

Forward osmosis for the dewatering of pyrolysis oil aqueous phase

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Abstract

Removing water from the pyrolysis oil is a challenge because the oils are thermally unstable and consist of dissolved components in aqueous matrix. Therefore, techniques are needed for removing water without altering the chemical composition in an economic feasible way. Here we investigated an osmotic driven membrane process forward osmosis (FO) which removes pure water without dissolved components and can operate at ambient temperature. The driving force for this process is the osmotic pressure difference between feed solution (FS) and osmotic agent (draw solution (DS)). In this study cellulose acetate (CA) membranes and two osmotic agents (draw solutions) were used: NaCl and MgCl₂ solutions; the tests were done at 25 °C over 12 h. The study demonstrates that the FO process is a promising process; water was removed reasonably well within 12 h. This investigation shows that the NaCl solution is relevant over other solutions used; however, diffusion of the solutes from the DS to FS is a challenge given that alkali metal ions above the accepted level impair the oil. Therefore, membranes with high selectivity and draw solutions that produce high water fluxes with minimal reverse solute fluxes are needed.

Keywords

Pyrolysis oil;

Forward osmosis;

Draw solutions;

Dewatering;

Reverse solute diffusion