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Selectivity of ice crystallization and refrigeration waste heat integration in freeze desalination of brine - Application and Optimisation

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Abstract content
   (Max 300 words)

Upon cooling, water reverts to its solid form – ice. Due to the small dimensions and lattice configuration of the ice crystal, inclusion of compounds in the crystal lattice is impossible. Mechanisms of contamination include; the interfacial tension between the small ice crystals and brine which causes the mother liquor to adhere to the crystal surface, interstitial entrapment of impurities between the ice crystals and pockets of impurities in the bulk crystal structure. The process of ice crystallisation is highly selective and therefore can be an important unit operation for the separation and purification of water. This unique property of ice is applicable to desalination of salt laden wastewaters (e.g. industrial brines) if the nucleation process is properly comprehended and controlled. Study on the bearing of various operating parameters on ice crystal purity was carried out, experimentally using synthetic (2-5% NaCl) and industrial brines, on a HybridICE™ pilot plant. Ice slurry was formed by circulating brine in a loop through cooled scraped surface heat exchangers. The ice in the slurry was then filtered off. Heat transfer, brine flow rate, ice scraping frequency and residence time in the filter, were the parameters used to counteract impurity entrapment mechanisms in ice during optimisation. Low value waste heat generated during the cooling process was used to evaporate the freeze concentrated brine under vacuum. Ice of 98% purity and distillate of 99.5% purity were obtained.
Keywords: Freeze desalination, Heat exchange, Distillate, Brine, Optimization

Apply to be
 consider for a student
   award (Yes / No)?

Yes

Level for award
 (Hons, MSc,
   PhD)?

MSc

Main supervisor (name and email)
and his / her institution

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Would you like to
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Yes

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