Effects of Voltage and Number of Cell on Desalination of Brackish Water with Electrodialysis Method

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Abstract

Brackish water is an alternative source of raw water in the coastal areas. One alternative method of brackish water treatments is electrodialysis (ED) which involves preferential transport of ions through ion exchange membranes with an electrical current as the driving force. This research aims is to analyze the effect of applied voltage and number of cell to desalinate high concentration of total dissolved solid (TDS) in brackish water.

The ED reactor was operated for 72 hours with the applied voltages of 6V, 9V and 12V, and the cell number of 5 and 7 cells. Membrane effective area was 100 cm$^2$ for each cell, while the electrode area is 25 cm$^2$ each.

The results showed that contact time of brackish water (TDS = 2.000 mg/L) in reactors affected the quality of water produced. The highest TDS removal efficiency in the 5 cell was obtained by applying 6V, i.e., 61%. This equals to the salinity removal of 71%, chloride ion removal of 62%, 38% of permanganate value with final pH of 7.7. Similarly, the 6V experiment showed the highest TDS removal efficiency in the 7 cell, i.e., 92%, (equals to 79% of salinity removal, 94% of chloride ion removal, 24% of permanganate value with a final pH of 8.0. Therefore, it can be concluded that the 7 cell ED reactor is more effective to desalinate the brackish water with the energi consumption of 139,68 kWh m$^{-3}$, lower than in the case of the 5 cell reactor, 126,72 kWh m$^{-3}$.

Keywords: brackish water, cell, ED, TDS, voltage.
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