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Novel polymer film heat exchangers for seawater desalination

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ABSTRACT

Multi-effect distillation (MED) plants with co-current flow show moderate process conditions with respect to temperature and pressure differences between consecutive effects. Thus, polymers seem to be best suited as a low-cost and less-corrodible alternative to metal alloys. Furthermore, polymer surfaces are less susceptible to scaling. In order to proof this concept, a falling film plate evaporator with heat transfer surfaces made of polyetheretherketone (PEEK) films was built. One of the main challenges is to assure a sufficient mechanical stability of the polymer film and simultaneously provide a low thermal resistance for heat conduction. Calculations and experiments show that a polymer film thickness of 25 mm, in combination with an appropriate spacer geometry, is sufficient for mechanical stability in MED plants. This low film thickness results in a thermal resistance for heat conduction comparable to 1.5 mm thick stainless steel. In order to demonstrate the applicability of polymer films for heat transfer surfaces, experimental investigations of the overall heat transfer coefficient were carried out at different operating conditions with a pilot plant scale polymer film heat exchanger.

Keywords: PEEK; Polymer film; Mechanical stability; Heat exchanger; Heat transfer; Falling film; Evaporation

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