Model parameters:

The concentration dependent viscosity of the Glucose solution was calculated using the following correlation[1]

$\mu = \mu_0 0.954 \exp(27.93\, X_w)$,

where μ_0 is the viscosity of pure water (in cP) and X_w is the water mole fraction in the solution.

Other model parameters are summarized in the following table:

Channel height, h	Channel width, W	Porosity, ϕ	Number of channels, n	Glucose Diffusivity[2]	Butanol Diffusivity[3]
0.7 mm	70 cm	0.85	30	6.7E-10 m^2/s	1E-9 m^2/s

General dependence of osmotic permeation on process parameters

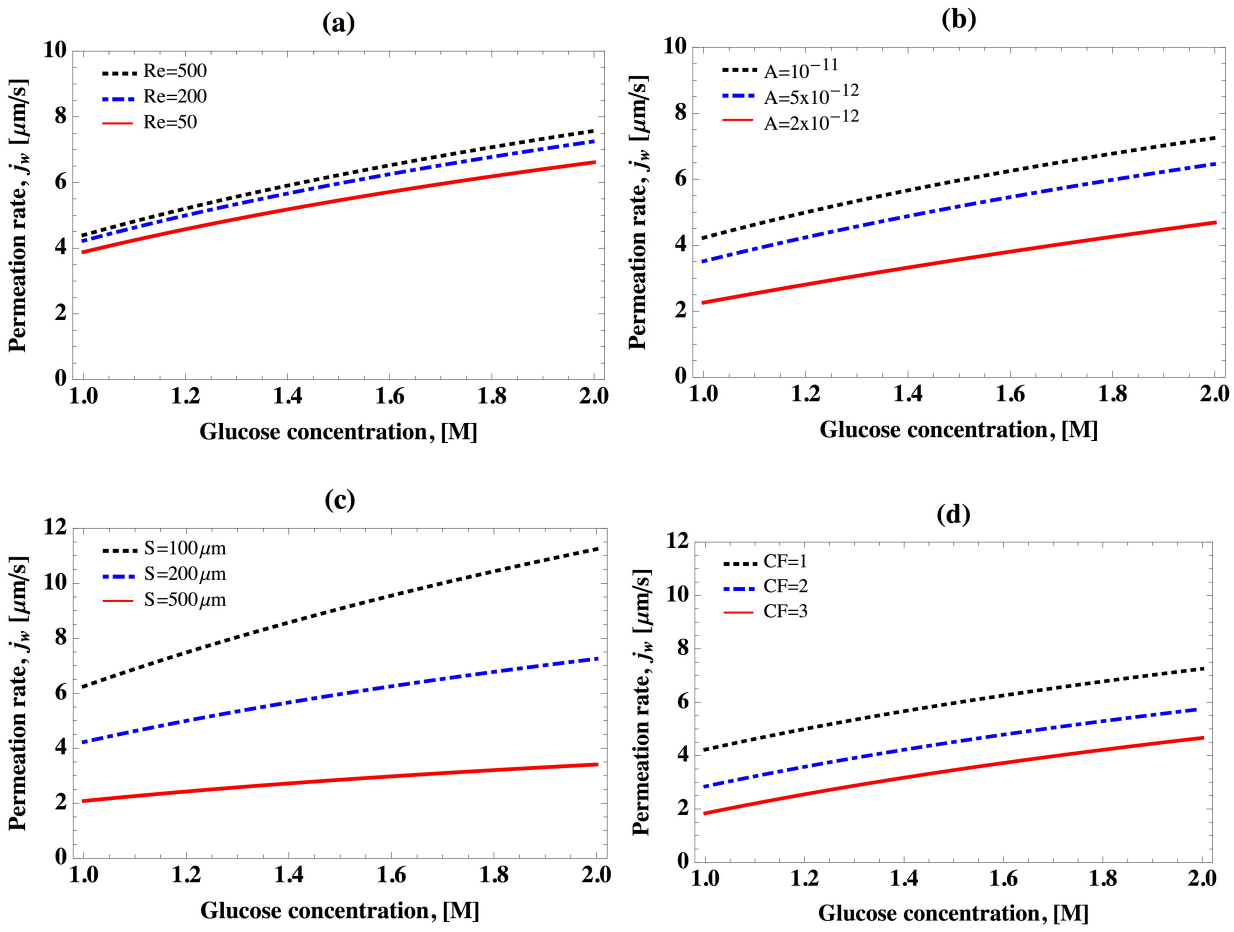

Figure S1: Osmotic permeation rate as a function of draw strength (Glucose concentration) for the Forward Osmosis contacting of ABE and Glucose, calculated as a function of various important process parameters. (a) Channel hydrodynamic conditions, in terms of the Reynolds

number. (b) Membrane water permeability (c) Membrane structure parameter (d) Concentration factor, CF, defined as the ratio of ABE concentration in the concentrated stream to the initial concentration. Note: unless otherwise noted, parameters used in the calculations are C_B=20 g/L, Re=200, A=10^{-11}m/s/Pa and S=200 µm.

Experimental system

The experimental system (see schematic in Fig. S2) consisted of a custom-made polycarbonate membrane cell (see Fig. S3), where channels, machined into each side of the cell, are separated by a membrane and clamped together using external bolts. Channel dimensions are 200(L)x60(W)x0.8(h) mm, with an effective membrane surface area of ~120 cm^2. Each channel is fed from a feed tank using a magnetic pump, at a constant flowrate of ~15mL/min, equivalent to an average velocity of ~0.3m/s in each channel. The osmotic draw solution tank (Glucose) was fitted with an overflow valve leading to an external container placed on top of a digital balance. The water flux was then measured according to the time rate of change of the mass.

The membranes used in the experiments were either a Cellulose Tri-Acetate (CTA) membrane from Hydration Technologies (HTI) or SW30 Polyamide thin-film composite membrane from Dow-Filmtec. Solutions used were prepared using distilled water and as-received Glucose (99.9% purity, Sygma-Aldrich) and Butanol (99.1% purity, Frutarom).

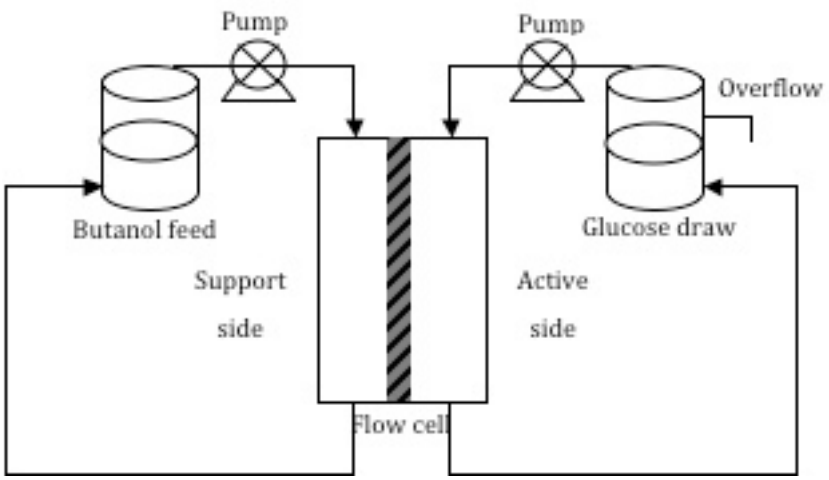

Fig S2: Schematic drawing of the bench-scale osmotic membrane system.

Figure S3: The membrane cell used for the experimental test.

References

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