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<AT>Amino-functionalized surface modification of polyacrylonitrile hollow fiber-supported polydimethylsiloxane membranes

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<ABS-HEAD>Highlights► Amino group was introduced to improve surface polarity of PDMS membrane. ► The water contact angle of PDMS membrane decreased after the modification. ► The concentration of N atom on surface of PDMS membrane reached up to ~6%. ► The density of PDMS membrane decreased while the swelling degree increased. ► CO_2 permeability increased while selectivity decreased after the modification.

<ABS-HEAD>Abstract

<ABS-P>This study aimed to improve surface polarity of polydimethylsiloxane (PDMS) membranes and provide surface active sites which were easy to react with other chemicals. 3-Aminopropyltriethoxysilane (APTES) containing an amino group was introduced into a PDMS membrane by crosslinking to prepare polyacrylonitrile hollow fiber-supported PDMS membranes with an amino-functionalized surface. Fourier transform infrared and X-ray photoelectron spectroscopic analyses proved the existence of APTES and its amino group in the PDMS membrane. The concentration of N atoms on the PDMS membrane surface reached ~6% when the mass ratio of APTES/PDMS oligomer in the PDMS coating solution was increased to 4/3. The water contact angle decreased from ~114° to ~87.5°, indicating the improved surface polarization of the PDMS membrane. The density and swelling degree of the PDMS membrane decreased and increased, respectively, with increasing APTES content in PDMS. This phenomenon increased CO_2 permeability and decreased CO_2/H_2 selectivity, CO_2/CH_4 selectivity, and CO_2/N_2 selectivity. When the mass ratio of APTES/PDMS oligomer was increased from 0 to 4/3, the CO_2 permeation rate of the hollow fiber-supported PDMS membranes initially decreased from ~2370 GPU to ~860 GPU and then increased to ~2000 GPU due to the change in coating solution viscosity.

<KWD>Abbreviation: PDMS, polydimethylsiloxane; APTES, 3-Aminopropyltriethoxysilane; UV, ultraviolet; TEOS, tetraethyl orthosilicate; PAN, Polyacrylonitrile; DBD, dibutyltindilaurate; FTIR, Fourier transform infrared; XPS, X-ray photoelectron spectroscopy; WCA, water contact angle;