Manipulation of grafting location via photograftering to fabricate high performance ethylene vinyl alcohol copolymer membrane for protein separation

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DRUV were employed to analyze the BP location on the two external sides of membrane EVAL-T and EVAL-B (Fig.S1). There was no obvious change of the DRUV spectra of EVAL-T and EVAL-B, indicating the BP functionalized on the external sides of membranes was unaffected by changing the UV-facing side of membrane.

![Figure S1. DRUV spectrum of two sides of membranes EVAL-T and EVAL-B (BP functionalized amount: 0.20 µmol·cm⁻²)]
ATR-FTIR and XPS were employed to analyze the surface composition and grafting location on the external sides of membrane EVAL-T and EVAL-B (Fig.S2). For EVAL-T, the peak intensity on the topside was higher than that on the backside, while for EVAL-B, the peak intensity on the backside was higher than that on the topside. This indicated that the grafted chains mainly distributed on the UV-facing side of membrane. From the results of XPS, the N content on the topside and backside of EVAL-T was 3.1% and 1.2%, and that of EVAL-B was 1.7% and 3.3%. The N content on the UV-facing side was higher than that of UV shielding side, which was consistent with the results obtained by ATR-FTIR.

Figure S2. FT-IR and XPS spectrum of membranes EVAL-T and EVAL-B (GD 0.9 μmol/cm², a. the original EVAL membrane; b. the topside of membrane; c. the backside of membrane)
The morphology and roughness on two sides of membrane EVAL-T and EVAL-B was examined by AFM. As shown in Fig.S3, the isolated rough spots were observed on the topside of the original EVAL membrane, while large-sized peaks and valleys were observed on the backside, owing to the porous structure (1.0-2.0 μm) on the backside of membrane. The root-mean-square (RMS) which was used to evaluate the surface roughness was about 22.4 nm and 46.5 nm, respectively. For membrane EVAL-T, the roughness of the topside (UV facing side) increased after modification, and the RMS was increased to 62.4 nm. There was no obvious change on the backside of EVAL-T, and the RMS was 41.8, also close to that of the original EVAL membrane. For membrane EVAL-B, the backside (UV facing side) had a lower roughness after modification, and the top surface morphology of EVAL-B (RMS 23.7) was similar to that of the original EVAL membrane. The lower roughness on the backside of membrane EVAL-B might be because the micro-sized membrane pores were occupied by the collapsed grafted chains.

![Figure S3. AFM image of membranes EVAL₀, EVAL-T and EVAL-B (GD 0.9 μmol/cm²)](image)

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