Hydrophilic and anti-fouling PES ultrafiltration membranes with PHEMA grafted silica nanoparticles as additive

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Introduction

Polyethersulfone (PES) membrane is one of the most popular polymer ultrafiltration membranes and widely used in water purification, beverage filtration, protein separation *et al*. PES membrane is not enough hydrophilic and thus it is easy to be hit by serious membrane fouling. Therefore, PES membrane often has to be modified in order to improve its hydrophilicity, anti-fouling ability and filtration properties. In the present work, poly(2-hydroxyethyl methacrylate) (PHEMA) grafted silica (SiO_2) nanoparticles (PHEMA@SiO_2 NPs) were used as additive to modify PES membrane.

Method

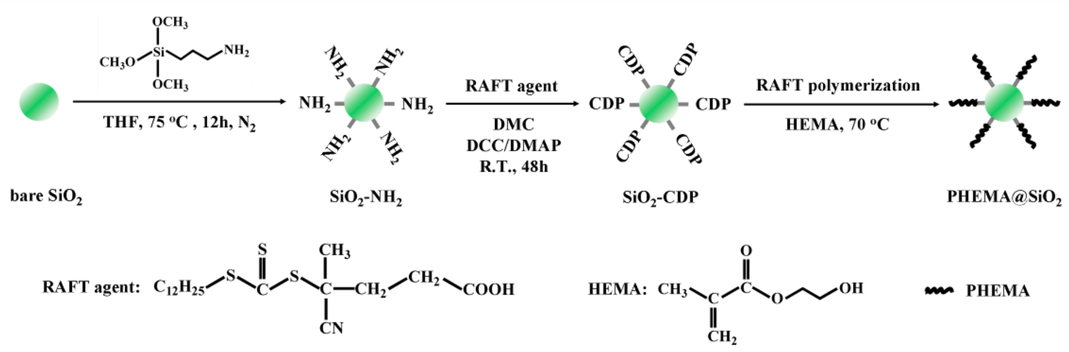

Fig.1 The synthesis route of PHEMA@SiO_2 NPs via surface-initiated RAFT polymerization.

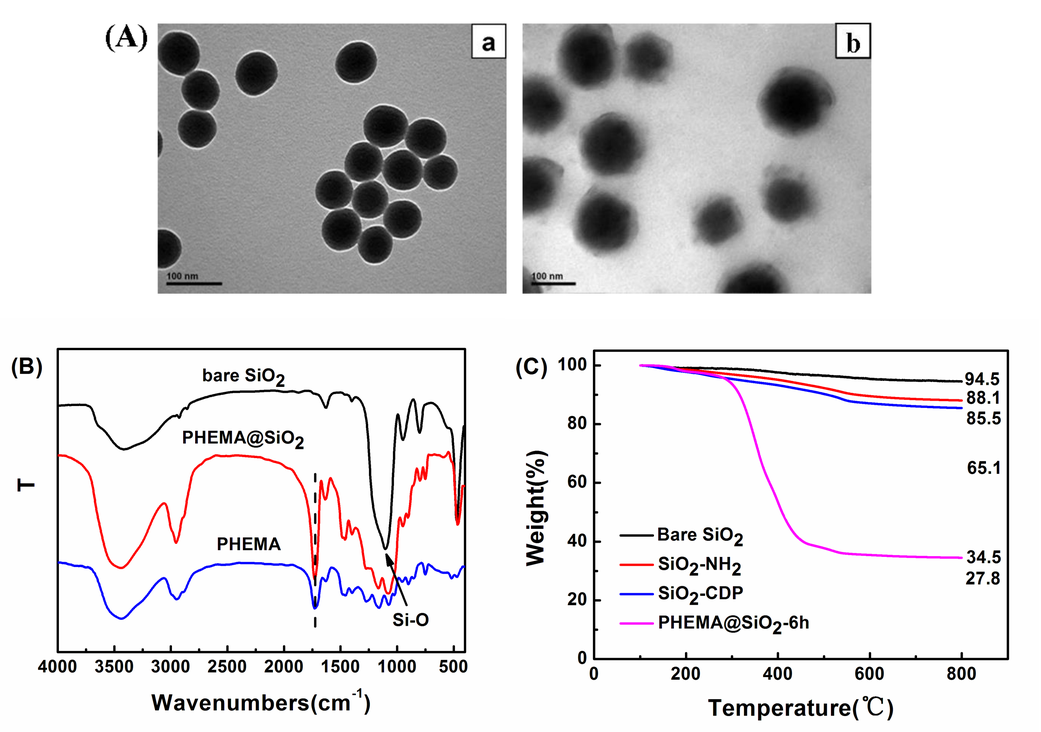

Fig.2 (A) TEM images, (B) FT-IR spectra and (C) TGA curves of the PHEMA@SiO_2 NPs.

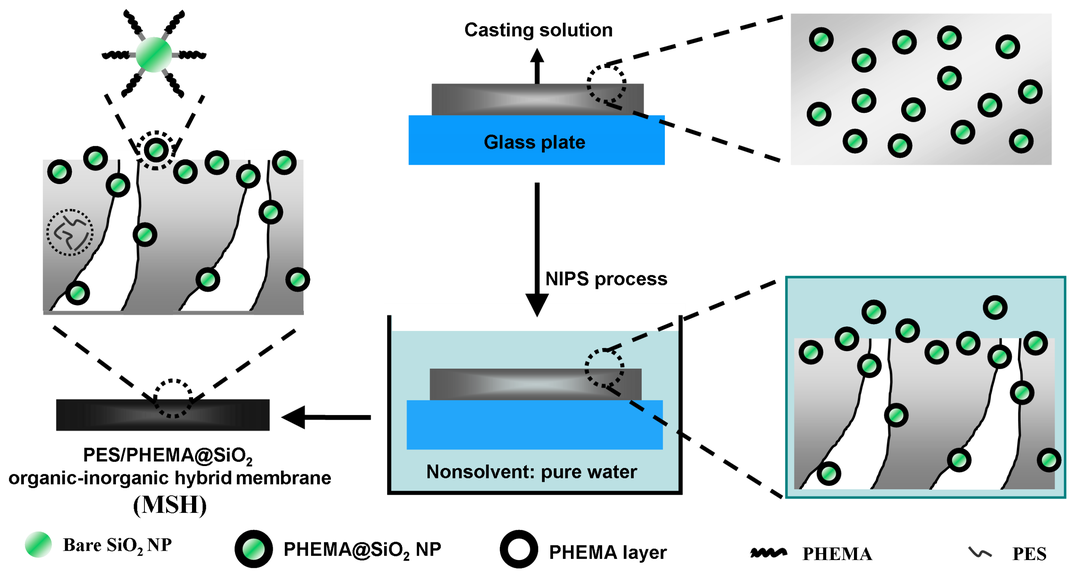

Fig.3 The preparation of the PES/PHEMA@SiO_2 hybrid membranes by the NIPS process.

Results and discussion

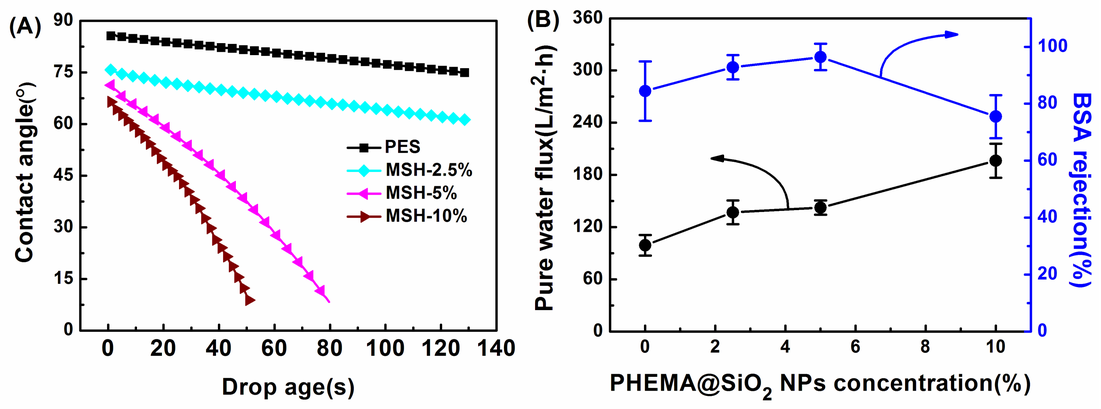

Fig. 4 (A) The curves of water contact angle decaying with drop age and (B) the pure water flux and BSA rejection for the pure PES and the PES/PHEMA@SiO_2 hybrid membrane with different PHEMA@SiO_2 nanoparticles concentration.

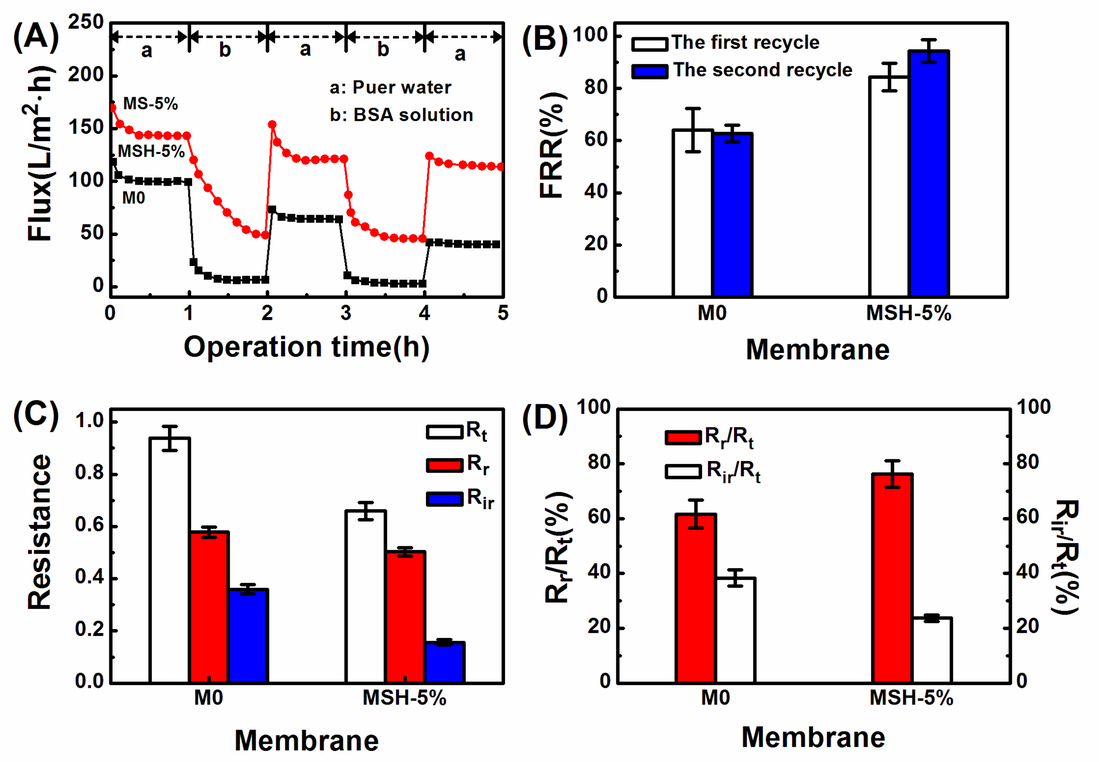

Fig. 5 Anti-fouling property of the membranes. (A) Typical time dependent fluxes for the pure PES and MSH-5 during two recycles of BSA ultrafiltration. Each filtration recycle included three steps: Pure water permeation, BSA solution filtration and pure water permeation again. (B) Water flux recovery ratio (FRR) of the membranes. (C) Resistances of membrane fouling based on the first recycle of BSA ultrafiltration. (D) The ratio of reversible fouling (Rr) and irreversible fouling (Rir) to the total fouling (Rt), respectively.

Conclusions

The PES/PHEMA@SiO_2 organic-inorganic hybrid membranes were successfully fabricated via NIPS process. The hydrophilicity, anti-fouling ability and filtration properties of the prepared hybrid membranes were better than that of pure PES membrane.

Acknowledgements

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References

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