

Desalination membrane selection using group fuzzy analytical hierarchy process

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ABSTRACT

This paper presents a group fuzzy analytical hierarchy process (FAHP) model for the selection of water desalination membranes. In addition to literature, experts from the pharmaceutical industry sector and academia were involved in setting and evaluating the criteria to be used in the selection process. Technical criteria focus on parameters concerning the type and configuration of the material of membrane, operational parameters concerning the work conditions under which the membrane will function and efficiency parameters concerning permeability, salt rejection and environmental performance over the lifecycle of the membrane. Non-technical criteria focus on the supply chain finance, volume and time parameters. The fuzzy opinions of 12 experts were aggregated using the aggregation of individual judgment (AIJ) method to obtain the weights of seven technical and five non-technical criteria and their corresponding sub-criteria using Chang's FAHP method. Obtained weights are then used to select the best reverse osmosis (RO) desalination membrane alternative among three different alternative membrane types widely used in the pharmaceutical industry; ESPA1 which is characterized by its energy saving among RO membranes during the filtration processes and produces around 2,100 gallons of permeate flow each day, CPA2 which is known for its high salt rejection and produces around 2,250 gallons of permeate flow each day, and LFC3 which is known for its low fouling and produces around 2,100 gallons of permeate flow each day. Experts agreed that technical criteria are far more important than non-technical criteria. Results show that salt rejection efficiency is the most important technical criteria, the cost is the highest-ranked non-technical criteria and CPA2 is the most preferred alternative.

Keywords: Decision making; Desalination; Fuzzy analytical hierarchy process; Membrane; Multi criteria

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