Electronic Supplementary Material (ESI) for RSC Advances.

Supplementary information

Membrane characterization techniques

Permeability

Permeability experiments were carried out using a dead-end stirred cell filtration system (Sterlitech, HP4750) pressurized with nitrogen gas. The module has a membrane area of 14.8 cm^2. In all further experiments, the membranes were firstly compacted at 10 bar for 1h. The flux profile over time was monitored in realtime, gravimetrically. Hydraulic membrane permeability was measured at different trans membrane pressures within the range of 2–4 bar and on at least three different membrane samples. Permeability is calculated from Eq. (1) which is as follows:

$$Permeability\left(L/m^2\text{h}.bar\right) = \frac{J_p}{\Delta p_{tm}} \quad (1)$$

where Jp is the permeate flux (L/m^2 h) and Δp_{tm} is the transmembrane pressure (bar)

Contact angle

The contact angles of the membranes were measured using KSV Attension Theta contact angle device on dried membranes. For ensuring the accuracy of the measurement, the analysis was performed at four different locations on the respective membranes. The roughness values (RMS) of the membranes were determined with optic profilometer (Digital Instruments). After completely drying at room temperature, the membrane samples were fixed on a glass slide and scanned over 10.0 µm×10.0 µm area.

Scanning Electron Microscopy

The top surface and cross-section morphologies of the membranes were directly observed for pore structure under SEM (Philips-XL30 SFEG) in high vacuum mode after coating with gold. Before the SEM analysis, the membrane samples were immersed in ethanol/water solutions at room temperature followed by step dehydration with 25, 50, 75 and 100% ethanol for 10 min. The membranes were then dried at room temperature to be ready for SEM scan.

Mechanical properties

The mechanical properties of bare and GO nanocomposite membranes were measured using SII DMS 6100 Exstar dynamic mechanical analyzer. Membranes were mounted between the grips and fastened. A cross sectional thickness measuring device was used to calculate the cross sectional area of the membranes. Data was acquired every three seconds at force increments of 250 N over 20 steps for a total load of 5,000 N. For each sample measurements were performed in triplicates and the average values were reported.

Zeta potential

For surface charge analysis of the membranes, streaming current measurements were performed with an electrokinetic analyser (SurPASS, Anton Paar GmbH, Austria) using a measuring cell for solid samples with a planar surface. For each measurement, membrane samples of 20 mm×10 mm were fixed on sample holders using double sided adhesive tape. The sample holders were inserted into the adjustable-gap cell such that the membrane surfaces were facing each other. A gap of 100 µm was set between the sample surfaces. Prior to sample mounting, the membranes were soaked in 10^{-3} mol/L KCl solution for 24 h. Before starting the measurement, the samples were thoroughly rinsed with the measuring electrolyte solution. KCl solution of 10^{-3} mol/L was used as the background electrolyte. The pH of this aqueous solution was adjusted as 6.2 with 0.1 M HCl. The measurements were repeated twice for different membrane samples.

Porosity

The membrane's pore size distribution, mean pore size and bubble point (largest pore size) were measured using a capillary flow porometer (Quanthchrome Porometer USA), based on the wet/dry flow method.