Supportimg Information for the manuscript entitled:

The Increase of Antibiofouling Properties of Reverse Osmosis Membrane by Oxidized CNTs

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1. Preparation of oxidized CNTs

For the confirmation of attached acid groups on the CNT surface during the modification, analyses using Raman spectroscopy and XPS were carried out. Fig S1 shows the Raman spectra of pristine CNT and oxidized CNT; distinct characteristic peaks of D band and G band of CNT were observed 1308 cm^{-1} and 1600 cm^{-1}, respectively. The D/G ratio, which is the peak intensity ratios of D band and G band, increased after the modification, indicating that acid treatment increases the defect on CNT surfaces. Similar results increasing the D band intensity by the functionalization of CNT surface were reported by others. Surface compositions of the CNTs prepared from the acid mixture were characterized by XPS analysis (Fig S2). The content of oxygen increases after the modification process. The increase of the atomic ratios of oxygen to carbon (O/C) indicates the introduction of acid groups on the CNT surface by the acid treatment. The acid group formed on CNT can increase the dispersion of CNTs in the aqueous solution and in the polyamide and PVA layers by the H-bonding and/or dipole-dipole interactions. Therefore, acid groups were attached on the defective surfaces of CNT during the modification process according to the Raman spectroscopy and XPS analysis. Since CNT surfaces were chemically modified to functional groups having oxygens, the CNTs prepared from the acid mixture were named as the oxidized CNTs.

Fig S1. Raman spectra of pristine and oxidized CNT.

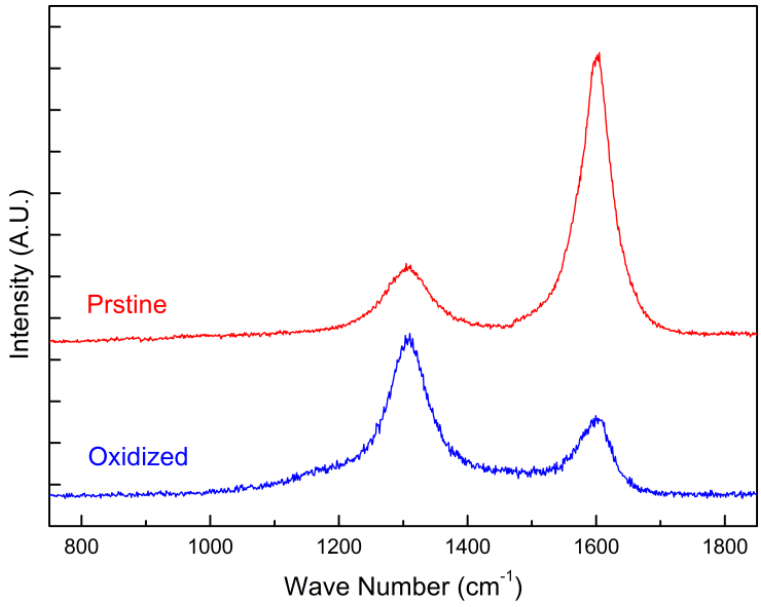

Fig S2. (a) XPS spectra and (b) O/C ratios of pristine and oxidized CNT.

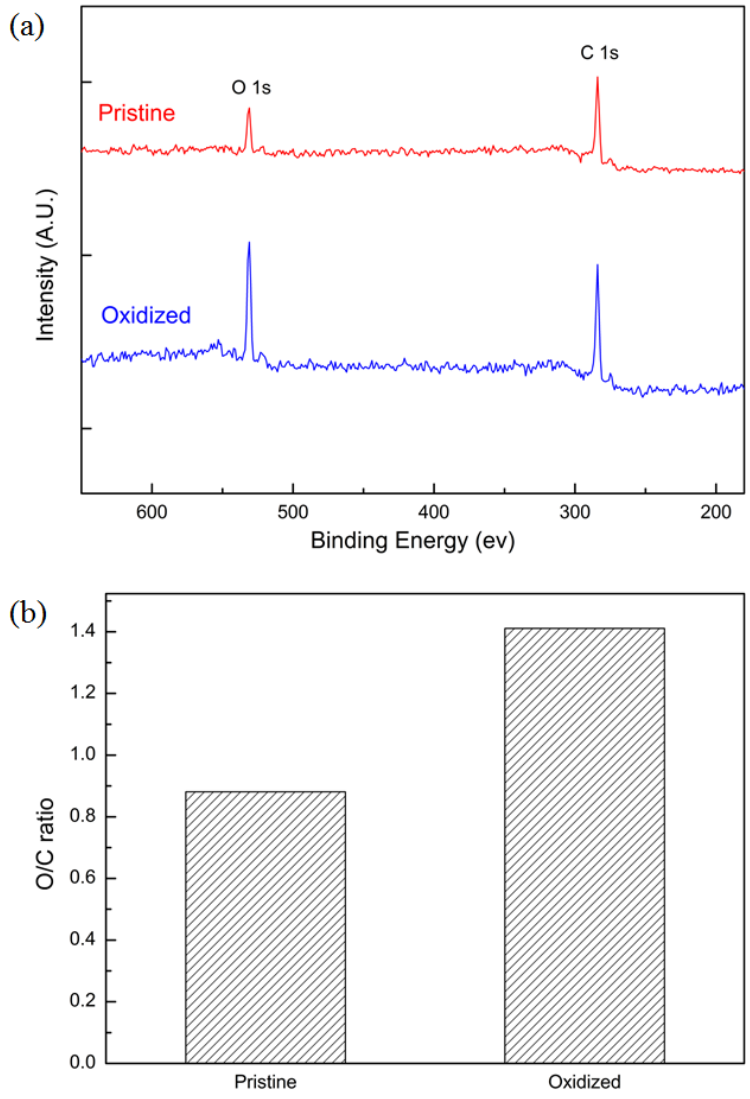

Fig S3. Photographs of PA membrane (left) and PA-CNT-PVA membrane prepared by 0.2 wt% of CNT-dispersed solution and 0.2 wt% of PVA solution (right).

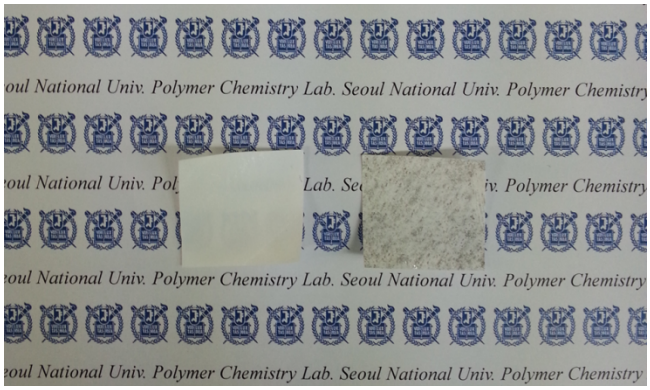

Fig S4. SEM images of PA-CNT-PVA membrane prepared by 0.4 wt% of CNT-dispersed solution and 0.2 wt% of PVA solution (PA-CNT0.4-PVA0.2 membrane).

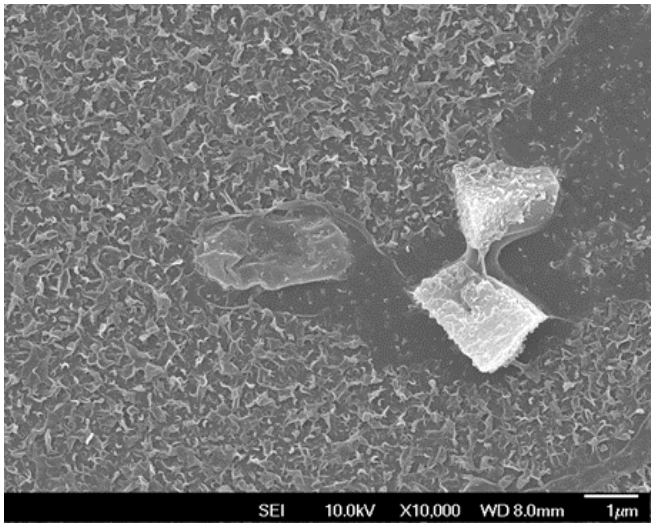

Figure S5 AFM images of (a) PA, (b) PA-PVA0.4, (c) PA-CNT0.2-PVA0.2, and (d) LFC-1 membranes.

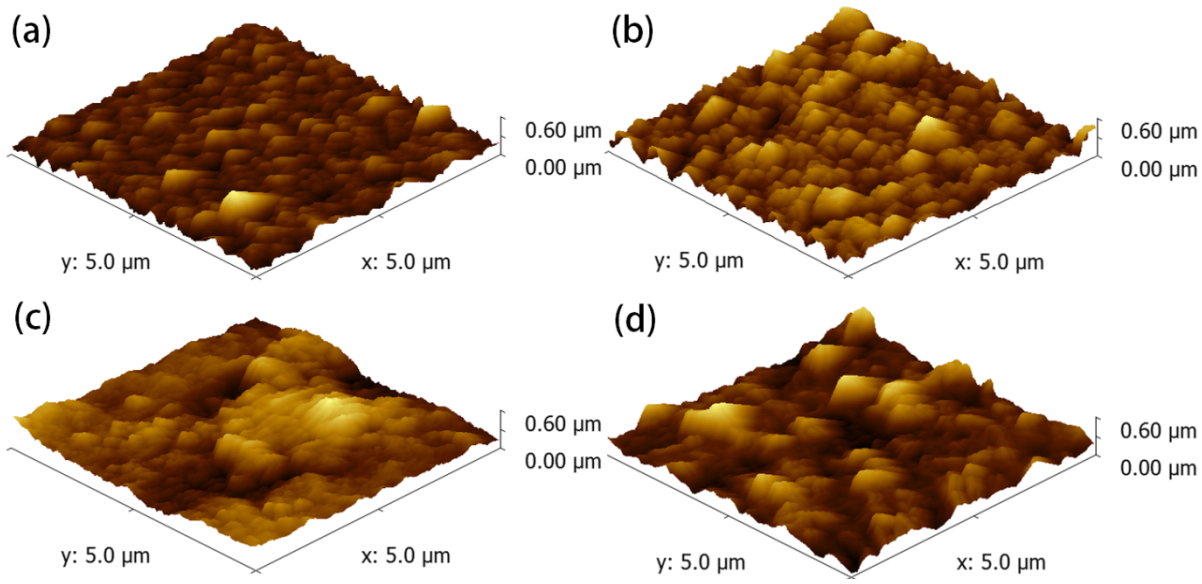

Table S1. XPS elemental composition (in at %) of the surface of PA and PA-CNT0.2-PVA0.2 membrane for before and after 3 days of pure water filtration.

	C 1s	O 1s	N 1s	O/C ratio
PA (before filtration)	71.60 ± 0.46	17.40 ± 0.14	11.00 ± 0.55	0.24 ± 0.00
PA (after filtration)	72.54 ± 0.42	17.50 ± 0.23	9.95 ± 0.31	0.24 ± 0.04
PA-CNT-PVA (before filtration)	68.47 ± 1.05	29.28 ± 1.36	2.25 ± 0.84	0.43 ± 0.03
PA-CNT-PVA (after filtration)	68.69 ± 0.37	28.84 ± 1.52	2.46 ± 1.56	0.42 ± 0.02