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Life-cycle cost analysis of adsorption cycles for desalination

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ABSTRACT

This paper presents the thermo-economic analysis of the adsorption desalination (AD) cycle that is driven by low-temperature waste heat from exhaust of industrial processes or renewable sources. The AD cycle uses an adsorbent such as the silica gel to desalt the sea or brackish water. Based on an experimental prototype AD plant, the life-cycle cost analysis of AD plants of assorted water production capacities has been simulated and these predictions are translated into unit cost of water production. Our results show that the specific energy consumption of the AD cycle is 1.38 kWh/m^3 which is the lowest ever reported. For a plant capacity of 1000 m^3/d, the AD cycle offers a unit cost of \$0.457/m^3 as compared to more than \$0.9 for the average RO plants. Besides being cost-effective, the AD cycle is also environment-friendly as it emits less CO_2 emission per m^3 generated, typically 85% less, by comparison to an RO process.

Keywords: Economic analysis; Adsorption; Desalination; CO_2 emission saving

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