

## A Conceptual Design of Freeze Desalination Using Low Cost Refrigeration

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**Abstract :** In recent years, seawater desalination has been emerged as a potential resource to circumvent water scarcity, especially in coastal regions. Among the various methods, thermal evaporation or distillation and membrane operations like Reverse Osmosis (RO) has been exploited at commercial scale. However, the energy cost and maintenance expenses associated with these processes remain high. In this context Freeze Desalination (FD), subjected to the availability of low cost refrigeration, offers an exciting alternative. Liquefied Natural Gas (LNG) regasification terminals provide an opportunity to utilize the refrigeration available with regasification of LNG. This work presents the conceptualization and development of a process scheme integrating the ice and hydrate based FD to the LNG regasification process. This integration overcomes the high energy demand associated with FD processes by utilizing the refrigeration associated with LNG regasification. An optimal process scheme was obtained by performing process simulation using ASPEN PLUS simulator. The results indicated the new proposed process requires only 1 kWh/m<sup>3</sup> of energy with the utilization of maximum refrigeration. In addition, a sensitivity analysis was also performed to study the effect of various process parameters on water recovery and energy consumption for the proposed process. The results show that the energy consumption decreases by 30% with an increase in water recovery from 30% to 60%. However, due to operational limitations associated with ice and hydrate handling in seawater, the water recovery cannot be maximized but optimized. The proposed process can be potentially used to desalinate seawater in integration with LNG regasification terminal.

**Keywords :** freeze desalination, liquefied natural gas regasification, process simulation, refrigeration

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