Electronic Supplementary Material (ESI) for Analyst.
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Electronic Supporting Information (ESI)

Role of electric field for selective ion filtration in nanostructures

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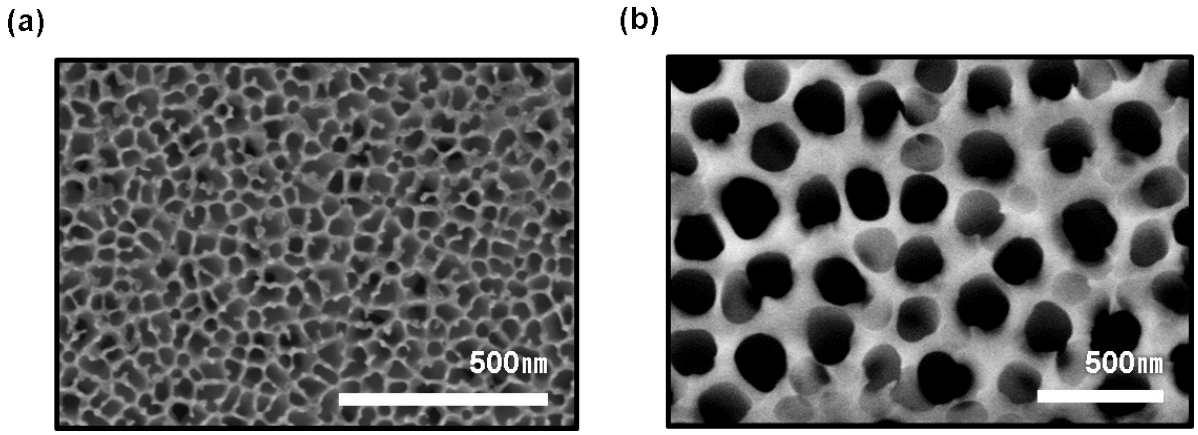

Figure S1 SEM images of frontal/rear view of AAO nanopore structure taken by FE-SEM, using platinum coating. Note that the scale bars incorporated in the figure were in the same size with different resolution to promote clearer realization of the size differences of the nanopores. Also, due to the funnel-shaped structure, as previously mentioned in Fig. 1, rear pore size is approximately 90% narrower than frontal pore size. For the details, please refer to Fig. 1. **(a)** Frontal view of AAO nanopore structure. **(b)** Rear view of AAO nanopore structure.

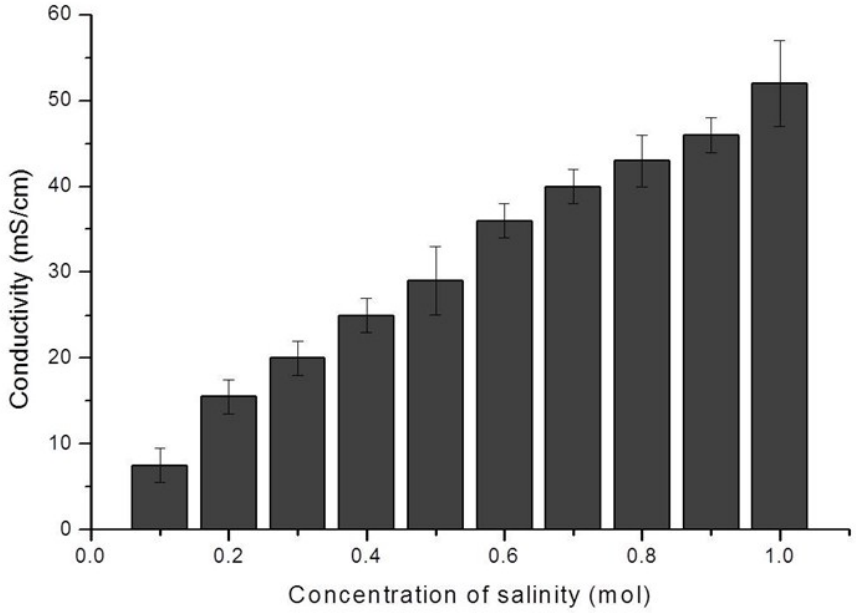

Figure S2 Bar graph for relative conductivity of the solution by its salinity concentration. In average, electrical conductivity of seawater is about 50 mS/cm, thereby designating baseline conductivity at 53 mS/cm. The results from the quantitative measure indicated that the electrical conductivity and ion concentration ratio are in linear relationship. Overall, electrical conductivity was increased when ion concentration was relatively high and vice versa.

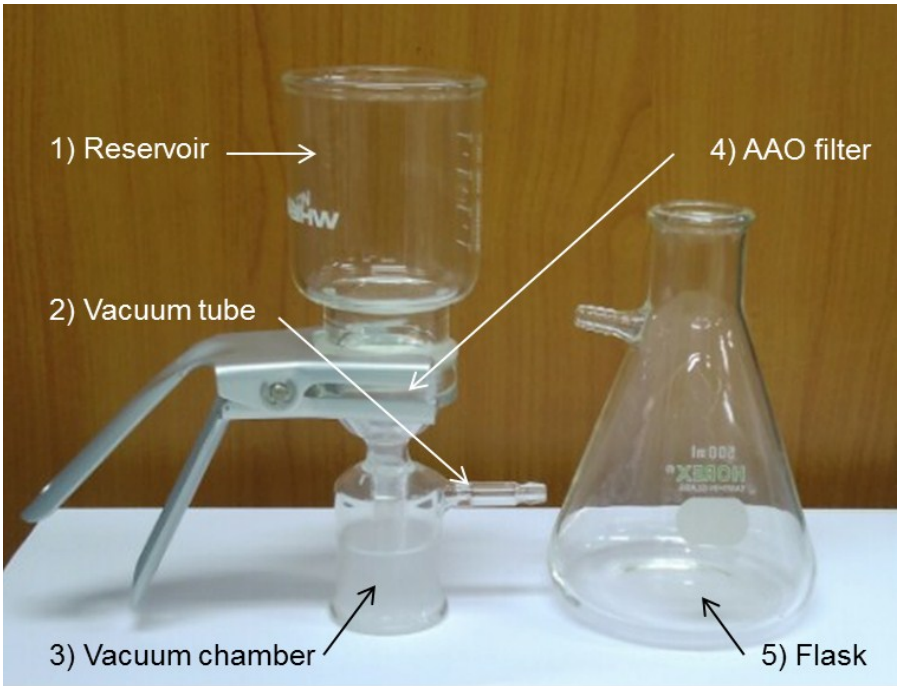

Figure S3 Vacuum filtering set image. The ionized solution is filtered in the following steps (Conductivity of before/after filtration was measure by electrical conductivity apparatus from Korea Tech's COND 6+); 1) The ionized solution is flown to Reservoir, 2) Negative pressure is applied to vacuum tube from the vacuum apparatus, 3) Negative pressure is built up in vacuum chamber to generate the flow, 4) The ionized solution is passed through AAO filter, 5) The filtered solution is stored in the Flask.

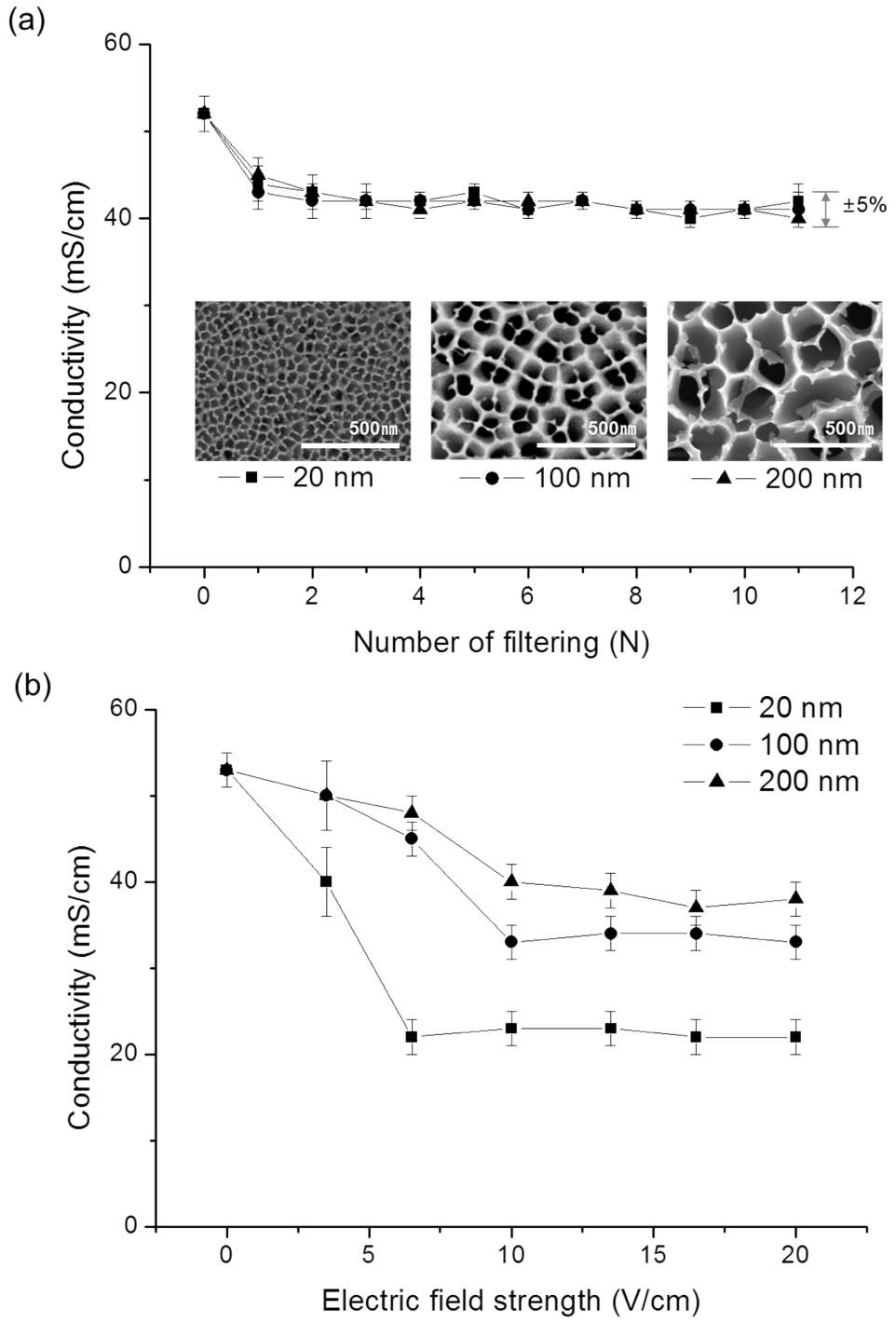

Figure S4 Graphs for differential analysis of 20 nm, 100 nm, and 200 nm Nafion-coated AAO nanopores. The results were derived from additional experiments on each nanopore, followed by the previous experiments mentioned in Fig. 3. For the details regarding this experiment, please refer to Fig. 3. **(a)** Graph for a relative conductivity by the number of filtering. The average difference in conductivity was about ±5%. SEM images of each nanopore are incorporated within the graph. **(b)** Graph for a relative conductivity by the electric field strength in different nanopore sizes. As confirmed in Fig. 3. (b), results from 100 nm and 200 nm had no significant difference in the conductivity when the electric field strength was greater than 10 V/cm. This indicates that the electric field strength greater than 10 V/cm has hardly affected the difference in conductivity, regardless of the size of nanopores. Also, as nanopore sizes become greater, ion separation functionality decreases accordingly.