Supplementary Material

Anion Exchangers Prepared from Graft Polymerisation of Microfibrillated Cellulose Using the Reactive Ionic Liquid

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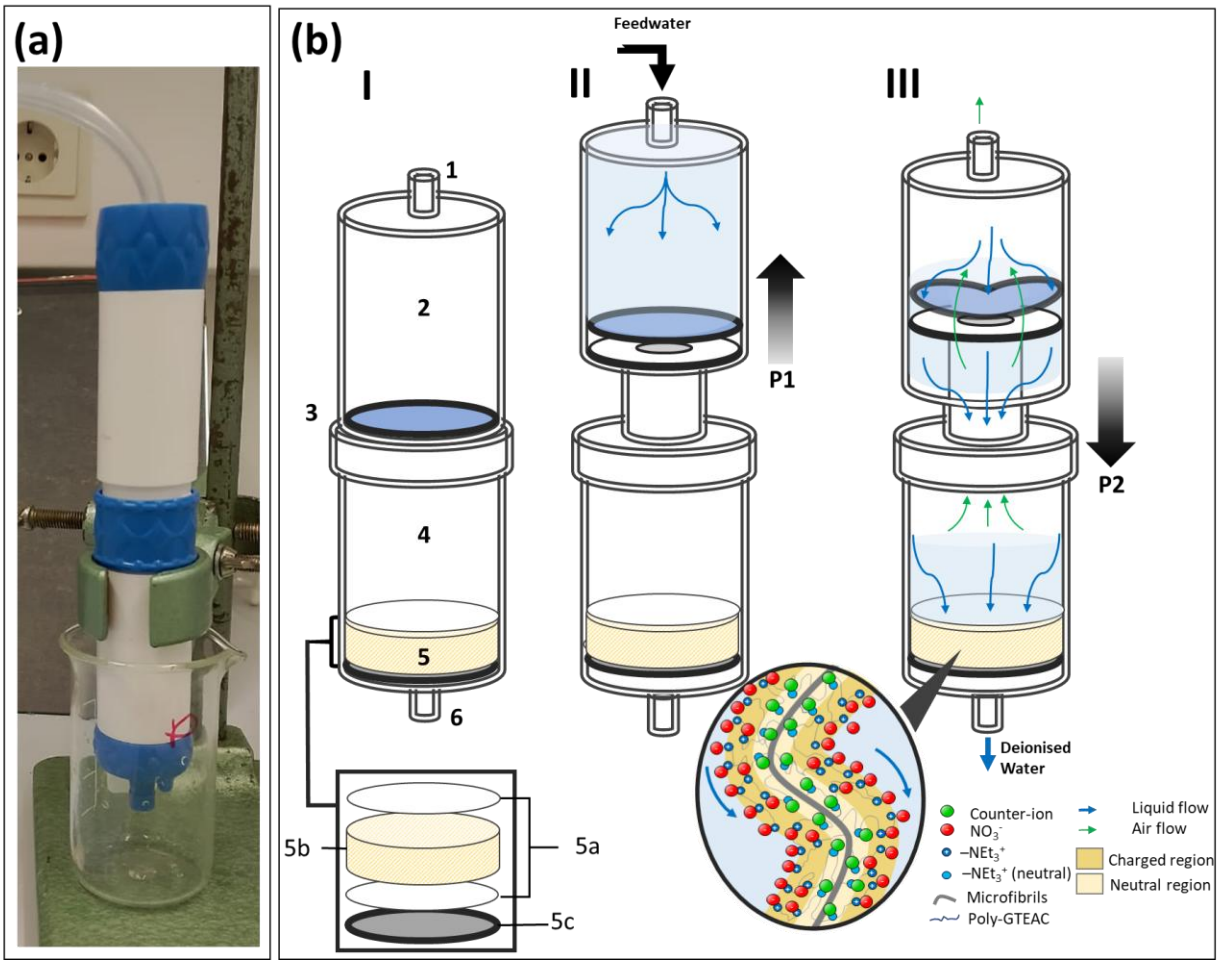

1, inlet; 2, feed conduit; 3, diaphragm; 4, filtration conduit; 5, filter cartridge assembly; 6, outlet; 5a, Whatman 21 cellulose filter papers (23.5 mm diameter, 0.1 mm thickness); 5b, QMFC fibre matrix (23.5 mm diameter, varying *h*); 5c, fixed polyethylene guard mesh filter (23.5 mm, 1 mm thick); I, mode of operation for the system at rest involves a cycling action to pump feedstock into the filtration conduit from the feed conduit; II, the flow is started by lifting 2 which fills it with the feed (P1); III, pushing feed conduit down contracts diaphragm and allows feed to enter conduit filtration conduit which begins filtration and in-situ ion exchange (P2).

Fig. S1 Dead-end filter cartridge system. (a) Lab-scale apparatus; (b) Simplified schematic for the system (The piston is equipped with a Teflon diaphragm which reciprocates back and forth to allow for fluid intake and input to the filtration conduit. The ion exchange mechanism is illustrated inset, with the indication of fluid flows.)

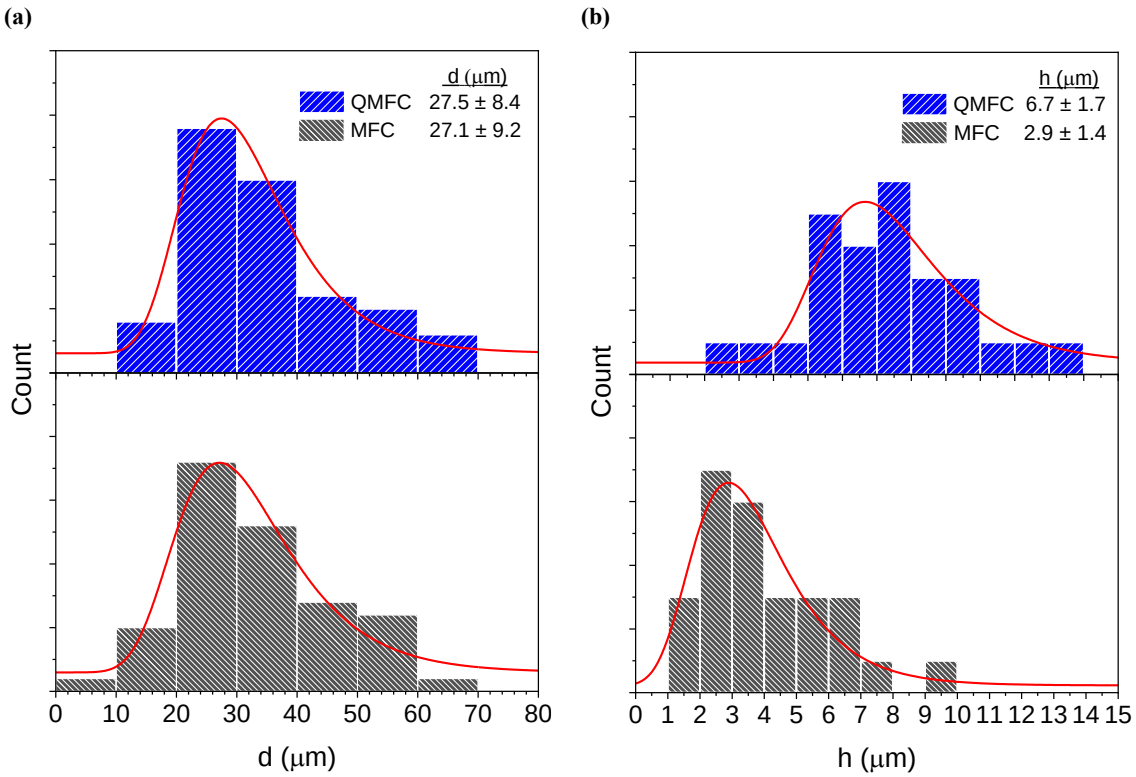

Fig. S2 The SEM-based fibre size analysis of the MFC and QMFC in terms of microfibril band dimensions. (a) width (*d*) and (b) thickness (*h*) (Fittings have been performed using a GEV distribution (R^2 = 0.85–0.97).)

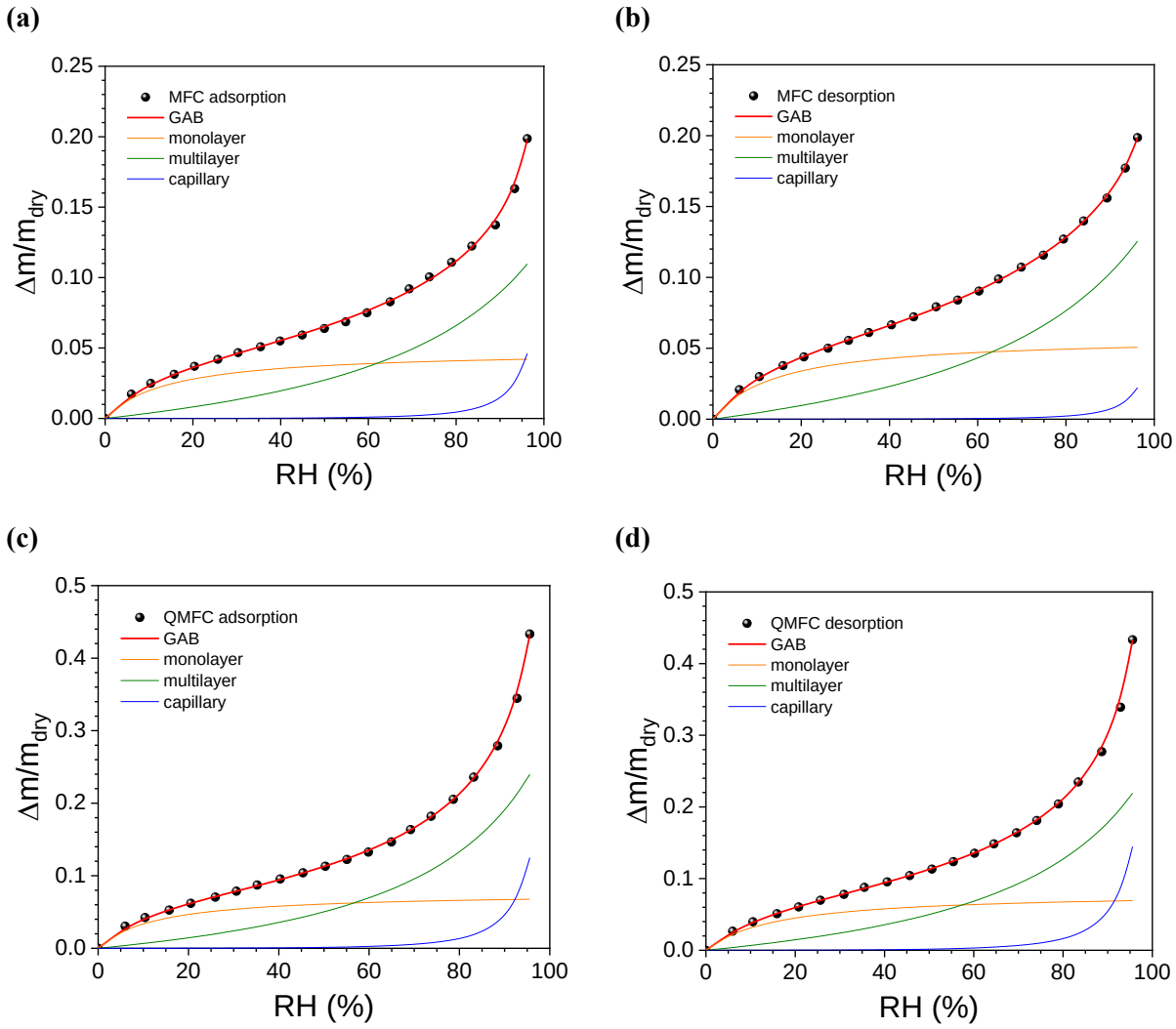

Fig. S3 Guggenheim, Anderson, and de Boer (GAB) model fittings. (a) Absorption and (b) desorption for MFC; (c) Absorption and (d) desorption for QMFC

Table S1 Modified Guggenheim, Anderson, and de Boer (GAB) fitting parameters (M_0, C, K and N), the SSO fitting parameters: exponent (n), the maximum bound water moisture capacity ($M_{SSO}{}^0$), and the sorption sites molar concentration (SSO) for the MFC and QMFC samples

Item	M_0	C	K	N	n	$M_{SSO}{}^0$	SSO (mmol/g)
MFC adsorption	0.048 4	10.51	0.721	0.00157	0.503	0.080	4.45
MFC desorption	0.058 2	10.87	0.710	0.00064	–	–	–
QMFC adsorption	0.076 7	10.78	0.793	0.00224	0.529	0.142	7.90
QMFC desorption	0.080 7	9.23	0.765	0.00331	–	–	–

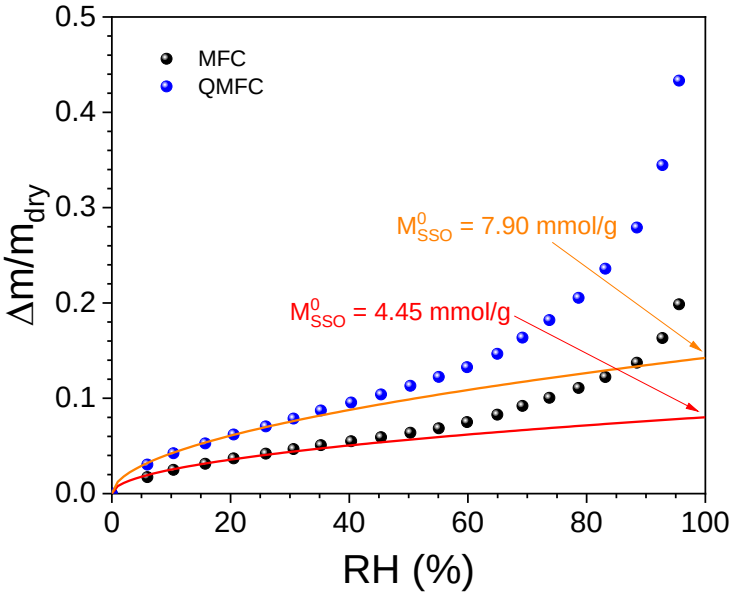

Fig. S4 Sorption site occupancy (SSO) model fittings for the MFC and QMFC samples

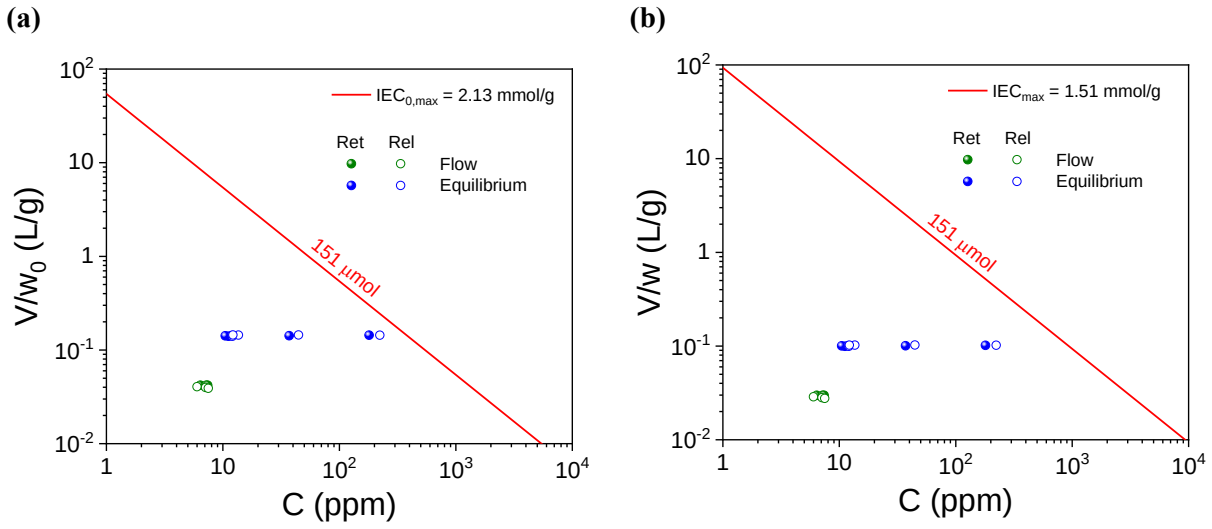

Fig. S5 Log-log plot of mass-normalised head volume vs. NO_3^- concentration for QMFC fibres relative to: (a) dry mass (w_0) of the original cellulose component and (b) dry mass (w) of the total composition of the QMFC (The red line relates to the IEC_{max} of 1.51 mmol/g (i.e., the total number of available sites of 151 µmol $–NEt_3^+$. The green and blue symbols correspond to IEC values for experiments conducted under flow conditions and equilibrium conditions, respectively.)