Improving the Antithrombogenicity of PES Membrane by Facile Covalent Linkage of Heparin

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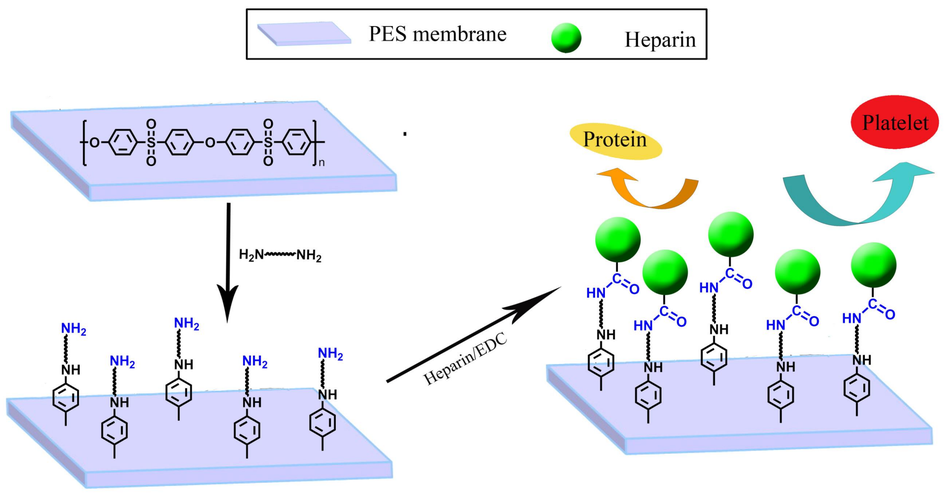
Background

Polyethersulfone (PES) is a widely used membrane material for hemodialysis due to its excellent thermal stability, mechanical strength and chemical inertness. Despite its popularity as a membrane material, the hydrophobic nature of PES causes membrane fouling and low biocompatibility. Heparin is widely used as anticoagulant during the hemodialysis process, while free heparin will cause complication like thrombocytopenia. In this work, a promising route to bind heparin onto PES membranes via covalent bond was investigated.



Scheme 1 Heparinization of PES membrane.

Surface Aminolyzation

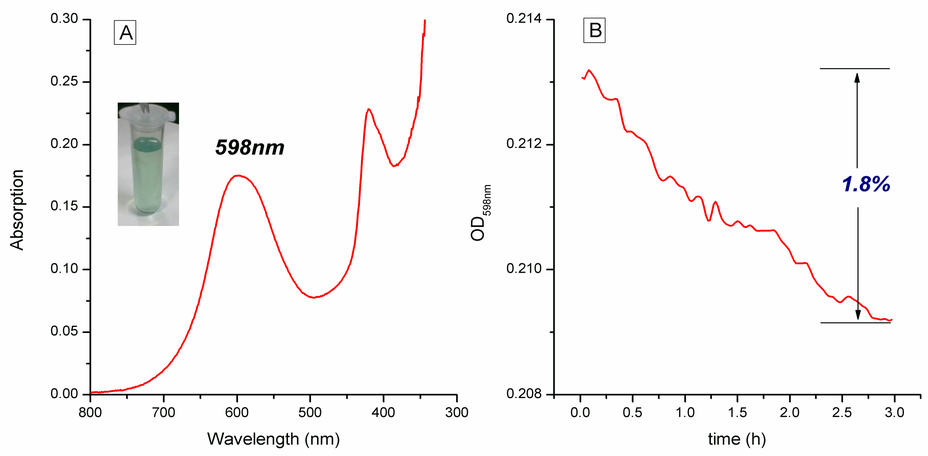


Figure 1 UV-vis absorption spectrum (A) and stability (B) of the solution of NH_2-PES membranes after chromogenic reaction.

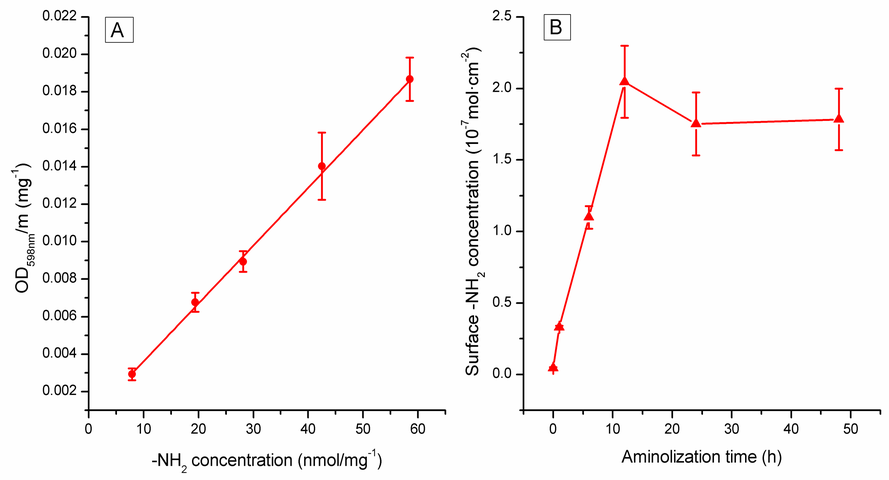


Figure 2 (A) The calibration curve for the surface analysis of amino group; (B) The surface $-NH_2$ concentration of NH_2-PES membranes that aminolyzed for different time.

Surface Heparin Covalent Immobilization

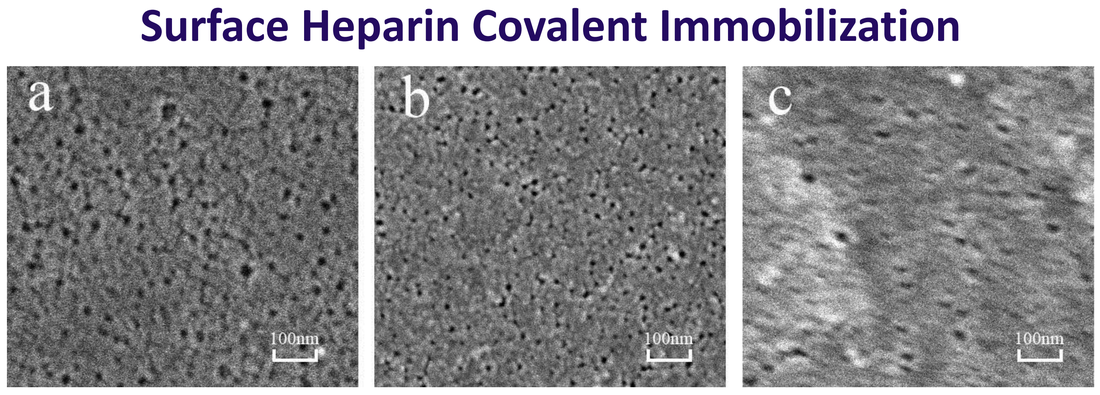


Figure 3 The SEM picture of PES membrane (a), NH_2-PES membrane (b) and Heparin-PES membrane (c).

Table 1 The content of surface element measured by XPS.

Membrane	Element content (mol%)			
	C	*O*	*N*	*S*
NH_2-PES	77.37	16.97	0.44	5.22
Heparin-PES	76.77	21.04	0.95	1.24

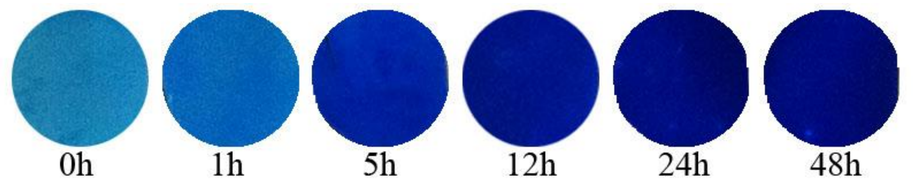


Figure 4 The adsorption of toluene blue for heparin-PES membrane that aminolyzed for different time.

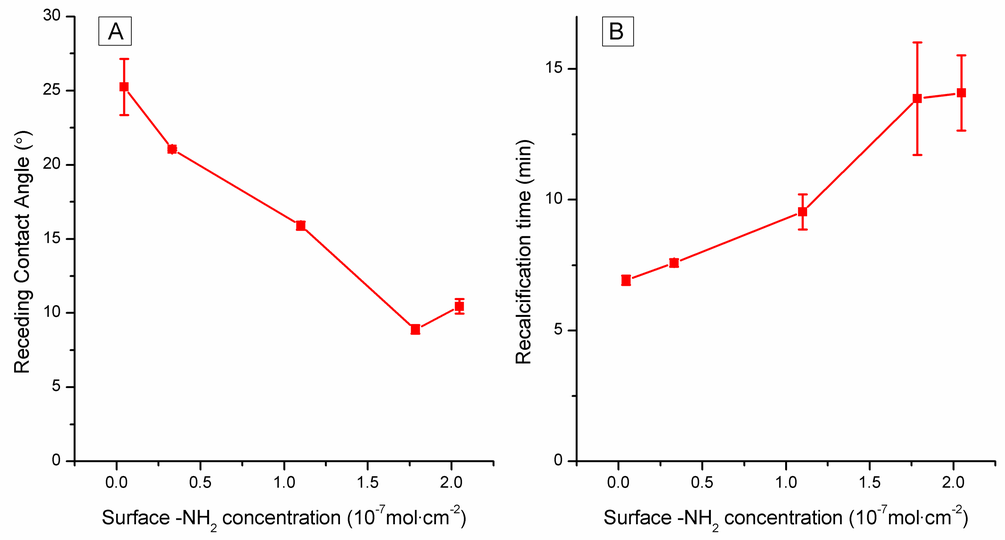


Figure 5 The receding Contact angle (A) and recalcification time (B) of heparinized PES membranes having different surface amino group density.

Conclusions

Amino group was introduced onto the surface of PES membranes effectively via a facile aminolyzation method. An then, heparin was then bound onto the aminated PES membrane surface stably via amide bond, rendering the membranes with improved hydrophilicity and antithrombogenicity.

Acknowledgements

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References

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[2] R. Li and H. Wang et al., J. Biomat Sci.-Polym. E. 2012, 24 (1), 15-30.