Coalescence of Oil Droplets using Sponge-like Structure of Polyvinylidene Fluoride Membranes

ABSTRACT

This work reports the effect of the membrane pore size distribution on the oil droplets size distribution in permeate using the polyvinylidene fluoride (PVDF) membranes. The spongelike structures of the PVDF membranes were fabricated via the phase inversion technique using 30% v/v ethanol aqueous solution as coagulation medium. Water and polyethylene glycol (PEG1000) were used as the pore forming additives in the dope solutions. Microfiltration was employed to coalesce the oil droplets at the transmembrane pressure of 2.5 bar. Simulated alkaline-surfactant-polymer (ASP) produced water was tested as the feed solution. Results revealed that the PVDF membranes with sponge-like structure were formed. The additives in the dope solutions have induced the membranes to become thicker due to more porous, spongy and resilient structure. The membrane pore sizes increased with the presence of the additives in the dope solutions especially when larger molecular weight of the additive, i.e., PEG1000 was used. The mode of the oil droplets radius increased from 61.2 nm in the feed solution to 95.1, 356.2 and 1335 nm in the permeates by the corresponding membranes without additive, with water and PEG1000 as the additives. The membranes with larger pore sizes as well as more open structure were able to trap and coalesce more oil droplets which produced larger size of the oil droplets in the permeates.