

## Supporting materials

The pore size of each membrane was calculated according to the method described by Nghiem et al. (Nghiem et al., 2004). The NF membrane was modeled as cylindrical capillary tubes and had the same radius. The feed water containing 10 mg/L glucose was filtered for the determination of the approximate molecular weight cut-off (MWCO) of each membrane as well as for the calculation of the membrane “pore” size.

The DSPM and DE model (Bandini and Vezzani, 2003; Bowen and Welfoot, 2002) was used to fit the glucose rejection data for obtaining the average “pore” radius of each membrane according to the equation

$$R_i = 1 - \frac{K_{i,c} \phi_i}{1 - \exp(-J_v K_{i,c} \delta / D_{i,p})(1 - K_{i,c} \phi_i)}, \quad (1)$$

The performance of the separation was indicated by the “real” rejection ( $R_r = 1 - c_p / c_m$ , where  $c_p$  and  $c_m$  are the concentrations of the solute in the permeate and near the membrane, respectively) which was corrected from the observed rejection ( $R_o = 1 - c_p / c_f$ , where  $c_f$  is the concentration of the solute in the feed) by taking account of the concentration polarization effect (García-Martín et al., 2014; Kim and Hoek, 2005; Nghiem et al., 2004; Shirazi et al., 2010) according to the equation

$$\left(\frac{1}{R_r} - 1\right) = \exp\left(-\frac{J_w}{K_f}\right) \left(\frac{1}{R_o} - 1\right), \quad (2)$$

where  $J_w$  is the water flux and  $K_f$  is the mass transfer coefficient which is related to the Sherwood number ( $Sh$ ) by  $K_f = Sh \cdot D / d_h$  (where  $D$  is the solute diffusivity and  $d_h$  is the hydraulic diameter). The following equation was used for the calculation of the Sherwood number (Kong et al., 2016; Mccutcheon and Elimelech, 2006; Sutzkover et al., 2000),

$$Sh = 1.85(\text{Re} \cdot \text{Sc} \cdot \frac{d_h}{L})^{0.33}, \quad (3)$$

where  $\text{Re}$  is the Reynolds number ( $\text{Re} = u d_h / \nu$ , where  $u$  is the cross-flow rate and  $\nu$  is the kinematic viscosity),  $\text{Sc}$  is the Schmidt number ( $\text{Sc} = \nu / D$ , where  $D$  is the diffusivity of the solute) and  $L$  is the length of the filtration cell channel.

The effective membrane thickness ( $\Delta x / A_k$ ) was calculated according to Eq. (4).

$$J_w = \frac{r_p^2 \Delta p}{8\mu} \frac{A_k}{\Delta x}, \quad (4)$$

where  $J_w$  is the water flux,  $\Delta p$  is the pressure difference on both sides of the membrane,  $\mu$  is solvent viscosity.

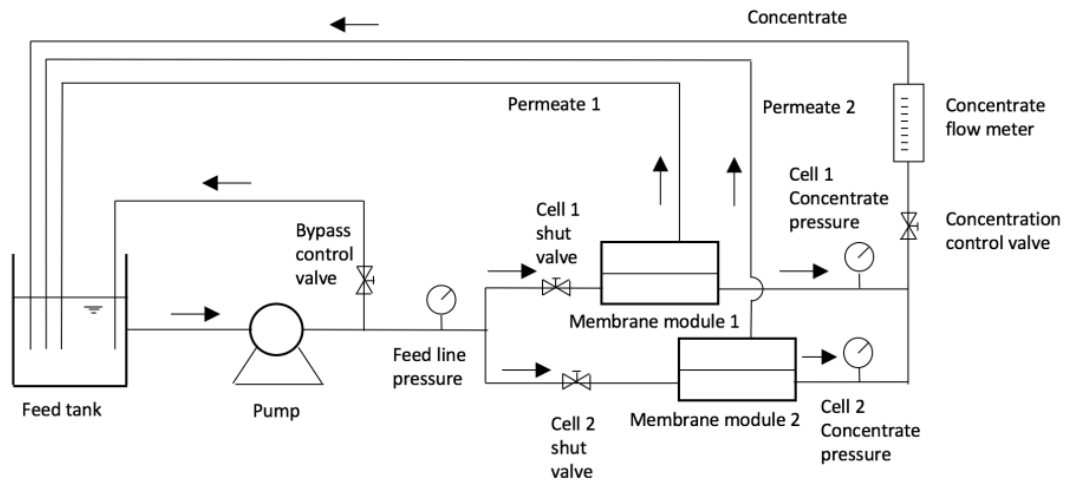


Fig. S1 Schematic experimental unit for nanofiltration.

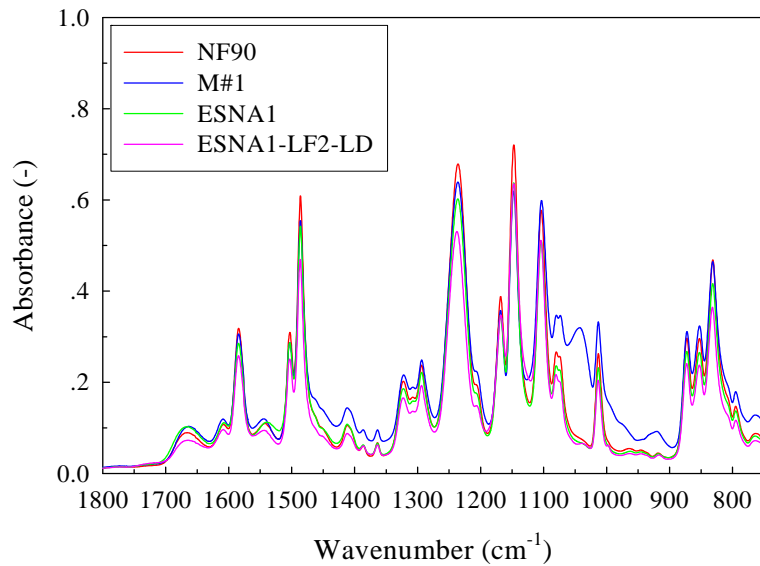


Fig. S2 FTIR spectra for the NF90, M#1, ESNA1, and ESNA1-LF2-LD membranes.

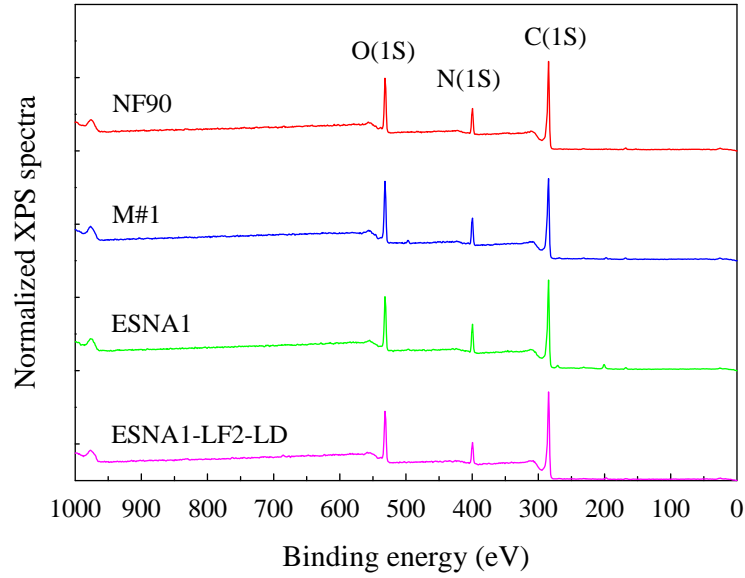


Fig. S3 XPS survey spectra for the NF90, M#1, ESNA1, and ESNA1-LF2-LD membranes.

Table S1 Elemental compositions and oxygen to nitrogen (O/N) ratios of the for NF membranes from XPS analysis

Membrane	XPS surface element analysis			
	O (%)	N (%)	C (%)	O/N ratio
NF90	16.9	13.2	69.2	1.28
M#1	18.9	13.1	66.3	1.44
ESNA1	16.5	13.3	67.7	1.24
ESNA1-LF2-LD	17.0	10.0	71.2	1.70

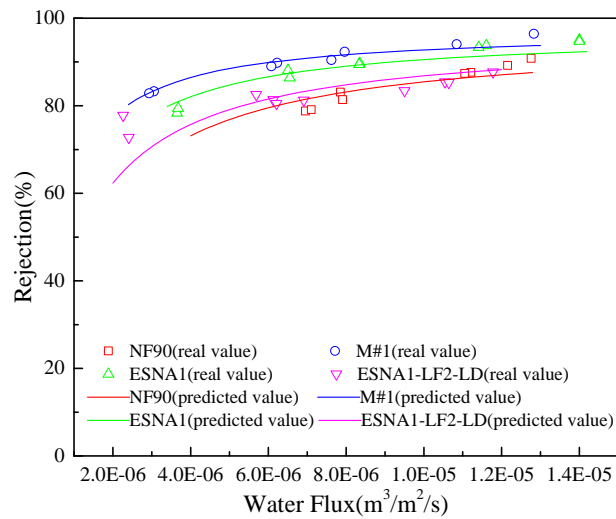


Fig. S4 Rejection of glucose (with a molecular weight of 180 g/mol) at a concentration of 10 mg/L by the four membranes.

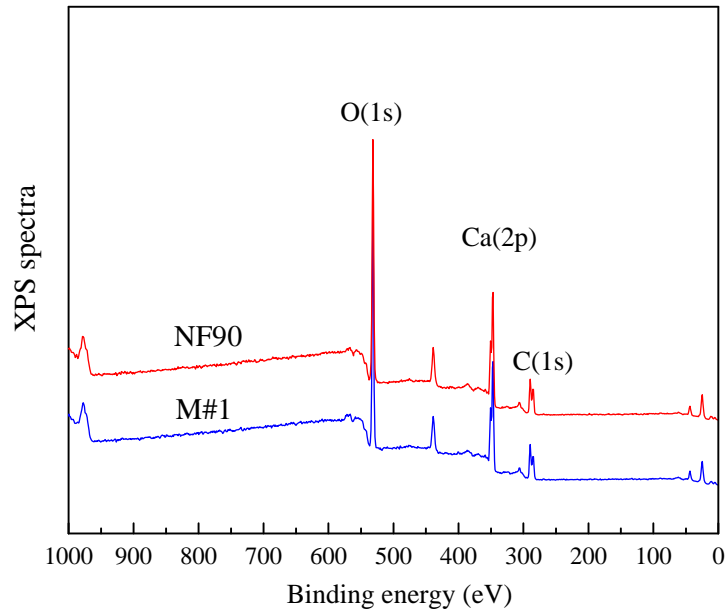


Fig. S5 XPS survey spectra for the fouling NF90 and M#1 membranes.

## References

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