applied sciences

MDPI

Supporting Information

Preparation and physicochemical properties of tannin-immobilized membrane adsorbent

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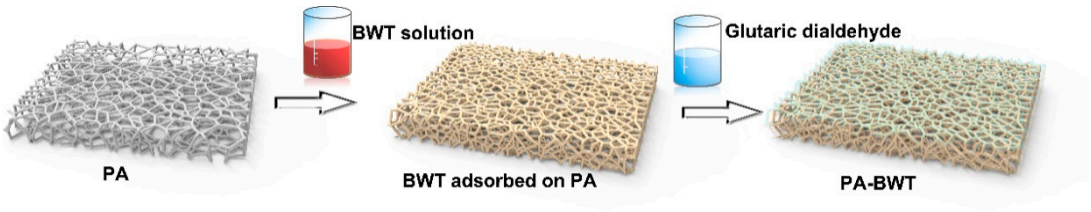
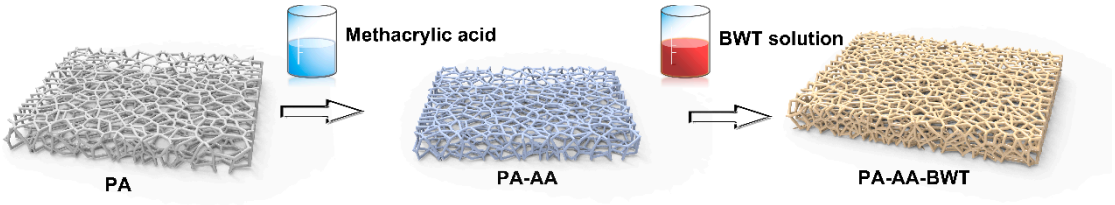
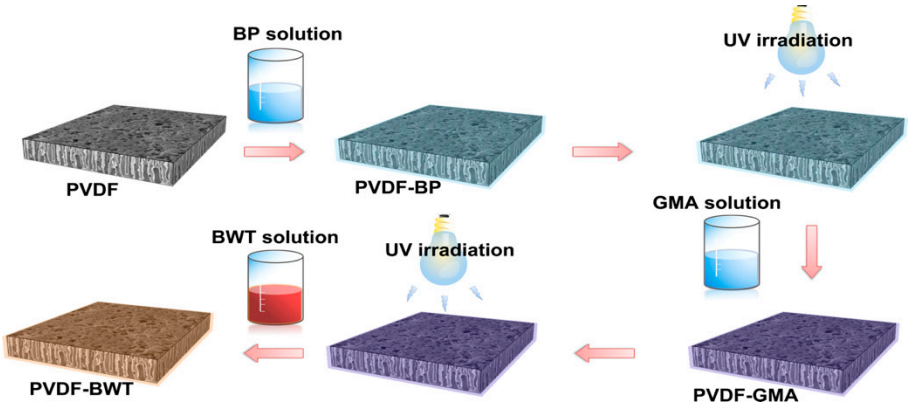


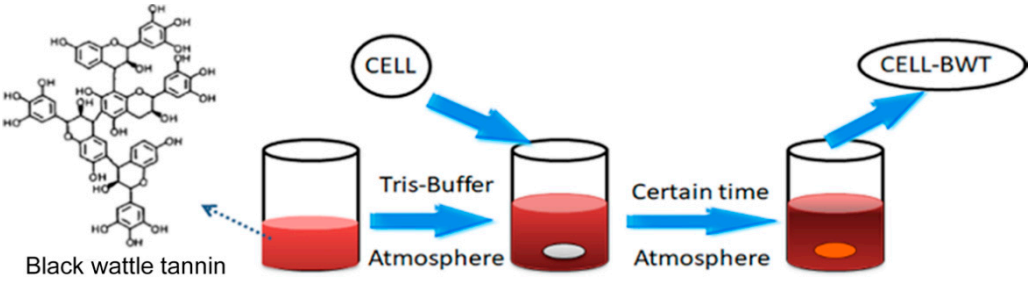
Schematic S1. Schematic illustration showing the preparation of PA-BWT.



Schematic S2. Schematic illustration showing the preparation of PA-AA-BWT.



Schematic S3. Schematic illustration showing the preparation of PVDF-BWT.



Schematic S4. Schematic illustration showing the preparation of CELL-BWT.

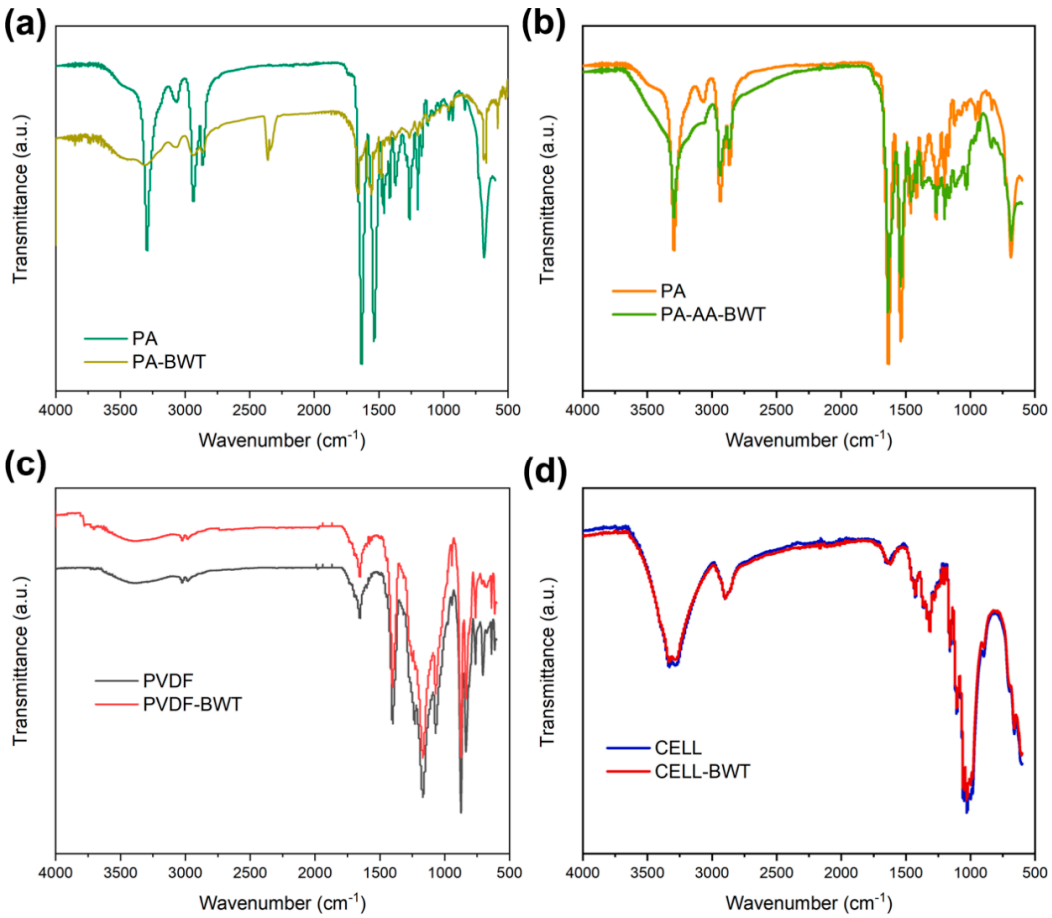


Figure S1. The FTIR spectra of (a)PA and PA-BWT, (b) PA and PA-AA-BWT, (c) PVDF and PVDF-BWT, (d) CELL and CELL-BWT.

The FTIR spectrum of the M-TANs to support the successful synthesis of tannin-immobilized membrane. As shown in Figure 1(a), the spectrum of PA-BWT shows stretching vibrations of O-H and N-H around 3340 cm^{-1}, C-H stretching at 2933 cm^{-1} and 2850 cm^{-1}, which also appear in the PA. It also exhibits stretching vibrations of the phenolic group v(C-OH) at 1540 and 1590 cm^{-1}, showing a little red shift than the corresponding peaks of tannin, which gives proof to the successful immobilization of tannin. The FTIR spectrum of PA-AA-BWT is shown in Figure 1(b), compared with PA, a new peak appeared at 1090cm^{-1}, which was attributed to the stretching vibration peak of C=O in the ester group, due to the grafting of acrylic acid. The FTIR spectra of PVDF before and after immobilized BWT are shown in Figure 1(c). The spectrum of PVDF shows bending vibration of C-F around 700 cm^{-1}, C-H stretching at 1400 cm^{-1} and 1700 cm^{-1}. After immobilized BWT, the bending vibration of C-F around 700 cm^{-1} disappeared in PVDF-BWT which due to the the fracture of C-F bond during irradiation grafting. The Figure 1(d) shows the FTIR spectra of CELL before and after immobilized BWT, there is little difference between the spectra of these two, which is because the immobilization of BWT on the CELL is done by coating and there is no change of chemical bond.

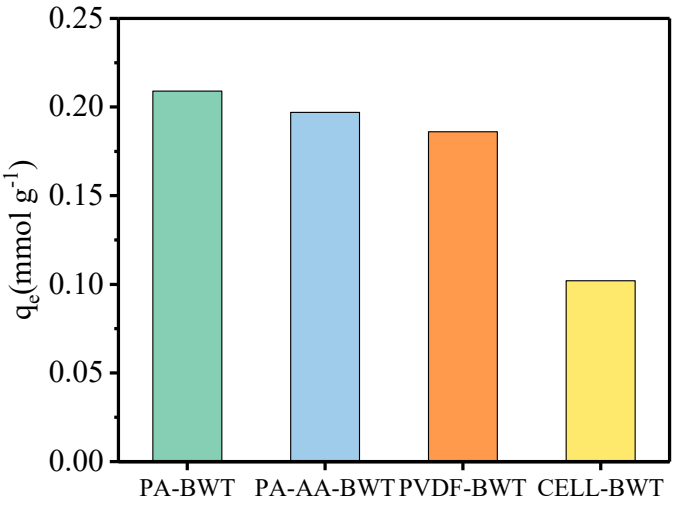


Figure S2. Adsorption capacity of UO_2^{2+} on different M-TANs: the initial concentration of the UO_2^{2+} solution is 1 mmol L^{-1}, the pH is 5.0, and the adsorption time is 24 h.

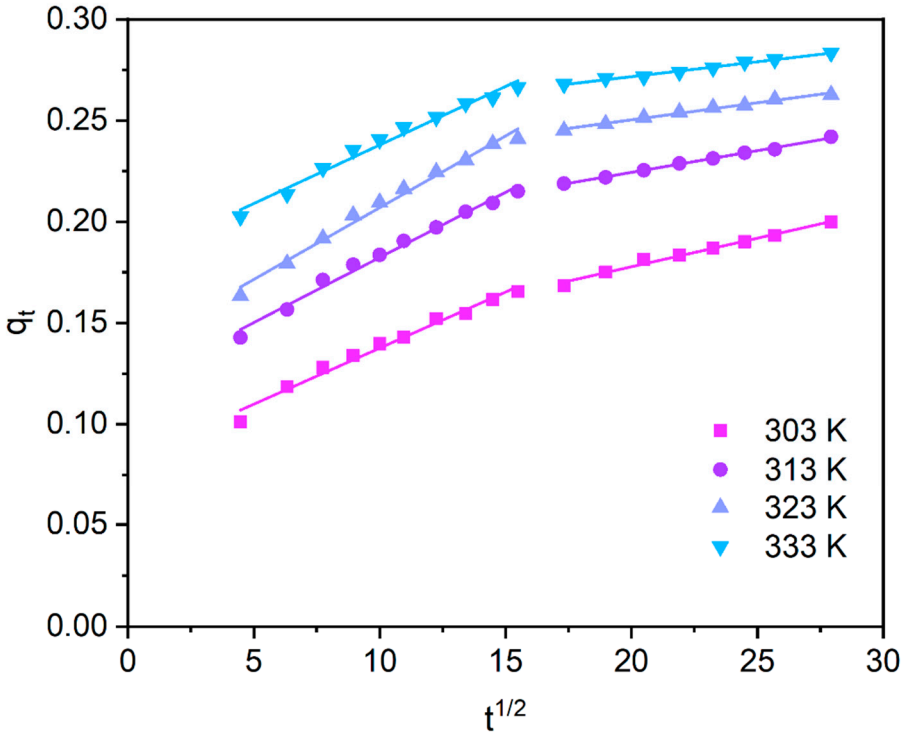


Figure S3. Adsorption kinetics regression by the Weber-Morris model: $q_t = k_{ip}t^{1/2} + C$, where q_t (mmol/g) are the adsorption capacity of UO_2^{2+} at time t, k_{ip} is Internal diffusion rate constant and C is a constant of the surface boundary layer thickness of the adsorbed material.

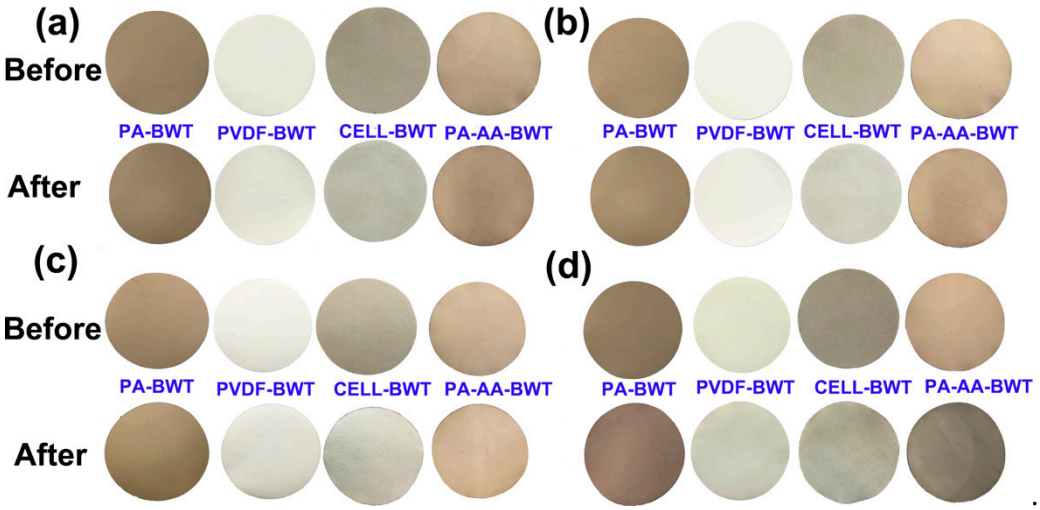


Figure S4. Digital photos of different M-TAN before and after long-term shaking and soaking at different temperatures (a) 20°C, (b) 50°C, and pH (c) pH=2, (d) pH=9.