (PEMFC), molten carbonate fuel cells (MCFC) and solid oxide fuel cells (SOFC). Extensive fundamental investigations have been conducted over the past several decades on polymer electrolyte membrane fuel cells. Furthermore, solid alkaline fuel cells (SAFCs) attract much attention because of their many important advantages such as the use of metal catalysts on the electrodes with reasonable price, fast oxygen reduction reaction at the cathode, anode oxidation efficiency of liquid fuels, low corrosion.*

*Study and investigation of anion exchange membranes (AEMs) has an important role in determining the properties and performance of SAFCs. The aim of this study is to investigate the properties of AEMs for the use in SAFCs. Furthermore, effective ion exchange groups, hydroxide ion conductivity mechanism, characterization methods, membrane structures, polymer materials and stability of AEMs in alkaline media were investigated.*

**Keywords: Solid Alkaline Fuel Cell (SAFC), Anion Exchange Membrane (AEM), Membrane Structures, Ion Conductivity**

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# Wettability Alteration Around the Wellbore in Gas Condensate Reservoirs to Avoid Condensate Banking

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## Abstract

*The productivity of condensate-gas reservoirs can be adversely affected by accumulation of condensate near the wellbore when the pressure decreases below the dew point. One of the proposed methods to prevent this condensate banking is altering rock wettability from liquid-wetting to gas-wetting by appropriate chemical treatment. We evaluated the performance of this treatment process for a real well by single well simulation study. The effect of relative permeability modification on the residual oil saturation in the region 1 around the well, total condensate production and total gas production were studied in our simulation work. The effect of chemical treatment up to different radial distances from the wellbore on total gas and condensate production were compared. The results showed short distance treatment around the well may be sufficient to prevent condensate accumulation near the wellbore. The economic analyses showed that the wettability alteration can increase gas production revenue. The results of the present work demonstrated that the chemical treatment can be economically applied in the field scales.*

**Keywords: Gas Condensate Reservoir, Simulation, Wettability, Relative Permeability, Added Value**

# Dehydration of Organic Compounds Using Poly Vinyl Alcohol Membranes in Pervaporation Process

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**Abstract**
*Dehydration of the organic compounds using conventional established processes such as distillation in addition to being highly energy intensive, suffers from the limitations in achieving high degrees of separation particularly in case of azeotropic mixtures. Membrane pervaporation technology has great potentials to be used for this application owing to the lower energy consumption as well as the simplicity of the operations. Prominent characteristics of membranes prepared from poly (vinyl alcohol) (PVA) such as hydrophilicity as well as high thermal and mechanical stability have attracted many researchers to use this polymer for dehydration of organic compounds. Fabrication of asymmetric mixed matrix PVA membranes and inclusion of nano-particles in PVA matrix are among the most recent approaches developed for obtaining pervaporation membranes with enhanced separation performance. This paper aims to review the recent progresses in development of PVA-based pervaporation membranes for dehydration of organic compounds.*

**Keywords: Dehydration of Organic Compounds, Pervaporation, Membrane, Poly Vinyl Alcohol**

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# Introduction to Nanomedicine and Nanodrugs

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**Abstract**
*Nowadays applications of Nanotechnology are really extended and the interaction between Nanotechnology and bio molecules creates a new field which is called "Nanomedicine" or "Nano-assisted medicine". Thus, Nano-medicine as a new field of science and technology needs to be better known along with related issues such as medical devices at the Nano scale (Biosensors), in vitro diagnostics, drug delivery systems, issues of trade and industrial perspectives. Therefore, in this paper, by introducing and explaining them, it has been tried to take a step in order to make familiar with this area.*

**Keywords: Nanomedicine, Nano Technology, Regenerative Medicine, Nanodrug, Drug delivery**

# Application of Biofilm in Porous Media

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## Abstract

*Iran lies in tropical climate while global worldwide warming and subsequent draughts in recent several years intensified the notion of climatology ,consequently optimal quality of urban and industrial water received more crucial considerations as though it is necessary to set more precaution over water consumption trends ,meanwhile utilizing treated wastewater with eliciting convenient strategies for optimum consumption is sensible critically.*

*The current paper represents two strategies by utilization of biofilm in solid surfaces (technology of biobarrier formation and trickling filter technology). Stepwise biofilm formation in these two areas is also explained and practical mathematical modeling in addition to present process employed is discussed in detail. The present paper reviews the employment of biofilm formation to upgrade the production of various industries such as petroleum, mineral, metallurgical, ceramic and hydrological facilities.*

*The concept of biofilm, due to its increased growth of prostheses utilization in medical applications improves bacterial replication and colonies in body as though to threat the health & life even causing fatality, therefore the process of biofilm replication shall be manifested in positive and negative perspectives.*

**Keywords: Biofilm, Trickling Filters, Biobarrier, Porous Media**