Application Potential of Forward Osmosis-Nanofiltration Hybrid Process for the Treatment of Mining Waste Water

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Abstract : The mining wastewater contains inorganic metal salts, which makes it saline and additionally contributes to contaminating the surface and underground freshwater reserves that exist nearby mineral processing industries. Therefore, treatment of wastewater and water recovery is obligatory by any available technology before disposing it into the environment. Currently, reverse osmosis (RO) is the commercially acceptable conventional membrane process for saline wastewater treatment, but consumes an enormous amount of energy and makes the process expensive. To solve this industrial problem with minimum energy consumption, we tested the feasibility of forward osmosis-nanofiltration (FO-NF) hybrid process for the mining wastewater treatment. The FO-NF process experimental results for 0.029M concentration of saline wastewater treated by 0.42 M sodium-sulfate based draw solution shows that specific energy consumption of the FO-NF process compared with standalone NF was slightly above (between 0.5-1 kWh/m3) from conventional process. However, average freshwater recovery was 30% more from standalone NF with same feed and operating conditions. Hence, FO-NF process in place of RO/NF offers a huge possibility for treating mining industry wastewater and concentrates the metals as the by-products without consuming an excessive/large amount of energy and in addition, mitigates the fouling in long periods of treatment, which also decreases the maintenance and replacement cost of the separation process.

Keywords : forward osmosis, nanofiltration, mining, draw solution, divalent solute
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