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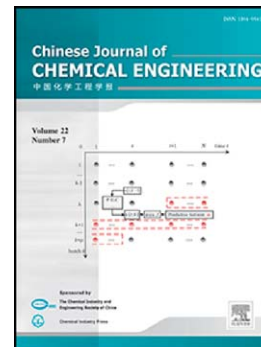
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Oilfield produced water treatment in internal-loop airlift reactor using electrocoagulation/flotation technique

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Abstract

Oilfield produced water is large quantities of salty water trapped in underground formations and subsisted under high temperatures and pressures that are brought to the surface along with oil during production. PW contains a lot of pollutants such as hydrocarbons and metals, this water must be treated before being disposal. Therefore, different techniques are being used to treat produced water. Electrocoagulation is an efficient treatment technique involving the dissolution of anodes and formation of electro-coagulants, while the simultaneous generation of H₂ bubbles at the cathode leads to the pollutant removal by flotation. EC method is one of the most promising and widely used processes to treat oilfield produced water. In the present work, a conventional internal-loop (draught tube) airlift reactor was utilized as electrocoagulation/flotation cell for PW treatment by inserting two aluminum electrodes in the riser section of the airlift reactor. The EC airlift reactor was operated in a batch mode for the liquid phase. Different experimental parameters were studied on the oil and turbidity removal efficiencies such as current density, initial pH, electrocoagulation time, and air injection. The experimental results showed that mixing of the oil droplets in the PW was accomplished using only the liquid recirculation resulted by H₂ microbubbles generated by EC process which enhanced the oil removal. The experimental results further showed that the EC time required achieving $\geq 90\%$ oil removal efficiency decreases from 46 to 15 min when operating current density increases from 6.8 to 45.5 mA·cm⁻². This reactor type was found to be highly efficient and less energy consumption compared to conventional existing electrochemical cells which used mechanical agitation.

Keywords: produced water; wastewater treatment; electrocoagulation/flotation; internal loop; airlift reactor

Introduction

Produced water (PW) is water associated with crude oil during the extractive operations in the oil reservoirs, which often contains large amounts of this water. The chemical and physical properties of the produced water are unstable and the change of these properties depends on several factors including the geology of the oil reservoir, the hydrocarbon composition of crude oil extracted, geographical location and history of water injection. Produced water contains many

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