Supplementary Information
for
Self-Cleaning PDA-Ag@PVDF Membrane for Oil/Water Separation and Dye Adsorption from Emulsion

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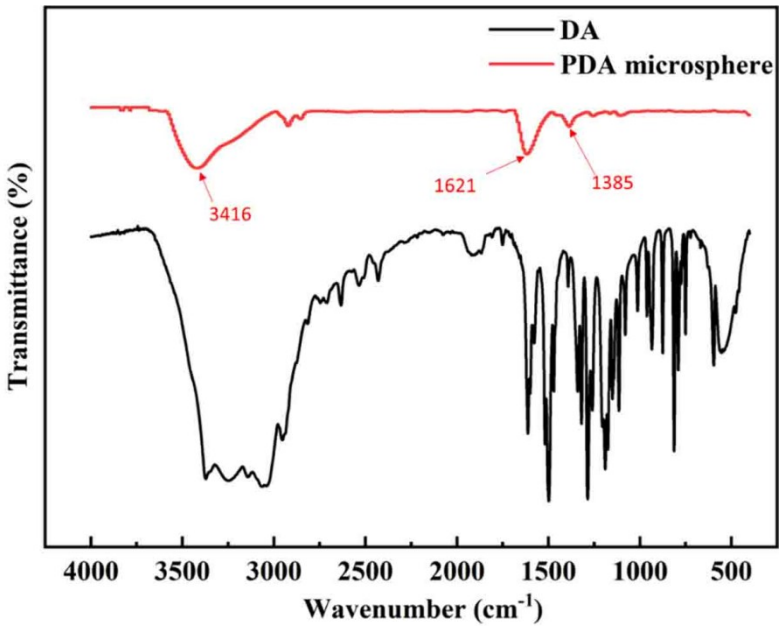

Fig. S1. FT-IR spectra of DA and PDA microsphere.

The functional groups of the prepared PDA microspheres were determined by FT-IR as shown in Fig. S1. It can be seen that the stretching vibrations of phenolic O-H and N-H produce characteristic peaks at 3416 cm^{-1} single bond. And the peak at 1621 cm^{-1} is due to the stretching vibration of the aromatic ring and the bending vibration of N-H. The characteristic peak at 1381 cm^{-1} can be attributed to the bending vibration of phenolic C-O-H and the presence of N-H vibration (stretching vibration, bending vibration) can prove the occurrence of rearrangement reaction and polymerization reaction, and the oxidative polymerization of dopamine successfully prepared PDA microspheres.

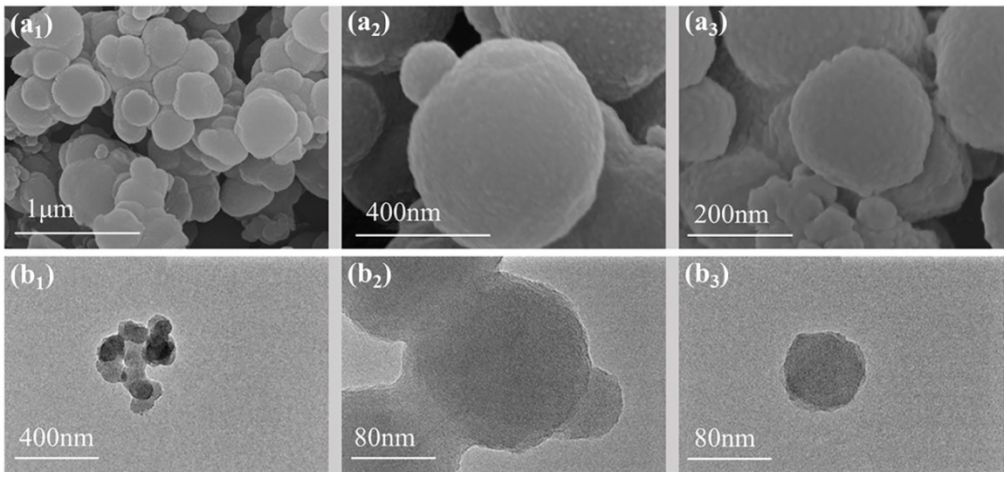

Fig. S2. (a)SEM images of PDA microspheres, (b)TEM images of PDA microspheres.

As shown in Fig. S2, the morphology of the prepared PDA microspheres was detected by TEM and SEM. The SEM images showed that the PDA microspheres were stacked with each other, and the single microspheres showed a relatively regular sphere with a slightly uneven outer surface. At the same time, it can be confirmed that the PDA microspheres have a uniform spherical structure by TEM characterization.

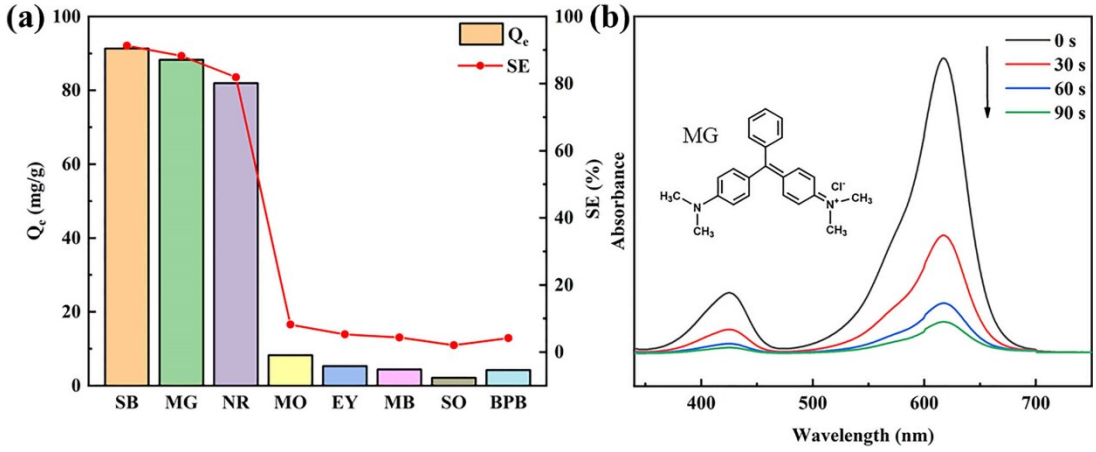

Fig. S3. (a) Equilibrium adsorption amount Q_e and separation efficiency SE of PDA-Ag microspheres on several dyes; (b) sequential UV-vis spectra of PDA-Ag microspheres adsorbed MG (50 mg/L) in aqueous solution.

As shown in Fig. S3(a), the Q_e of PDA-Ag for cationic dyes SB, MG, and weakly cationic dye NR could reach 91.33 mg/g, 88.26 mg/g, and 81.94 mg/g, corresponding to 91.33%, 88.26%, and 81.94% of SE, respectively. While for MO, EY, MB, SO and BPB the adsorption was extremely low, only 8.22%, 5.32%, 4.37%, 2.11% and 4.21%, respectively.

As shown in Fig. S3(b), the intensity of the absorption peak in the UV spectrum of the dye solution decreased sharply within 30 s after the addition of the adsorbent, and the absorption peak tended to level off after 90 s, which indicated that PDA-Ag still had the ability to adsorb MG rapidly after the regeneration procedure.

Porosity test of pristine PVDF membrane. The membrane porosity can be determined by gravimetric method to determine the weight of the liquid contained in the membrane pores.

$$\varepsilon = \frac{(w_1 - w_2)/d_w}{(w_1 - w_2)/d_w + w_2/d_p} \times 100\% \quad (1)$$

where w_1 was the weight of the wet membrane (g), w_2 was the weight of the dry membrane (g), d_w was the pure water density (0.998 g cm^{-3}) and d_p was the polymer density (as the inorganic content in the membrane matrix was small and $d_p$was approximate to d_{PVDF}, namely 1.765 g·cm^{-3}).

According to the gravimetric method, the porosity of the pristine PVDF membrane is 43.69±0.5 %.