Fabrication of Porous Polymer Coating Layers with Selective Wettability on Filter Papers via Breath Figure Method and Their Applications in Oil/Water Separation

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\textbf{Figure 1.} The polymer solution droplets profile in the measurement of liquid interfacial tension between the PBTF-30 dichloromethane solution and water by hanging drop method.

The result was calculated by digital image processing with OWRK method, and the interfacial tension between the PBTF-30 DCM solution and water is measured as 5.36 mN·m\textsuperscript{-1}. 
The interfacial energy balance $z_0$ is defined as:

$$z_0 = \frac{z}{R} = \frac{\gamma_w - \gamma_{w/s}}{\gamma_s}$$  \hspace{1cm} \text{Equation S1}

Where $z$ is the distance between the droplet center and the air/solution interface; $R$ is the droplet radius; $\gamma_{w/s}$ is the interfacial tension between water and solution; $\gamma_w$ and $\gamma_s$ are the surface tension of the water and the solution, respectively. When $-1 < z_0 < 1$, one layer of droplets stayed between the air and solution interface, forming monolayer ordered structures. When $z_0 > 1$, the droplets immerge into the solution, forming multilayer films. When $z_0 < -1$, water droplets could not remain at the interface or in the solution, so no ordered structure could be obtained.

**Figure S3.** Schematic view of a spherical water droplet at the air/solution interface, with copyright permission from references.

$\gamma_s$ and $\gamma_w$, the surface tension of solution and water, respectively; $\gamma_{w/s}$, the interfacial tension between water and the solution; $z$, the distance between the water droplet center and surface; $R$, the radius of the spherical water droplet.
Figure S4. SEM images of the coating layers formed by PBTP-30 by spin coating method on (a) filter paper; (b) planar glass slide in the concentrations of 15 mg/mL.

Figure S5. The strong Tyndall effect displayed by N-50 under the 405 nm ultraviolet light.

Figure S6. SEM images of the coating layers by N-50 (5 mL, 10 mg/mL) with 2 μL water (a) shear damaged polymeric coating layer; (b) coating layers in situ formed on fiber; (c) High magnification SEM image of the communicating pores.
Figure S7. Water droplet contact statue under the oil phase of the N-50 coated filter paper (petroleum ether was employed as oil phase and was dyed into yellow), digital photographs of (a) the side view; (b) the top view.

The Flux ($F$) of petrol ether /water mixture was assessed by measuring the time spent in collecting the permeated oil, and calculated by Equation 2.

$$F = \frac{V}{St}$$  

Equation (2).

Where $V$ is the volume of the petrol ether, $S$ represents the effective surface area of superhydrophobic composite, and $t$ is the time, which is 60s (The video of the filtration process can be found in supporting information Video 2). The effective surface area $S$ is in dynamic changing as the filtration proceeding. The initial $S$ is 2.49cm$^2$ and the final $S$ is 0 cm$^2$ since the $F$ is a constant, the value of $S$ is averaging as 1.2445 cm$^2$ and applied in $F$ calculate. The value of $F$ as calculated is 2989.15Lm$^{-2}$ h$^{-1}$. 