

Biological treatment of produced water in a sequencing batch reactor by a consortium of isolated halophilic microorganisms

ABSTRACT

Produced water or oilfield wastewater is the largest volume of a waste stream associated with oil and gas production. The aim of this study was to investigate the biological pretreatment of synthetic and real produced water in a sequencing batch reactor (SBR) to remove hydrocarbon compounds. The SBR was inoculated with isolated tropical halophilic microorganisms capable of degrading crude oil. A total sequence of 24 h (60 min filling phase; 21 h aeration; 60 min settling and 60 min decant phase) was employed and studied. Synthetic produced water was treated with various organic loading rates (OLR) (0.9 kg COD m⁻³ d⁻¹, 1.8 kg COD m⁻³ d⁻¹ and 3.6 kg COD m⁻³ d⁻¹) and different total dissolved solids (TDS) concentration (35,000 mg L⁻¹, 100,000 mg L⁻¹, 150,000 mg L⁻¹, 200,000 mg L⁻¹ and 250,000 mg L⁻¹). It was found that with an OLR of 0.9 kg COD m⁻³ d⁻¹ and 1.8 kg COD m⁻³ d⁻¹, average oil and grease (O&G) concentrations in the effluent were 7 mg L⁻¹ and 12 mg L⁻¹, respectively. At TDS concentration of 35,000 mg L⁻¹ and at an OLR of 1.8 kg COD m⁻³ d⁻¹, COD and O&G removal efficiencies were more than 90%. However, with increase in salt content to 250,000 mg L⁻¹, COD and O&G removal efficiencies decreased to 74% and 63%, respectively. The results of biological treatment of real produced water showed that the removal rates of the main pollutants of wastewater, such as COD, TOC and O&G, were above 81%, 83 %, and 85%, respectively.

Keyword: Oilfield brine; Oilfield wastewater; Produced water; Sequencing batch reactor; Tropical halophilic microorganisms