

# Supplementary Materials: Phosphonium Modified Nanocellulose Membranes with High Permeate Flux and Antibacterial Property for Oily Wastewater Separation

Kun Peng <sup>1,2</sup>, Chenglong Wang <sup>1,2</sup>, Chunyu Chang <sup>2,3,4,\*</sup> and Na Peng <sup>1,\*</sup>

<sup>1</sup> Key Laboratory of Coal Conversion and New Carbon Materials of Hubei Province, School of Chemistry and Chemical Engineering, Wuhan University of Science and Technology, Wuhan 430081, China

<sup>2</sup> College of Chemistry and Molecular Sciences, Wuhan University, Wuhan 430072, China

<sup>3</sup> Engineering Research Center of Natural Polymer-Based Medical Materials in Hubei Province, Wuhan University, Wuhan 430072, China

<sup>4</sup> Laboratory of Biomedical Polymers of Ministry of Education, Wuhan University, Wuhan 430072, China

\* Correspondence: pengna@wust.edu.cn (N.P.); changyu@whu.edu.cn (C.C.)

## Preparation of Oil/Water Nanoemulsions

For the preparation of various nanoemulsions, the same proportions and methods were used. Typically, 0.5 g Tween 80 (surfactant) and 99.375 g water were mixed, and then

0.125 g oil was added, and the mixture was subjected to 100 W ultrasonic treatment (SCIENTZ, 40 kHz, China) for 2 h. After ultrasonic treatment, four kinds of nanoemulsions, including petroleum ether/water and chloroform/water, pump oil/water and dimethicone/water emulsions were obtained.

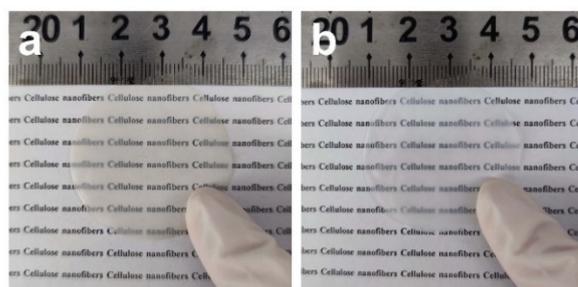


Figure S1. Photographs of TCNF membrane (a) and THPC@TCNF membrane (b).

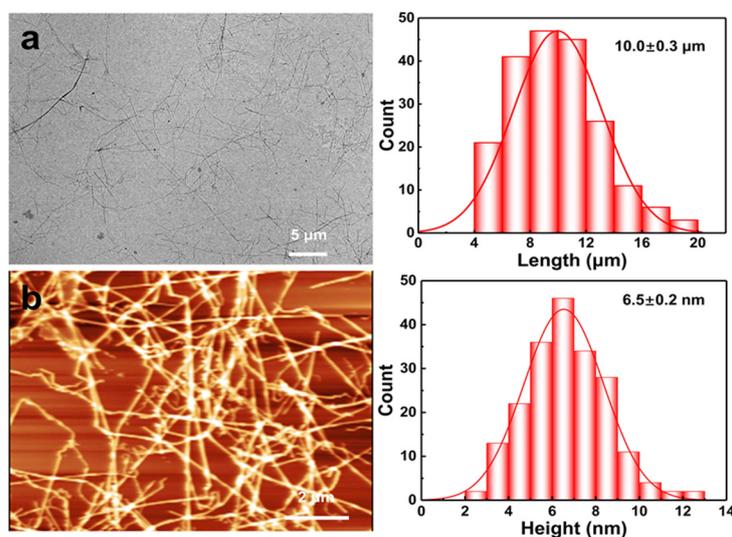


Figure S2. Characterization of the morphology, length and height distribution of TCNFs.



Figure S3. Photograph of TCNFs suspension.

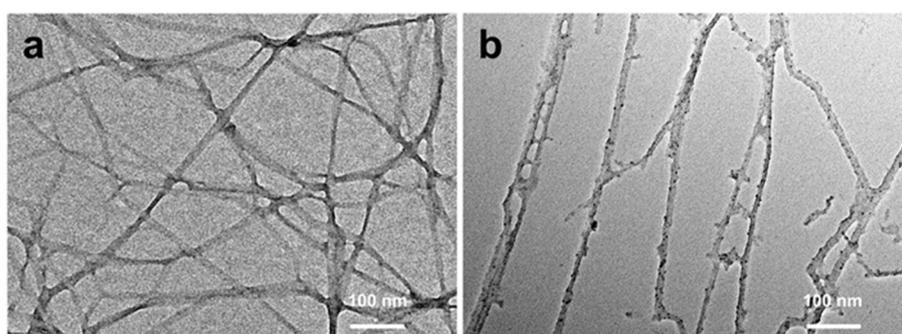


Figure S4. TEM images of TCNFs before (a) and after modified with THPC (b).

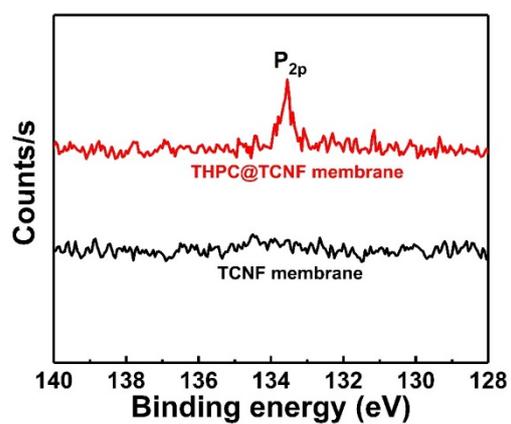


Figure S5. High-resolution P<sub>2p</sub> spectra of TCNF membrane and THPC@TCNF membrane.

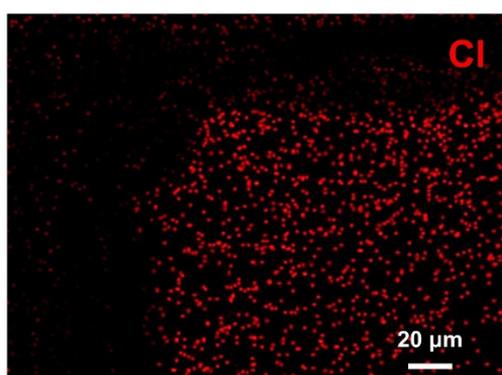


Figure S6. EDS mapping of chlorine element on THPC@TCNF membrane.

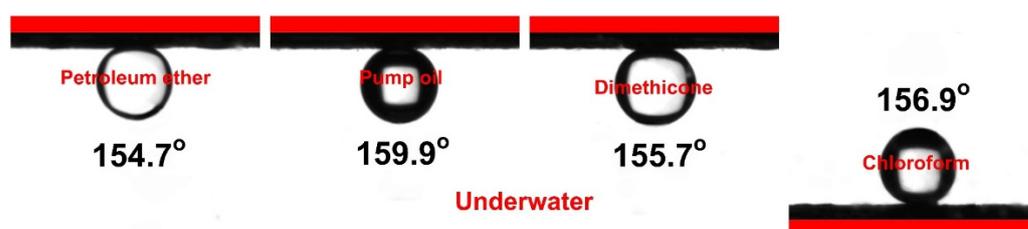


Figure S7. Various oil droplets on TCNF membrane underwater.

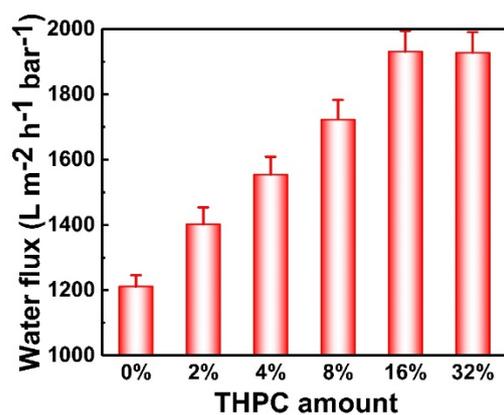


Figure S8. Water flux of THPC@TCNF membranes with different THPC content.

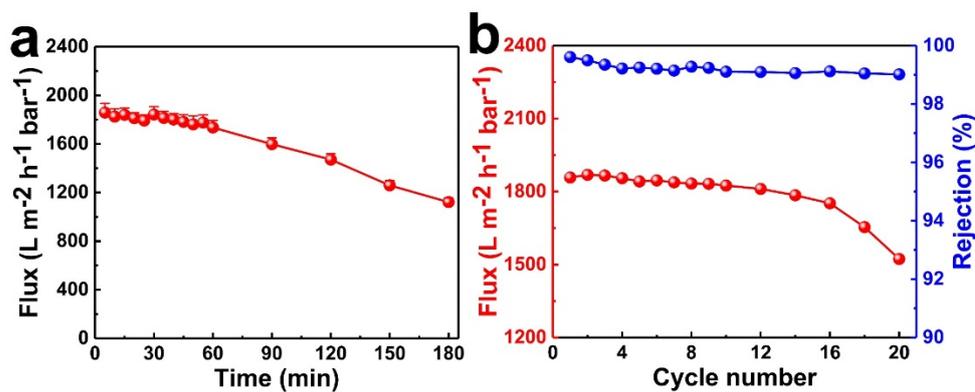


Figure S9. (a) Water flux of THPC@TCNF membrane during continuous separation and (b) cycling performance of THPC@TCNF membrane for petroleum ether/water nanoemulsion.

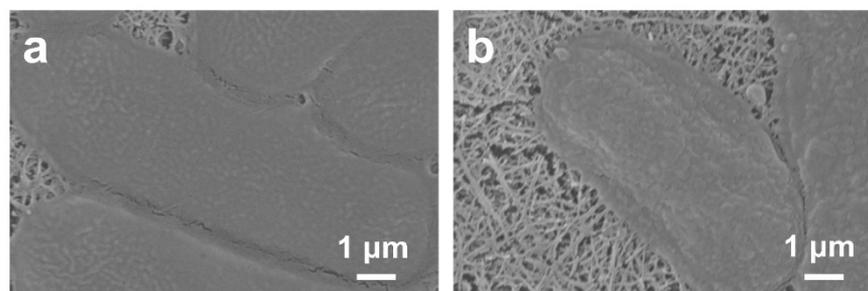


Figure S10. SEM images of *B. subtilis* after contacting with TCNF membrane (a) and THPC@TCNF membrane (b) for 1 h.