# Durable Nanofiber-Based Membrane with Efficient and Consistent Performance for Oil/Saltwater Separation

**Rand ElShorafa [1], Zhaoyang Liu [2,*] and Said Ahzi [3]**

[1] Division of Sustainable Development, College of Science and Engineering, Hamad Bin Khalifa University, Qatar Foundation, Education City, Doha P.O. Box 34110, Qatar; relshorafa@hbku.edu.qa
[2] Qatar Environment and Energy Research Institute, Hamad Bin Khalifa University, Qatar Foundation, Doha P.O. Box 5825, Qatar
[3] ICUBE Laboratory—CNRS, University of Strasbourg, 2 Rue Boussingault, 67000 Strasbourg, France; ahzi@unistra.fr
* Correspondence: zhliu@hbku.edu.qa

1. Optimization of material load on the cellulose paper

Performance Test

A represented in Figure S1, optimization process was performed for the deposition of titanate nanofibers and CNF solution with 15 different compositions. Performance test had been carried out using vegetable oil to determine the best composition of titanate nanofibers and CNF.

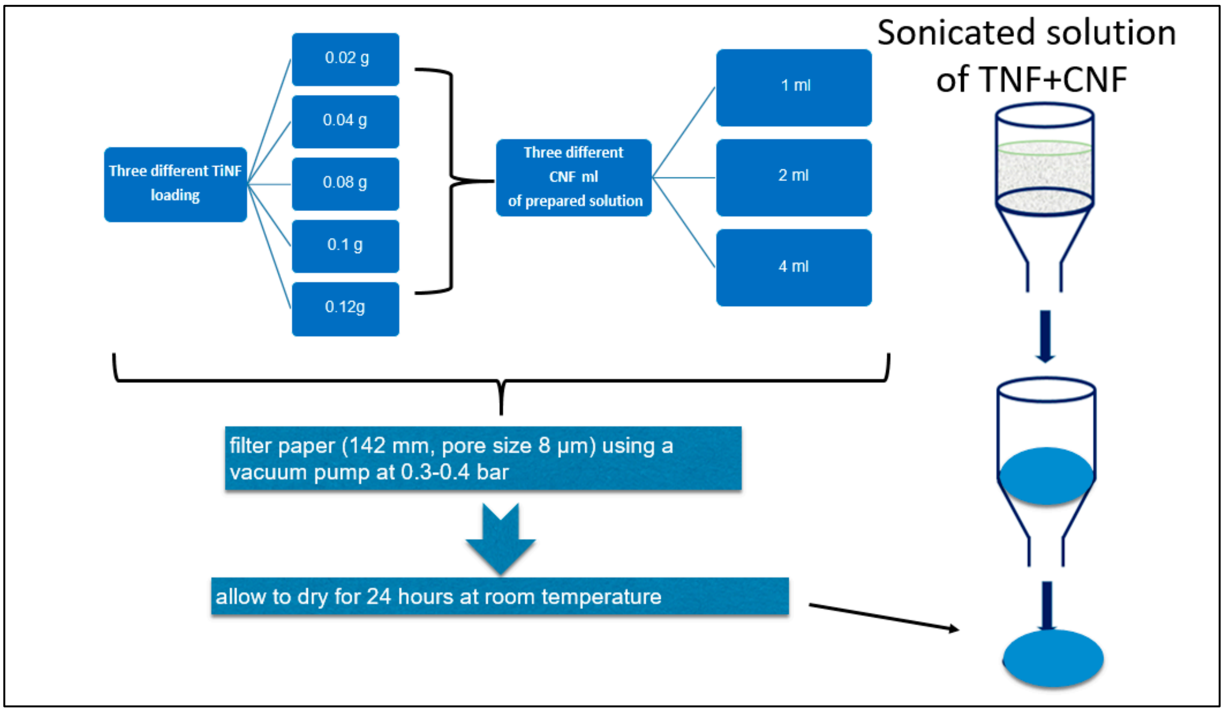


**Figure S1.** Optimization process for the deposition of titanate and CNF nanofibers with 15 different compositions.

Figure S2 represent the percentage of oil rejection and water flux of the prepared membranes, respectively. According to Figure S2, as the loading of TNF increases, the oil rejection increases and the water flux decreases. The same trend is observed when content of CNF increases. When CNF solution volume is 2 ml and TNF loadings are 0.08 g, 0.1 g, and 0.12 g, more than 99% oil rejection is achieved, however, the water flux is low when TiNF loading is 0.1g and 0.12g, and relatively high water flux when TNF loading is 0.08g. Thus, when the TNF loadings is 0.08 g and CNF volume is 2 ml, best condition is achieved with oil removal of more than 99% and a water flux of 1520 LMH/bar.

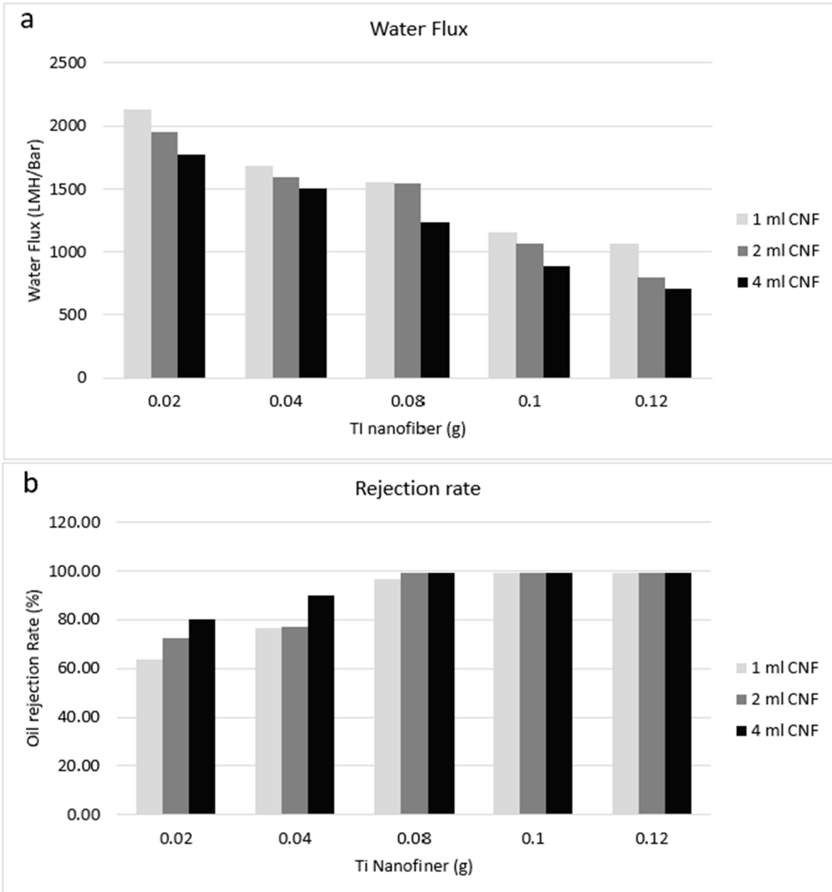


**Figure S2.** (**a**) Water Flux using TNF/CNF membrane using different loading of TNF and CNF. (**b**) Percentage of oil rejection using TNF/CNF membrane using different loading of TNF and CNF.

2. Long term PH stability

To instigate long term PH stability of the new membrane, TNF/CNF membrane was exposed ex-situ to different acidic and basic condition for 384 hours. The membrane sample was removed from the acidic or basic solution at different time intervals (24, 48, 96, 292, 384 h) and then rinsed with DI water. After that, the performance of the membrane was investigated. Figures S3a and S4a present the performance test (oil rejection rate) and water flux (LMH/bar) of the TNF/CNF mem-brane after different time interval exposure to acidic and basic environment respectively. Environment. Figures S3b and S4b present the oil concentration in the permeate at different time interval exposure to acidic and basic environment respectively. It is concluded from the performance test that the performance of CNF/TNF membrane was maintained after exposure to harsh acidic or basic environment.

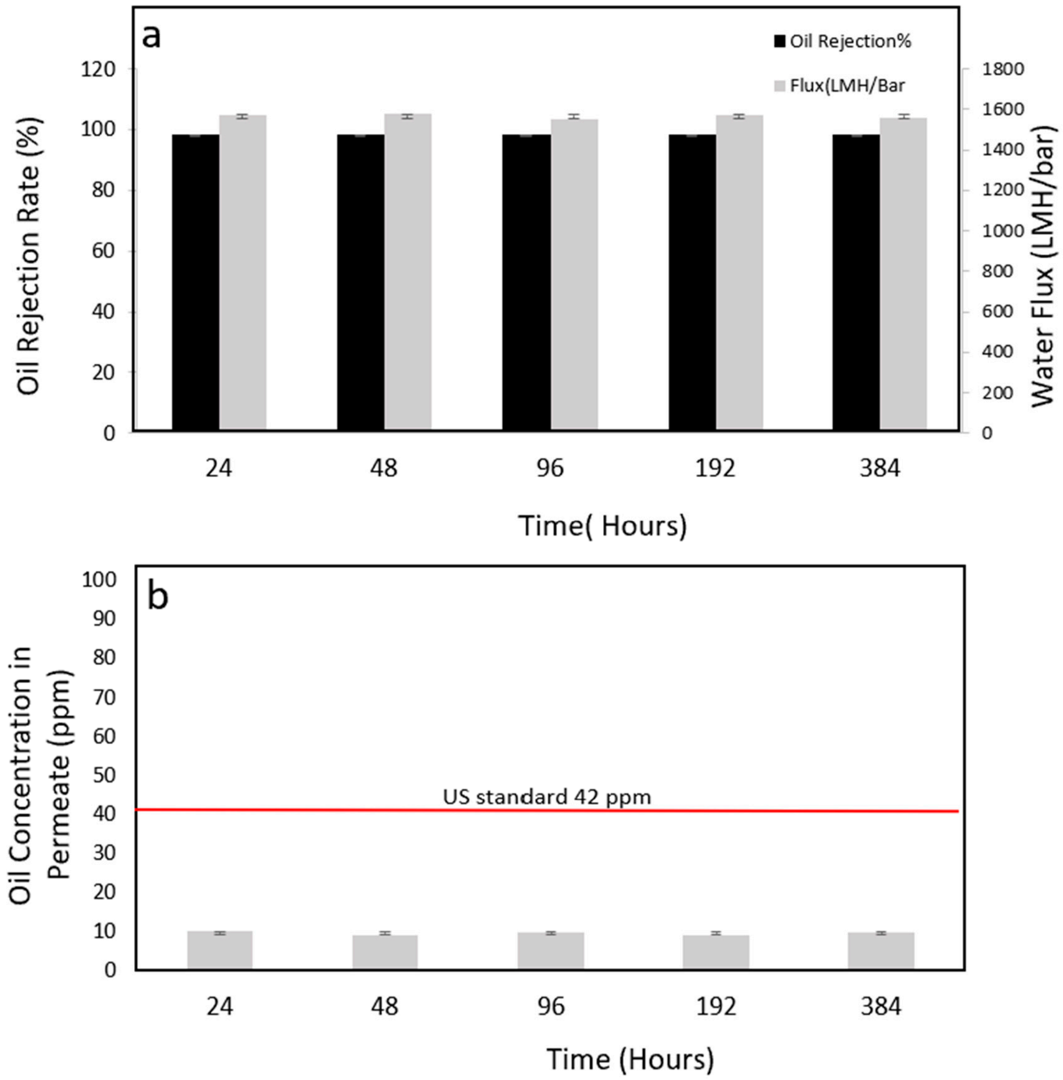


**Figure S3.** Long term acidic stability test (0.1 M HNO3, PH~1). (**a**) Performance test (oil rejection rate) and water flux (LMH/bar)) of the TNF/CNF mem-brane after different time interval exposure to acidic environment. (**b**) Oil concentration in the permeate different time interval exposure to acidic environment.

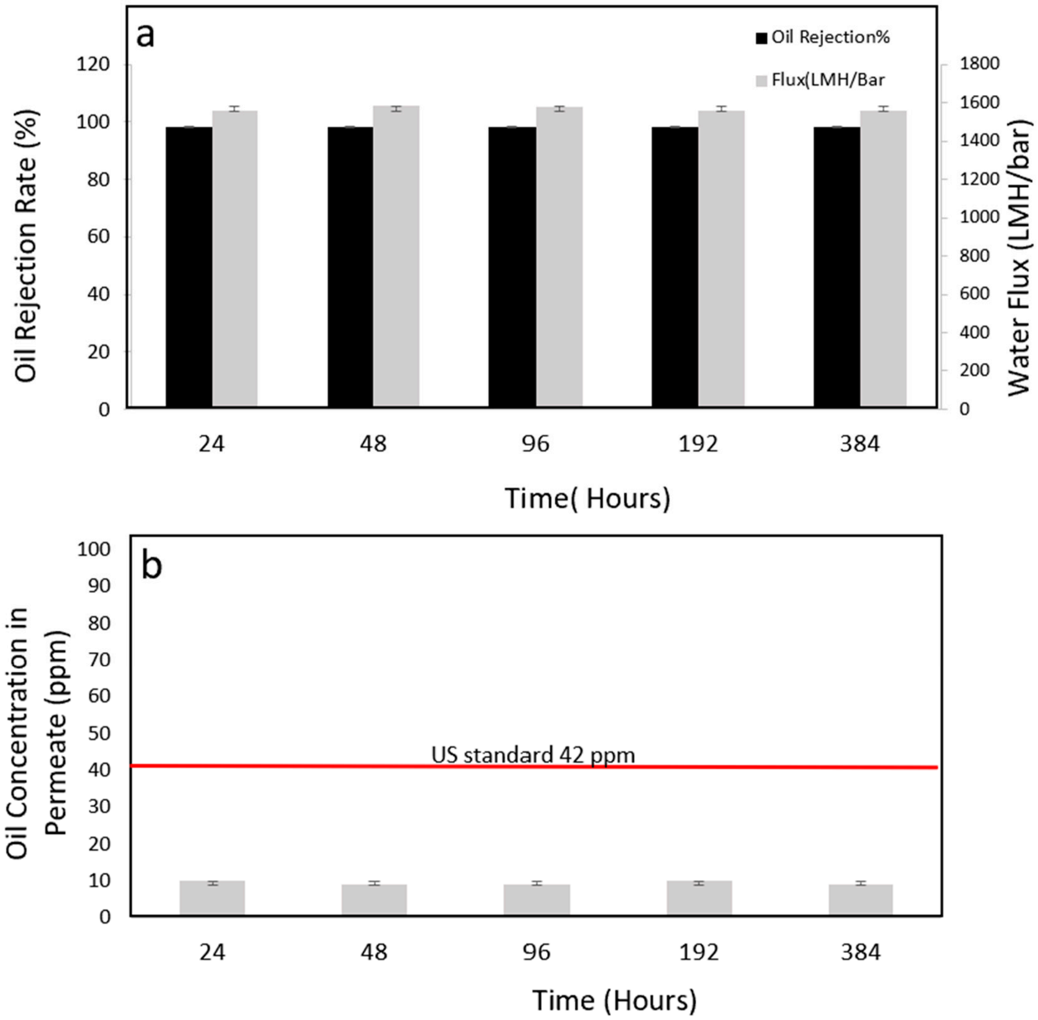


**Figure S4.** Long term basic stability test(0.1 M NaOH, PH~13)). (**a**) Performance test (oil rejection rate) and water flux (LMH/bar)) of the TNF/CNF mem-brane after different time interval exposure to basic environment. (**b**) Oil concentration in the permeate different time interval exposure to basic environment.