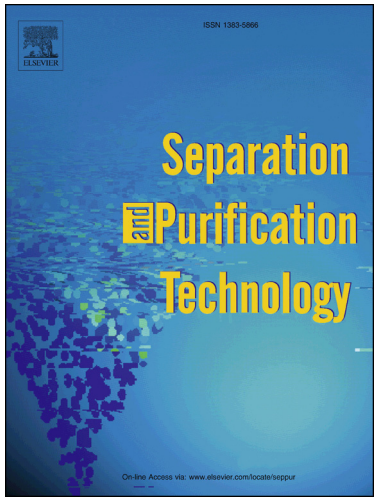

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Membranes for helium recovery: an overview on the context, materials and future directions

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Abstract

Helium demand is expected to double within the next two decades given its essential role as a cryogenic fluid and an inert gas in various technological applications whereas its production capacity only increases by 3% per year, leading to an inevitable rising price of helium in the near future. Despite its status as the second most abundant element in the universe, natural gas is currently the only most commercially viable source for helium extraction. However, the common practice of most natural gas industries, at the present, is to let its helium component remains mixed with other gases throughout the gas supply chain processes until the final venting step. Helium recovery unit should instead be integrated as the last unit operations component of the liquefied natural gas plant to exploit the extra revenue from helium recovery. This review aims to validate the potential of membrane technology to be utilized in such separation unit since membrane may provide significant economic incentive over the cryogenic distillation or pressure swing adsorption processes. Five different membranes, i.e., polymer, silica, zeolite, metal-organic framework and mixed matrix metal-organic framework membranes are surveyed in terms of their helium or hydrogen separation permeation performance and the related stabilities during permeation processes. In the

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