B306

Characterization of antibacterial property of functional polymeric hollow fiber membrane

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1. Introduction

Surface modifications have been studied extensively for improvement of membrane hydrophilicity by photo-grafting of functional monomers on the base membrane surface using UV irradiation. This process has several advantages such as low cost of operation, mild reaction condition and absorption of UV light without affecting the bulk polymer of base membrane.

This study was aimed to improve both antifouling and antibacterial property of polyethersulfone (PES) membrane by means of photo-induced grafted polymerization using quaternary 2-dimethylaminoethyl - methacrylate (qDMAEMA) monomer.

2. Experimental

A porous hollow fiber PES membrane (molecular weight cut-off:150kDa) with 15 cm in length was immersed into methanol solution of benzophenone (BP) for overnight. Then PES membrane was dried at room temperature for 1 h and placed into a quartz-vessel that contains a monomer solution of qDMAEMA. Graft polymerization was carried out by UV irradiation. After reaction was complete, the grafted PES membrane was washed with DI water and kept for 2 nights. Grafting amount (GA) was calculated as the dried weight of grafted polymer per outer surface area.

Water contact angle was measured to check the hydrophilicity of the grafted PES membrane. Fouling experiments were done for the grated PES membrane using BSA solution. Shake flask test was carried out to investigate antibacterial property of the grafted PES membrane against *Escherichia coli* as the model Gram-negative bacteria. The grafted PES membrane of 0.005 g was placed in a 40 ml PBS containing a 1-5×10^7 cells/ml of test bacterial suspension. Then, the samples were incubated for 8 hr at 37 °C and the numbers of active bacteria were counted.

3. Result and discussion

Figure 1 shows water contact angle and water permeability of grafted PES membrane against the grafting amounts. By increasing grafting amount, water contact angle decreased. This means the membrane surface became more hydrophilic. Water permeability also decreased by increasing grafting amount. This is due to the existence of grafted monomer on the membrane surface.

Figure 2 shows fouling results of original PES membranes (molecular weight cut-off: 150kD and 30kD) and grafted PES membranes with various grafting amounts. For original PES membranes (●, △), permeabilities decreased sharply due to severe fouling. On the other hand, grafted PES membranes showed more stable performances. This was attributed to the improvement of membrane surface hydrophilicity by grafting of qDMAEMA. Therefore, this qDMAEMA grafting was confirmed to be useful for reduction of membrane fouling.

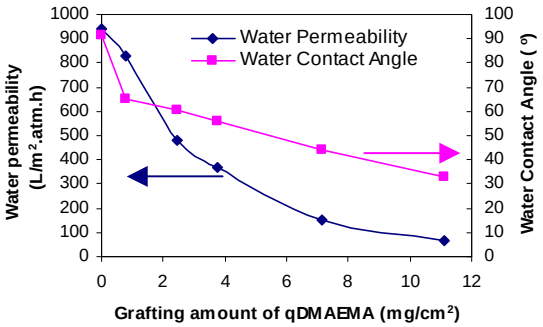

Figure 1 Water permeability and water contact angle of grafted PES membrane against grafting amount.

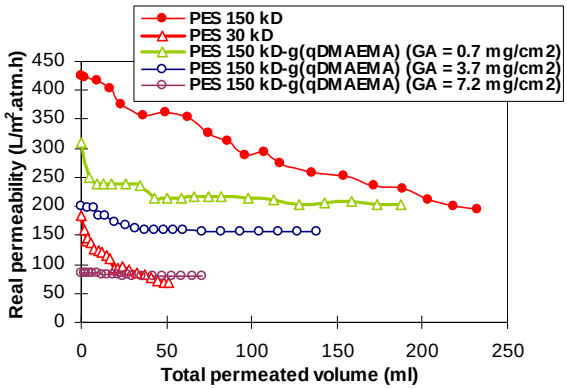

Figure 2 Time course of water permeabilities of original and grafted PES membranes during fouling experiment.

Table 1 shows antibacterial results of original and grafted PES membranes measured by shake flask method. The bacteria was killed almost 90% when they are exposed to the grafted PES membrane. This is due to the antibacterial property of quaternary ammonium site grafted on the membrane surface. Thus, it was proved that the PES membrane grafting qDMAEMA had antibacterial property as well as antifouling property.

Table 1 Antibacterial property measured by the shake flask test

Membrane type	Bacteria numbers (cfu/ml)	Reduction (%)
Original PES	1.11×10^4	-
PES-g(qDMAEMA)	1.20×10^3	89.2

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