Supporting Information

Superior Separation Performance of Ultrathin Gelatin Films

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1. Molecular structure of gelatin

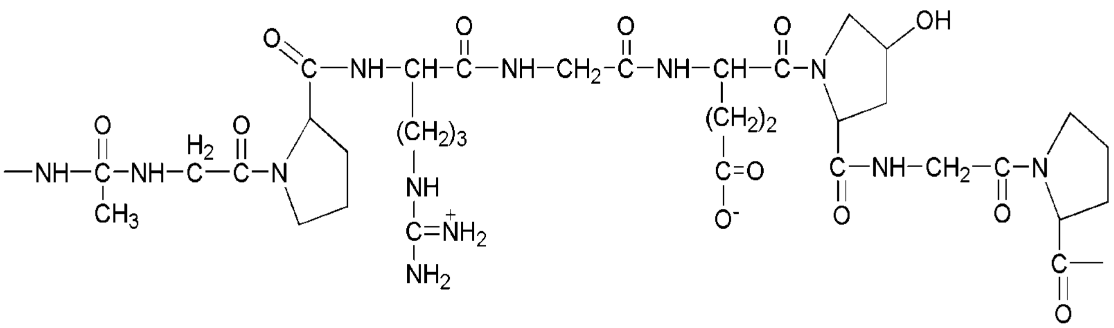

Figure S1 The molecular structure of gelatin (adopted from Reference 16 in the main text).

2. SEM images of the copper hydroxide nanostrands (CHN) layer and single-walled carbon nanotube layer

Figure S2a shows the SEM image of the CHN layer prepared by simple mixing 10 ml, 4 mM $Cu(NO_3)_2$ solution with equal volume 1.4 mM aminoethanol solution under stirring and aged for 2 days. Then 10 ml of this aged solution was filtered on a polycarbonate membrane with pore size of 400 nm. It is clear that fibrous structures were overlapped each other and formed porous networks with surface pore size of about 10 nm. Figure S2b demonstrates that the SWCNTs are still in small bundles with partially isolated single tubes. The surface pore size of this SWCNT layer is in the range of several to ten nanometers.

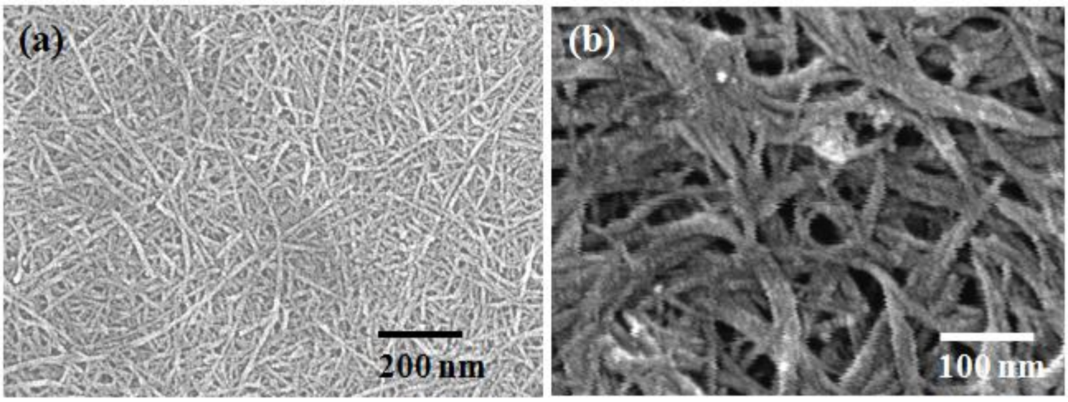

Figure S2 SEM images of (a) CHNs porous layer and (b) SWCNT porous layer, prepared by filtered on a PC membrane surface.

3. Additonal SEM images of G1 to G5 gelatin films

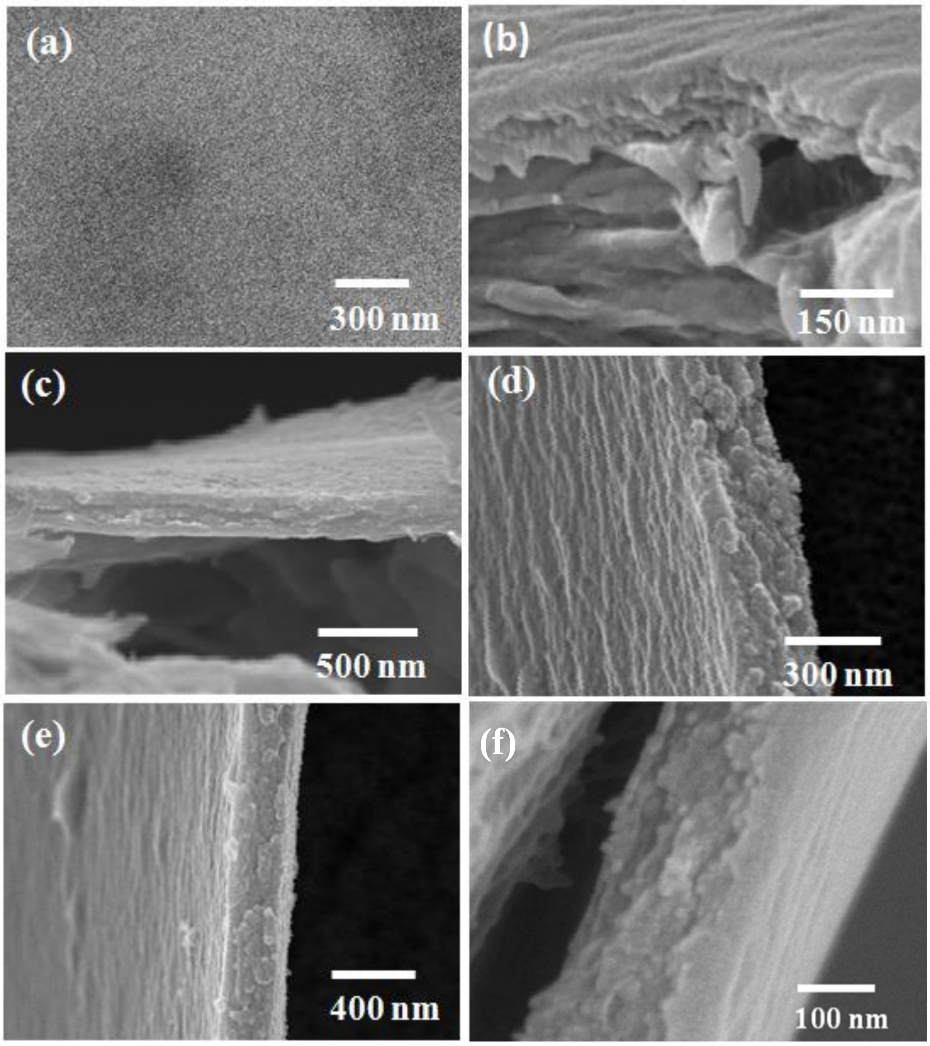

Figure S3 SEM images of (a)-(b) G1; (c) G2, (d) G3, (e) G4 and (f) G5 gelatin films, respectively.

4. FTIR spectra of pristine gelatin and cross-linked gelatin

For confirm the cross-linking reaction, the FTIR spectra of pristine gelatin, and the cross-linked gelatin films were recorded and shown in Figure S4. The new peak at 2359 cm^{-1} observed from the GA cross-linked gelatin, which arises from C-H bond in C_3H_6 alkene generated by the cross-link reaction between gelatin chains with GA[1-3]

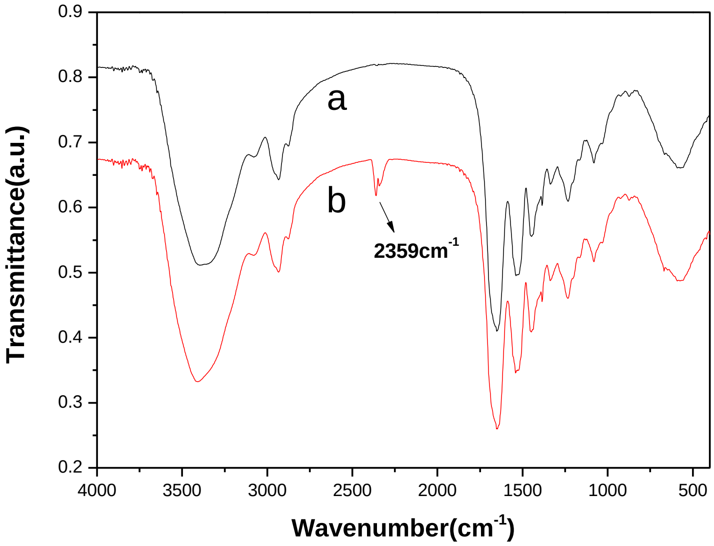

Figure S4. FTIR spectra of (a) pristine gelatin and (b) GA cross-linked gelatin.

5. Separation performance of single-walled carbon nanotube porous layer

Figure S5 shows the UV-vis spectra recorded from the original feed solution, retentate and permeate solutions after filtered 20 ml of 20 nm gold nanoparticle aqueous solution through SWCNT layer, which was prepared by 3 ml, 0.1 mg/ml SWCNT dispersion. It is clear that the concentration of 20 nm gold nanoparticles was increased in the retentate, and dramatically decreased in the permeation. It is calculated that the rejection of 20 nm gold is 87% by this SWCNT porous layer. This means that the effective pore size of this SWCNT layer is close to 20 nm.

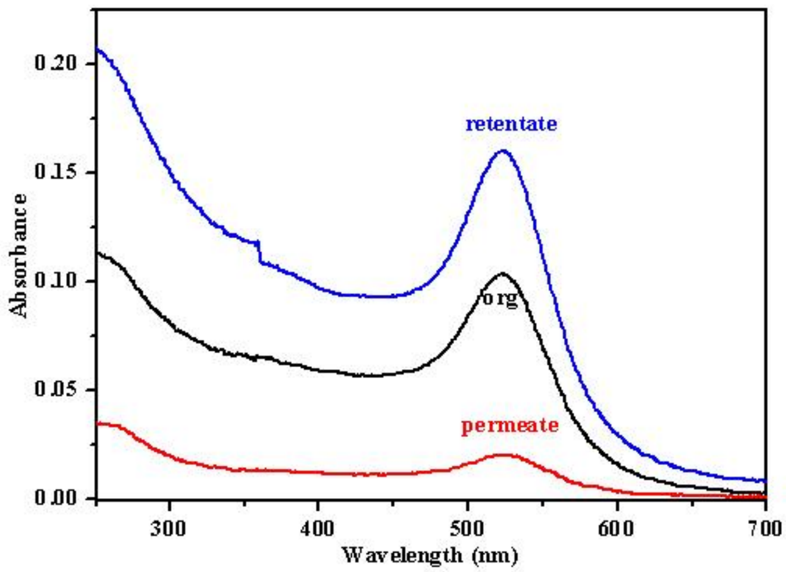

Figure S5 The UV-vis spectra of the original feed solution, retentate and permeate solutions after filtered 20 ml of 20 nm gold nanoparticle aqueous solution through SWCNT layer prepared from 3 ml, 0.1 mg/ml SWCNT dispersion.

6. The relationship between the thickness of gelatin layer and the filtration volume of the stocked gelatin solution

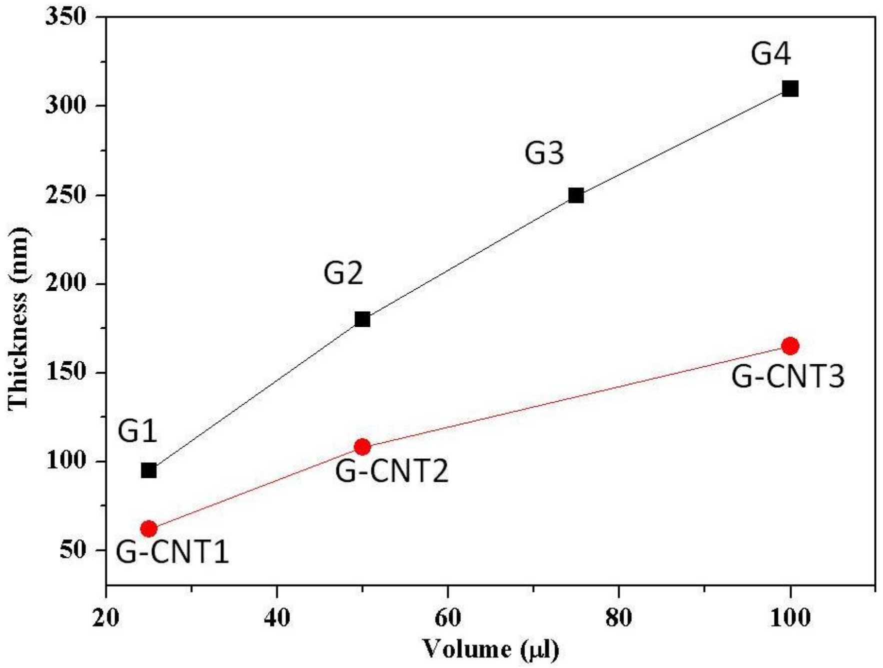

Figure S6. Thickness vs. filtering volume of 0.1 wt% gelatin solution.

References:

1. M. Azami, F. Moztarzadeh, M. Tahriri, *J. Porous Mater*. 2010, **17**, 313.

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3. C. S. Kia, D. H. Baeka, K. D. Ganga, K. H. Leea, I. C. Umb,Y. H. Parka, *Polymer* 2005, **46**, 5094.