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# Improved performance desalination of the synthesized CNT/ceramic composite membrane distillation for oil field produced water desalination

**Zahra Sadeghian**[1] and **Kimia Sadeghian**[2]
[1]Research Institute of Petroleum Industry, Iran
[2]Iran University of Science and Technology, Iran

The largest waste stream is generated in oil and gas industries. In order to meet environmental regulations as well as to reuse produced water, treating brine produced water is very important. Membrane distillation (MD) is an emerging desalination technology for desalination of highly saline waters that it can enhance desalination performance using CNT/ceramic composite membrane. In this work, the membrane is composed of a homemade ceramic support made of alumina based with a fluorinated hydrophobic grafting molecules layer. The CNT was used for thin film constructed on hydrophobic membrane. The modified surfaces were characterized by contact angle and FTIR. The results support the contact angle values (>150°) and FTIR spectrum indicating perfluoroalkylsilane substitution with hydroxyl groups. The modified hydrophobic membrane was utilized in vacuum membrane distillation (VMD) set up to desalination of brine steam. VMD used in range of 70-95°C for brines contains 50 g/L sodium chloride obtaining the crude oil salting plant. The CNT immobilized membrane significantly enhanced to permeate flux with the flux reached as high as 39 Kg/m$^2$h at 80°C. The salt rejection was higher than 99% observed. The enhanced performance of flux can be due to the fluid permeation through the smooth and super hydrophobic inner walls of the grafted CNTs. In the fouling test, the permeate flux was reduced about less than 16% for the modified membranes over 60 h experimental run that it indicates that the enhanced surface hydrophobicity causes a better fouling resistance. The overall enhanced performance of the CNT assisted membrane can be due to the rapid transport of water vapor through the smooth CNT surface with hydrophobic nature, which lowers the transport resistance, accompanied by Knudsen diffusion paths at the nanoscale.

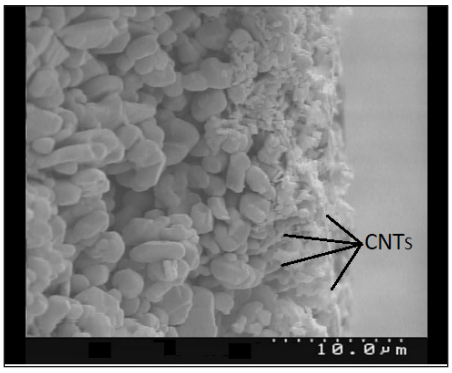


**Figure 1:** The synthesized CNT/ ceramic composite membrane (cross section image).

## Recent Publications

1. W Li, W Wang, Y Zhang, Y Yan, P Kral and J Zhang (2018) Highly efficient water desalination in carbon nanocones. Carbon 129:374-379.
2. J Kujawa, S Cerneaux, W Kujawski and K Knozowska (2017) Hydrophobic ceramic membranes for water desalination. Applied Sciences 7(4):402.
3. R Das, M E Ali, S B A Hamid, S Ramakrishna and Z Z Chowdhury (2014) Carbon nanotube membranes for water purification: A bright future in water desalination. Desalination 336(1):97–109.
4. M A Abu-Zeid, Y Zhang, H Dong, L Zhang, H L Chen and L Hou (2015) A comprehensive review of vacuum membrane distillation technique. Desalination 356:1-14.
5. B L Pangarkar, M G Sane, S B Parjane and M Guddad (2011) Vacuum membrane distillation for desalination of ground water by using flat sheet membrane. International Scholarly and Scientific Research & Innovation 5(3):572-577.

## Biography

Zahra Sadeghian is an Associate Professor in Materials Science and Engineering. She received PhD from TU Clausthal in Germany, 2005. She has been a fellowship in Chemical Engineering (membrane science) in RWTH Aachen University in 2010. She is working in Research Institute of Petroleum Industry (RIPI) from 2005. She is an expertise in nanostructured coatings for surface modification and nanomaterial synthesis such as carbon nanotube, graphene and their composites. She has also fabricated ceramic composites as adsorbent, catalysts and membranes. She has worked on oil field produced waste water treatment and desalination pilot plant using ceramic membranes. Also she has fabricated ceramic membranes for separation of hydrogen from syngas and other gas separation applications.

sadeghianz@ripi.ir

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