

Seawater Desalination using Gas Hydrates

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Seawater desalination using clathrate hydrate formation is an interesting potential hydrate application, as salt ions are excluded from the clathrate cavities during hydrate formation, thereby resulting in concentrated seawater in the bulk aqueous solution. The resulting hydrate crystals can be subsequently separated from the concentrated seawater and dissociated to produce fresher water. This paper evaluates and reviews, the hydrate based desalination technology which uses low pressure (cyclopentane) and high pressure (methane, methane + ethane) hydrate formers and different hydrate nucleation, growth, and separation methods and the resulting crystal morphology and saltwater removal efficiencies. A modified van der Waals and Platteeuw (vdWP) model based on statistical thermodynamics has been used to predict hydrate phase equilibria for all pure cyclopentane (CP) hydrate for different concentrations of aqueous salt solutions. Desalination efficiencies of up to 81 % (salinity decreased from 3.5 wt.% to 0.67 wt.%) can be achieved a bubble column apparatus and different washing/separation methods, including gravitational separation.