Supporting Information for

Polyacrylonitrile/UV329/titanium oxide composite nano-fibrous membranes with enhanced UV protection and filtration performance

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UPF calculation

UV protection factor (UPF) indicates the ability of a fabric to protect people against UV rays in the 290-400 nm wavelength band. The UPF is the ratio between the average effective UV irradiance on unprotected skin and that on protected skin. The UPF calculation formula is as follows:

$$\text{UPF} = \frac{\sum_{290}^{400} E_\lambda \times S_\lambda \times \Delta\lambda}{\sum_{290}^{400} E_\lambda \times S_\lambda \times T_\lambda \times \Delta\lambda} \tag{1}$$

where λ denotes the UV light wave wavelength, and its unit is nm; T_λ denotes the UV transmittance at a wavelength of λ whose unit is %; E_λ denotes the UV spectral energy efficiency relative to the red spot; $\Delta\lambda$ denotes the UV light wave length spacing, the whose unit is nm; S_λ denotes the solar spectral radiant energy, whose unit is W m^{-2}nm^{-1}.

UV transmittance is divided into T(UVA)$_{AV}$ and T(UVB)$_{AV}$ according to wavelength, which refer to the transmittance of the UV transmittance of 315~400nm and 190~315 nm wavelengths, respectively. The calculated of the method is as follows:

$$\text{T(UVA)}_{AV} = \frac{\sum_{315}^{400} T_\lambda \times \Delta\lambda}{\sum_{315}^{400} \Delta\lambda} \tag{2}$$

$$\text{T(UVB)}_{AV} = \frac{\sum_{290}^{315} T_\lambda \times \Delta\lambda}{\sum_{290}^{315} \Delta\lambda} \tag{3}$$

Filtration performance test

An automated filter tester provided by Huada Filter Technology Co., Ltd., China was used to measure the filtration efficiency and air flow resistance of the membranes. To measure the filtration performance, the fibrous membranes were put on a filter holder. The tester could deliver charge neutralized monodisperse solid NaCl aerosol particles that had a mass mean diameter of 300-500 nm and a geometric standard deviation not exceeding 1.86. The neutralized NaCl aerosol particles were feed into a filter holder and down through the filter with 100 cm^2 of effective area. The filter air flow resistance was measured with the combination of a flow meter and two electronic pressure transducers that detected the pressure drop through the filtration medium under testing.
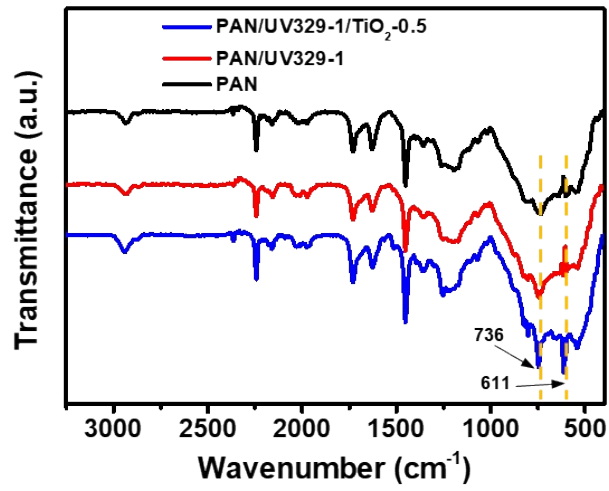
Fig. S1 FT-IR spectra of PAN, PAN/UV329-1, and PAN/UV329-1/TiO$_2$-0.5 nanofibrous membranes.
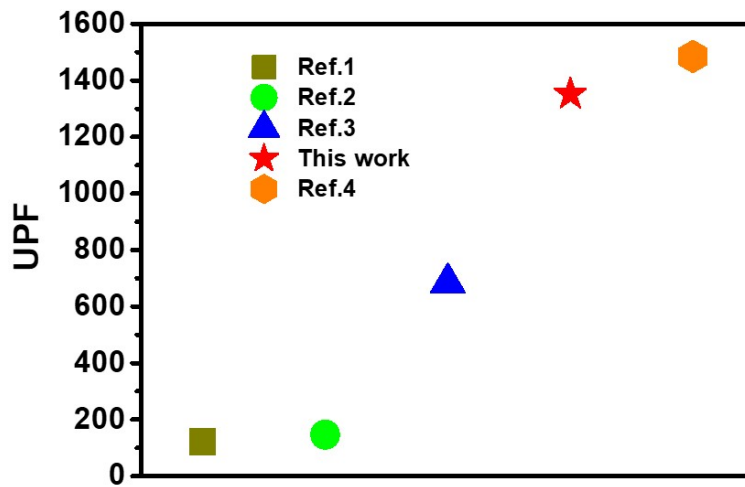

Fig. S2 Comparative analysis with the reported works.

Table S1 The average fibre dimeter, mean pore dimeter and filtration performance of PAN, PAN/UV329-1, PAN/UV329-1/TiO$_2$-0.5 nanofibrous membranes.

Samples	Average fibre dimeter (nm)	Mean pore dimeter (nm)	Filtration efficiency (%)	Pressure drop (Pa)
PAN nanofibrous membranes	404	1.8	99.90	273
PAN/UV329-1 nanofibrous membranes	448	2.1	99.83	188
PAN/UV329-1/TiO$_2$-0.5 nanofibrous membranes	572	2.8	99.57	145