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CHARACTERIZATION OF COMMERCIAL REVERSE OSMOSIS AND NANOFILTRATION MEMBRANES FOR MEMBRANE FOULING

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Membrane Filtration technique is being accepted worldwide as an environment friendly and energy efficient technique in Desalination Industry as compared to Thermal Desalination techniques. However, the performance of membranes which include permeate flux and rejection is affected by the membrane fouling. The properties of membrane and surface features such as porous structure, hydrophilicity/ hydrophobicity charge, polymer characteristics, surface roughness determine the fouling potential of the membrane. The hydrophilic and smooth membrane surface is usually considered desirable in tackling membrane fouling issues. Therefore, many studies have focused on to enhance surface characteristics of membranes by surface coating with polymers and nanomaterials. Since, membrane coating is not done during fabrication of the most commercially available membranes, therefore, it is also important to determine the surface features of the commercially available membranes to investigate their membrane fouling potential. Thus, the objectives of this study were (1) to perform membrane surface characterization of commercial Reverse Osmosis (RO) and Nanofiltration (NF) membranes using techniques such as SEM, AFM, FTIR and XPS; (2) to measure hydrophilicity/hydrophobicity of commercial RO and NF membranes through water contact angle measurement using sessile drop method and (3) to measure the flux and percentage rejection of NF and RO membranes using Dead end filtration technique. Here, the characterization of membrane surface in terms of surface roughness, using SEM and AFM, showed that the commercial RO membrane had more ridge and valley structures and higher average surface

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roughness i.e. 71.24 nm as compared to NF membranes (6.63 nm). In addition, water contact angle measurements showed that the NF membrane was more hydrophilic as compared to RO membrane. The average contact angle found for RO membrane was 59.94º. On the other hand, it was observed that NF membrane is extremely hydrophilic in nature. Due to which, contact angle value was not obtained for most of the runs. The droplet could diffuse in less than 5 seconds. In addition, the dead-end filtration experiments showed that the RO membrane had much lower flux as compared to NF membrane. This can be associated with the pore structure of these membranes. Since, the NF membrane has porous structure, in oppose to RO membrane, the flux of the NF membrane is usually higher than the RO membranes. As the membrane surface roughness and hydrophobicity makes it more susceptible to the fouling leading to reduction in membrane flux and performance, it can be concluded from this study that there is a need for surface coating of RO membrane with suitable nanomaterials such as graphene oxide to improve its hydrophilicity and surface smoothness. This will eventually make the membrane more resistant to membrane fouling and will establish the use of membrane filtration technique in desalination industry in Qatar in the future. Microorganisms have been isolated from Gulf sea water, identified and differentiated and are being used to study the biofouling of RO and NF membranes, that would be coated to limit the fouling problems. Acknowledgement: This research was made possible by NPRP grant # [9-318-1-064] from the Qatar National Research Fund (a member of Qatar Foundation). The findings achieved herein are solely the responsibility of the author[s].