Abstract

Treatment and Reclaiming of Iraqi oil field Produced Water by Flotation Column and Membrane Technology

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A large amount of oil field produced water is generated by South Oil Company. Oil-in-Water and TDS are the most serious pollutants for which current treatment technologies are often costly and ineffective in order to reuse water. In recent years, membrane process has been applied for produced water treatment.

The aim of the present work is to treat produced water from oil well before being disposed in environment or reused as re-injection to oil well or agriculture water. Oil field produced water is very difficult wastewater to treat and its characteristics change as well to well. The sample test of this study was taken from dehydrator in the DSI/North Rumila/Southern Oil Company in Basrah /Iraq. The treatment process of produced water consists of two stages. The first stage as pre-treatment is achieved by continuous dissolved air flotation (DAF) to reduce the oil content. The second stages, as

advanced treatment processes, are accomplished by microfiltration (MF) to reduce the turbidity and nanofiltration (NF) to reduce the salt content as TDS of produced water.

The experimental work was carried out using dissolved flotation column is of Perspex glass (0.1 m I.D, 1.5 m height). The bottom of the column connected to a conical joint of QVF glass with a Teflon distributer. The effect of operating parameters (flow rate of produced water, pH, initial oil concentration, flotation time, alum dosage and surfactant of SLS) saturated pressure=5 Atm on the oil content or oil removal efficiency was investigated. The results showed that the oil removal efficiency increases with increasing the flow rate of produced water, the flotation time and coagulants dosage. The oil removal efficiency in DAF unit without coagulants is equal to (80, 94, 95%) for initial oil concentration (30, 50, 70 ppm), respectively at a flow rate 0.03 m^3/h and pH=6. While flotation with coagulation, the results indicated that the removal efficiency is equal to 94% (residual oil content <10 ppm) at pH=5, alum dosage=560 ppm, and initial oil concentration=50 ppm, and the removal efficiency is equal to 89.6 at pH=6, alum+SLS dosage=80 ppm, and initial oil concentration=50 ppm. The kinetics of flotation column was studied and it was found that the order of the reaction is changing between zero to first order.

The treatment of produced water by membrane technique was carried out by cross flow mode in hallow fiber microfiltration (MF) and nanofiltration (NF). The effect of operating parameter such as transmembrane pressure (TMP) (1, 1.5, 2 bars) with cross flow 20 mL/min, at room temperature, on the flux, rejection, and turbidity and TDS removal was studied.

The experimental results by MF manifested that the permeation flux is (108, 156, 611 $l/m^2.h$) and transemembrane pressure is 2 bar at initial turbidity (100, 200, 300 NTU), respectively. But NF, as a final treatment of produced water to reuse, was studied at different feed concentrations (82950, 75050, 67150 ppm) with different TMPS. According to the experimental results, the higher permeation of flux =15 ($l/m^2.h$) at 82950 ppm and 2 bar, was obtained.

The experimental results of the removal efficiency were represented in two and three dimensional graphs. An empirical correlation for R% as a function of different parameters (flow rate, pH, and oil concentration) was developed by aided computer using the following formula:

$$\%R = a + c_1 * x_1^{n1} + c_2 * x_2^{n2} + c_3 * x_3^{n3}$$