Numerical Simulation and Sensitivity Analysis of In-Situ Combustion Process in a Laboratory System

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Abstract

The complications of In-Situ Combustion in heavy oil reservoirs cause the investigators to pay more attention to numerical simulation rather than experimental models. On the other hand, development of numerical simulation softwares supports them in this way. In this investigation an experimental model is simulated by numerical simulation software and sensitivity analysis of crude production in In-Situ Combustion process is evaluated by various parameters. Hence, the value of influence of these parameters is measured by sensitivity analysis. The operational parameters those are selected are pre-heating temperature, pre-heating by steam, air injection rate, and comparison of air injection to oxygen saturated air injection.

Keywords: In-Situ Combustion, Heavy Oil, Sensitivity Analysis, Combustion Front

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Review on Hydrodynamics of Liquid Droplets Production Using Electro-Spraying Method

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Abstract

Electro-spraying is a process in which the electric field is applied as an external force to the surface of a liquid capillary to control the size and size distribution of produced droplets. Electric filed exert an external force on the surface of a conductive liquid at nozzle tip in addition of gravitational force. These forces overcome surface tension and leading to elongation of meniscus and consequently separation of droplets. Smaller droplets could be overcoming on surface tension force using a higher electric force. On the other hand, it is possible to produce droplets with desire size and uniform size distribution by changing the external applied electric force. Electro-spraying is one of the known process which able to spraying the liquids into the very small droplets in range of micrometer and nanometer. The aim of this paper is the reviewing of droplets production in electro-spraying method and investigation on the effect of different parameters on the modes of this process.

Keywords: Electro-Spraying, Drop Size Controlling, Drop Size Distribution, Dripping Mode, Jet Mode

Simulation of Noise Conditioning on Chemical Process Data Using Adaptive Data Reconciliation

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Abstract

A novel method for linear dynamic data reconciliation problem is proposed. The method integrates recursive least square identifier and discrete Kalman filter state estimator. The model used for the method is a black box, linear, discrete, state space, and MIMO model. The structure of the model is fixed but its parameters are estimated with online noisy input-output data of plant using identifier. The identified model parameters along with plant input-output data are used for regeneration of free noise states and outputs. Simulink (toolbox of MATLAB) is used for implementation and simulation of this method. Plant data is entered from workspace of MATLAB. The data is artificially contaminated with white noise in Simulink.

The method is tested using input-output data of Tennessee-Eastman (TE) simulator. After simulation and comparison of true process data with reconciled process data, it can be shown that the results of this simulation are satisfactory.

Keywords: Data Reconciliation, Adaptive, Chemical Processes, Kalman Filter, Tennessee-Eastman

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Multi-Mechanistic Flow Domain in Gas Injection for Tight Gas Fractured Reservoirs – Compositional Approach

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Abstract

Gas condensate fractured reservoirs are one of those that molecular diffusion plays an important role in their production mechanism. This paper is the first that investigates the molecular diffusion in gas injection for a gas condensate fractured reservoir. Single block approach is used in this work. This single block is firstly saturated with methane, secondly, methane and ethane and lastly, with methane and n- pentane. Pressure at the left side of this matrix block is kept constant by injection while production is done at the constant pressure at the right side of that. Fully implicit with the using of Newton-Raphson technique is applied to solve highly non-linear equations at this simulation model. In order to speed up the simulation technique, Broyden updating approach is used to update Jacobian matrix. At the end, the most important conclusion is, in gas injection in naturally fractured gas condensate reservoirs, diffusion phenomenon is considerable for matrix blocks with the permeability of lower than 0.01 md in the case of single phase flow at the reservoir condition, while this permeability increases to 0.1 md when two phase flow occurs at the reservoir condition.

Keywords: Molecular Diffusion, Gas Condensate Reservoirs, Gas Condensate Fractured Reservoirs, Permeability

Increasing in Efficiency of a Hydrocyclone Model

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Abstract

The objective of this research is to improve the performance and efficiency of the hydrocyclones by testing four different cylindrical parts with applying vertical and horizontal rods. These parts were; short simple cylinder, long simple cylinder, hyperbolic type cylinder and parabolic type cylinder. Laboratory observations showed that in cases without a rod, a large diameter air core forms and causes some decrease in efficiency in particle sizes less than forty microns. Adding a horizontal rod in conical part leads to decrease in air core diameter, but increases instability in air core. In some cases, air core was eliminated by adding the vertical rod. Results show that adding horizontal and vertical rods increase the efficiency and flow split, and decrease cut size. In order to total efficiency, the parabolic cylinder had the best efficiency, and then long simple cylinder, short simple cylinder and the last was hyperbolic cylinder. In all experiments, the best case was observed by parabolic cylinder with horizontal and vertical rods, and worst case was the hyperbolic cylinder without any rod.

Keywords: **Hydrocyclone, Grade Efficiency, Air Core, Cut Size, Flow Split**

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Adsorption of Yellow GX Pigment by Mg-Fe-layered Double Hydroxide from Aqueous Solutions in Textile Industry

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Abstract

In the present work, adsorption of Yellow GX (YGX) pigment by layered double hydroxides from aqueous solutions of wastewater textile industry was investigated. At first we describe our attempts to synthesize Mg-FeLDH was prepared by dropwise addition of a mixed aqueous solution of $Mg(NO_3)_2.6H_2O$ and $Fe(NO_3)_3.9H_2O$ at pH= 9-10 followed by subsequent hydrothermal treatment for 24h in the mixture of water,1-propanol and surfactant (Ethylene glycole).This nanostructured particle is well characterized by infrared spectroscopy, Scanning electron microscope (SEM) and X-ray powder diffraction analysis. SEM images showed that the morphology of Mg-FeLDH is plate-like structure. XRD analysis showed the formation of sharper and intense peaks, which might indicate the larger crystallites size of LDH as well as higher crystallinity. The FT-IR spectra of LDH materials provide many important information, especially about the interlayer anions and hence are very useful to understand the structure of these materials.

The ability of these compounds to adsorb YGX pigment by ion exchange in pH=2-12, different temperature (35°C, 45°C, 55°C) has been evaluated by UV-Vis spectrophotometer. The adsorption experiments show that the amount of YGX adsorption increases with increasing temperature. This suggests that the interaction of adsorbate and adsorbent is endothermic in nature. Furthermore, it supports the surface heterogeneity of oxide surfaces.

Keywords: **Layered Double Hydroxides, Adsorption, Pigment, Yellow GX, UV-Vis Spectrophotometer**

Evaluation and Estimation of Gaseous Pollutant Emission Factors in Natural and Liquid Gas Processing Units

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Abstract

Oil and gas processing plants are one of the most air pollutant industries. In this paper, gaseous air pollutants emission factors were estimated for pollutant sources in an Iranian Natural Gas Liquids (NGL) plant using fuel analysis method and published emission factors. The results showed that the main pollutant sources in this unit are gas flare, gas turbines, pit and boiler. Total Hydro Carbons (THC) and CH4 emissions from gas flares and NO2 emission from gas turbine are higher than any other pollutant sources. Activity based emission factors were determined as 513.3, 2731.0, 0, 1805.3 and 225.6 g/1000kg LPG for NO_2, CO, SO_2, THC and CH_4 respectively on the basis of LPG production in the unit. Because of possible gas leakages from the units, CH4 emission factor have larger margin of error. Calculated emission factors can be used for emission estimation of air pollutant in other similar NGL processing units.

Keywords: **Air Pollution, NGL Production Unit, Emission Factor, NO_2, SO_2, CO**

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CFD Simulation of A Sono-Reactor Hydrodynamic for Maximum Intensity of Acoustic Cavitation

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Abstract

In recent years, many of research have been focused on energy production in the chemical processes such as crude oil upgrading during the collapse of cavitation microbubbles generated sonolytically. For maximum efficiency of sono-reactors, the effect of various physical and operational parameters must be determined. In present work, cavitation active zone and the effect of various physical and operational parameters on sono-reactor efficiency has been quantified with CFD simulation of acoustic wave propagation in water bulk. With an ultrasonic probe tip of diameter 13 mm, the pressure distribution has been simulated for different probe positions and the effect of probe depth in water has been investigated. Comparison with experimental results has clearly established the correctness of the numerical simulations. The results show for finding of optimum sono-reactor design the highest intensity of acoustic cavitation and produced cavitational energy can be predicted by CFD simulation reasonably.

Keywords: **Sono-reactors, CFD Simulation, Acoustic Cavitation, Crude Oil Upgrading**

Effects of Meshing Type and Turbulency Model on Flow Distribution of Gas/Liquid Two Phase Systems of Structured Packing Employing CFD Technique

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Abstract

The effects of meshing type and turbulency model on distribution and volume fraction of the liquid phase on the MontzpakB1-250Y structured packing at steady state condition was investigated employing computational fluid dynamics (CFD) technique. The volume of fluid method was used to simulate the liquid distribution, while different meshing types (e.g. tetrahedron and cooper algorithm) and turbulency models (including Standard $k-\varepsilon$, RNG $k-\varepsilon$ and Realizable $k-\varepsilon$) were used for modelling the system. Resulted equations were numerically solved employing the finite volume method. Liquid maldistribution was studied using (C_v) parameter and volume fraction of the liquid phase at various velocities and conditions. The results were compared with experimental data reported in the literature indicating that a proper selection of meshing type and turbulency model can significantly affect hydrodynamics simulation of the structured packing.

Keywords: **Two Phase Flow, Turbulency Models, Meshing, Volume of Fluid, CFD**