Supplementary Information for:

Circulatory osmotic desalination by mild temperature gradient based on lower critical solution temperature (LCST) phase transition materials

Yeongbong Mok‡, Daichi Nakayama‡, Minwoo Noh, Sangmok Jang, Taeho Kim, and Yan Lee*

Department of Chemistry, College of Natural Sciences, Seoul National University, Gwanak-ro 1, Gwanak-gu, Seoul 151-747, Republic of Korea.

‡ These two authors equally contributed to this work.

Table of contents:

**Fig. S1** Synthetic schemes of (a) nBu-TAEA and (b) nBu-PEI.

**Fig. S2** $^1$H-NMR spectra of (a) nBu-TAEA and (b) nBu-PEI.

**Fig. S3** (a) LCST phase transition and (b) molarity-temperature phase diagrams of nBu-TAEA and nBu-PEI.

**Fig. S4** Osmolality of (a) nBu-TAEA and (b) nBu-PEI

**Fig. S5** A video file showing the circulatory desalination based on nBu-TAEA.
Fig. S1 Synthetic schemes of (a) nBu-TAEA and (b) nBu-PEI.

Fig. S1a

Tris(2-aminoethyl)amine (TAEA) → n-butryc anhydride → N,N',N''-tri(n-butylated) tris(2-aminoethyl)amine (nBu-TAEA)

Fig. S1b

Branched polyethylenimine (b-PEI) → n-butrylated polyethylenimine (87% butylation) (nBu-PEI)
Fig. S2. $^1$H-NMR spectra of (a) $n$Bu-TAEA and (b) $n$Bu-PEI in CD$_3$OD.

Fig. S2a

Fig. S2b
Fig. S3a LCST phase transition of \textit{n}Bu-TAEA and \textit{n}Bu-PEI.\(^a\)

![LCST phase transition graph](image1)

Fig. S3b Molarity-temperature phase diagrams of \textit{n}Bu-TAEA and \textit{n}Bu-PEI.\(^a\)

![Molarity-temperature phase diagram](image2)

\(^a\)The molarity was calculated based on the density at 25\(^\circ\)C.
**Fig. S4a** Osmolality of \( n \text{Bu-TAEA} \)

![Graph showing osmolality of \( n \text{Bu-TAEA} \).](image)

\[ y = 0.8239x + 0.0138 \]

\[ R^2 = 0.9995 \]

**Fig. S4b** Osmolality of \( n \text{Bu-PEI} \)

![Graph showing osmolality of \( n \text{Bu-PEI} \).](image)

\[ y = 1.7616x - 0.0212 \]

\[ R^2 = 0.9911 \]
**Fig. S5** A video file showing the circulatory desalination based on nBu-TAEA. (File format: .WMV) The video recorded during 13 hours was compressed in 7.6 seconds.