Electronic Supplementary Material (ESI) for Biomaterials Science

Toward highly hemocompatible membrane for blood purification via physical blend of miscible comb-like amphiphilic copolymers

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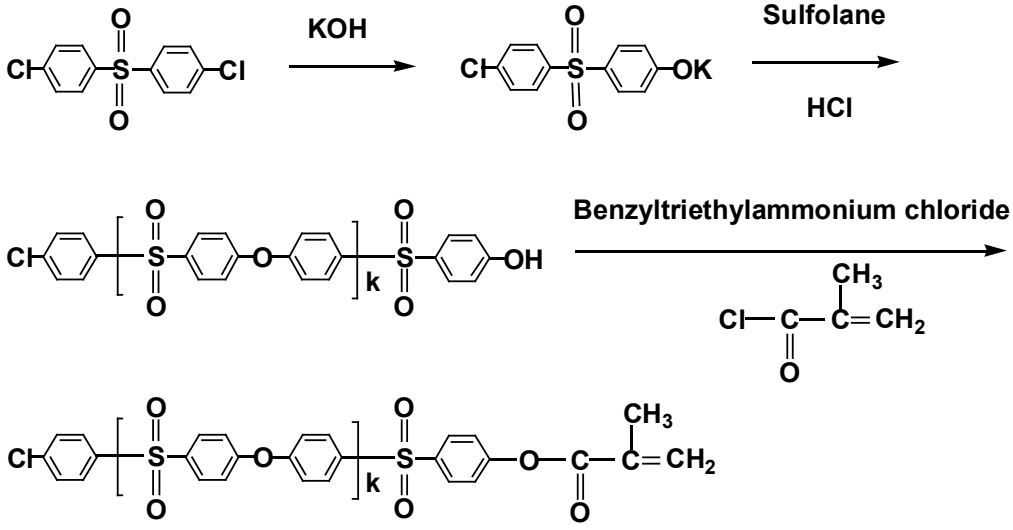
Supporting Information

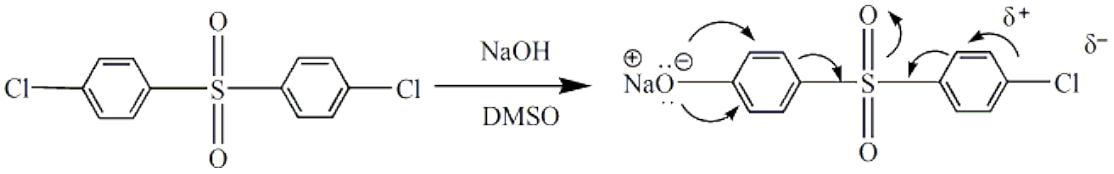
1. Synthesis of PES-MM.



Scheme S1. Schematic procedure of the synthesis of PES-MM.

2. Partially hydrolysis reaction of 4-Chloro,4-Hydroxydiphenylsulfone

For the preparation of 4-Chloro,4-Hydroxydiphenylsulfone (CHDS), the partially hydrolysis reaction of 4, 4-dichlorodiphenylsulphone (DDS) with NaOH can be carried out in the strong polar solvent without any protection or masking. This reaction is an important nucleophilic substitution reaction; solvent has remarkable effect on the reaction. The partially hydrolysis reaction is shown in **Scheme S2**. One of the chlorine atoms on DDS should be susceptible to attack by a nucleophilic species such as OH^{-1}, since that sulfuryl is a strong electron-withdrawing group in strong polar solvent of DMSO. However, the further substitution reaction with the other chlorine after the first nucleophilic substitution is difficult due to the formed sodium phenolate group on the partially hydrolyzed DDS. Two lone pair electrons in the oxygen formed a p-π conjugated structure with the benzene ring, making sulfuryl less attractive to the remaining substitution group. The electron distribution on the CHDS is also shown in **Scheme S2**.Compared with the partially hydrolysis reaction in the strong polar solvent condition, the hydrolysis reaction of the remaining chlorine is very difficult. Thus, the partially hydrolysis reaction of DDS with NaOH can be carried out in the strong polar solvent without any protection or masking, and CHDS was the most probable compound except for few unreacted DDS.



Scheme S2. Partially hydrolysis reaction of DDS.

The unreacted DDS could be removed by the after treatment at the base of their different solubilities in boiling water. The prepared powders were purified in boiling water for half an hour under stirring, and then cooled down to room temperature by changing the distilled water, this procedure was repeated three times. The resulting product (CHDS) was dried to constant weight under vacuum at 40 ºC for 24 h. Combining a liquid chromatography and ultraviolet spectrum analysis, we found that the 4, 4-dihydrodiphenylsulphone and DDS content can be reduced to acceptable level

in this work (the content of DDS was below 0.49 wt. %). However, much CHDS is taken away by water during after treatment. So the yield is about 61 wt. %.

3. Elution of the copolymer from the membrane

Pure distilled water was used as the blank control and the PVP (K-30) solution in distilled water (0.5 wt. %) was used as the negative control. The membrane (M-2-4) was immersed in distilled water for 30 days, and the obtained solution was termed as Sample solution. The elution of the copolymer from the membrane was detected by an UV-Vis spectrophotometer (UV-1750, Shimadzu Co., Ltd, Japan) at the wavelength of 190 to 600 nm. **Figure S1** shows the normal working curve of water solution of PVP and the UV-Vis spectra of the Sample solution.

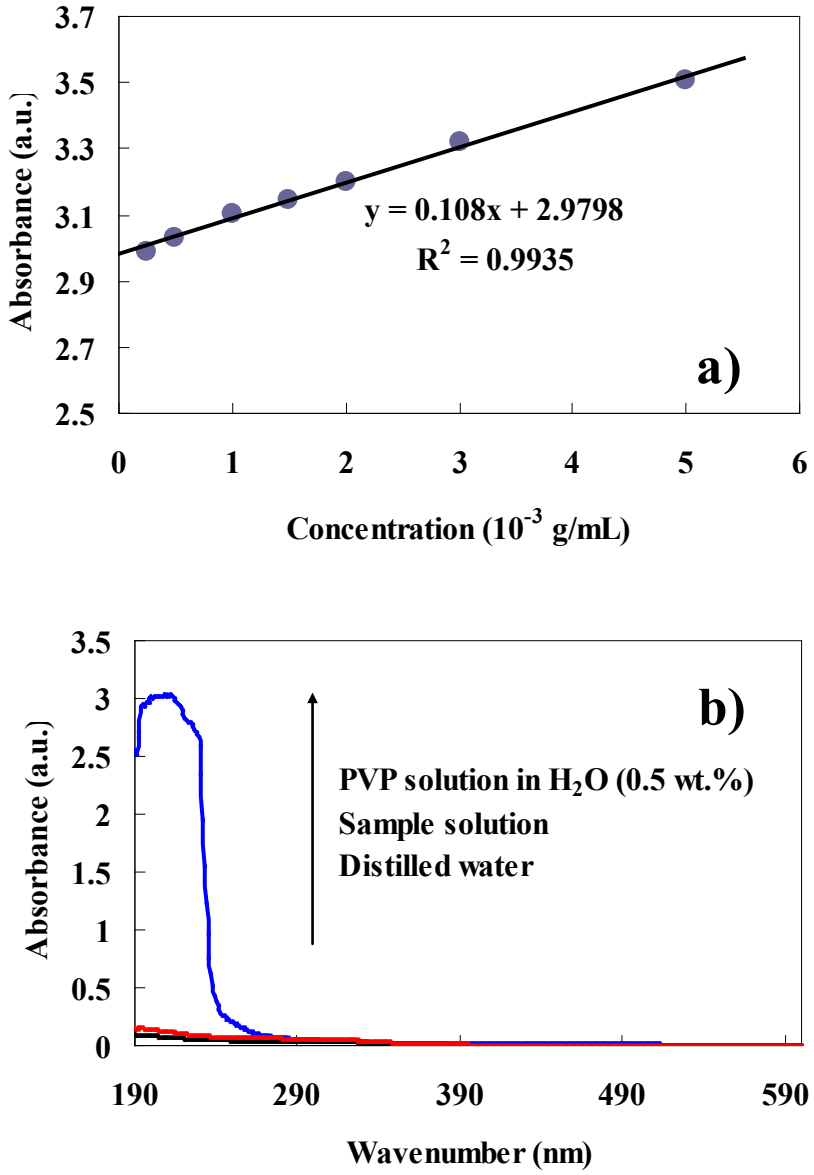


Figure S1 a) Normal working curve of water solution of PVP; **b)** The UV-Vis spectra of the water solution after the immersion of the membrane for 30 days.

4. Platelet adhesion by immunofluorescence

Platelet-rich plasma (PRP) from healthy human volunteers was collected. The PES and modified PES membranes were immersed in PBS solution and equilibrated at 37 °C for 1 h, and then the PBS solution was removed followed by introducing 1 mL of fresh PRP. The membranes were incubated with PRP at 37 °C for 2 h and the PRP was decanted. The membranes were rinsed 3 times with PBS solution. Finally, the membranes were treated with 2.5 *wt.* % glutaraldehyde in PBS at 4 °C for 1 day. The samples were washed with PBS solution, subjected to a drying process by passing them through a series of graded alcohol-PBS solutions (25, 50, 75 and 100 *wt*. %) and isoamyl acetate-alcohol solutions (25, 50, 75 and 100 *wt.* %). The platelet adhesion was observed using immunofluorescence method staining with 1:100 mouse antihuman CD41 antibody (Laboratory Vision, Fremont, Calif) according to the literature (Hashi CK, Derugin N, Janairo RR, Lee R, Schultz D, Lotz J, Li S. Arterioscler. Thromb. Vasc. Biol. 2010. 30: 1621-1627). The total numbers of adherent platelets from 8 different randomly selected zones were summed, and the number of the adherent platelets per square centimeter (Cells/cm^2) was calculated, and shown in **Figure S2**.

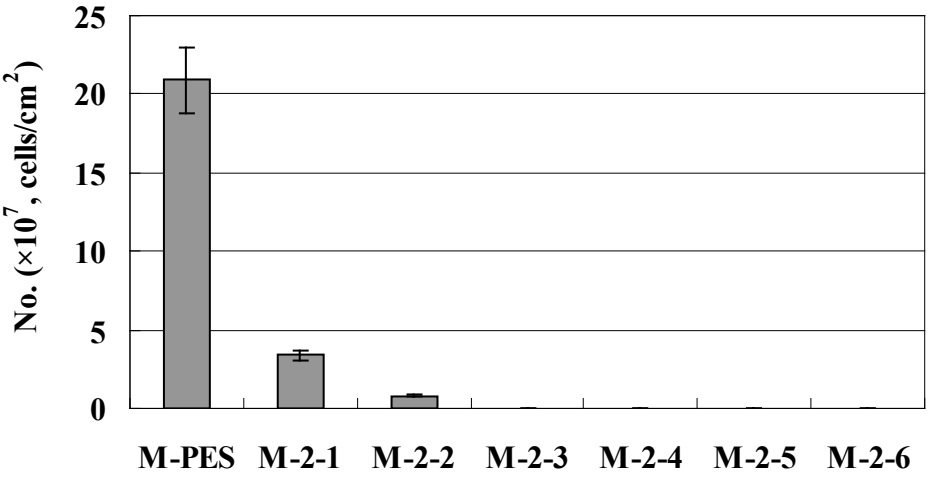


Figure S2 Number of the adherent platelets on the membranes adsorbed from platelet-rich plasma using immunofluorescence method.