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Virtual Engineering of a novel water desalination process utilizing hydrate technology

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ABSTRACT

Hydrate desalination provides an alternative to a more economical process in seawater desalination with respect to higher energy efficiency, process continuity and lower investment costs. However, this potential can be only exploited in an adequate manner when using up-to-date holistic modelling and simulation tools as offered by Virtual Engineering. A pure virtual twin of the process allows finding out - without very expensive experiments - the weakness of the process in a very early stage of development and to design the corresponding remedies.

One tool of Virtual Engineering is Petri nets. They allow to connect different units of operation via series of commands and to set up mathematical equations for each of them. Reference nets are extended version of Petri nets. They model not only discrete events such as process steps (compression and cooling), but also continuous systems.

In this work, we engineer virtually the whole water desalination process utilizing gas hydrate technology using reference nets. In addition, we implement a kinetic model using two different reactor types (i.e. stirred tank and bubble column) and we analyze the total energy consumption for each case. The results provide an insight about the optimal reactor type for a specific process design.

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