

Supplementary Information

Stepwise Ammonium Enrichment Using Selective Battery Electrodes

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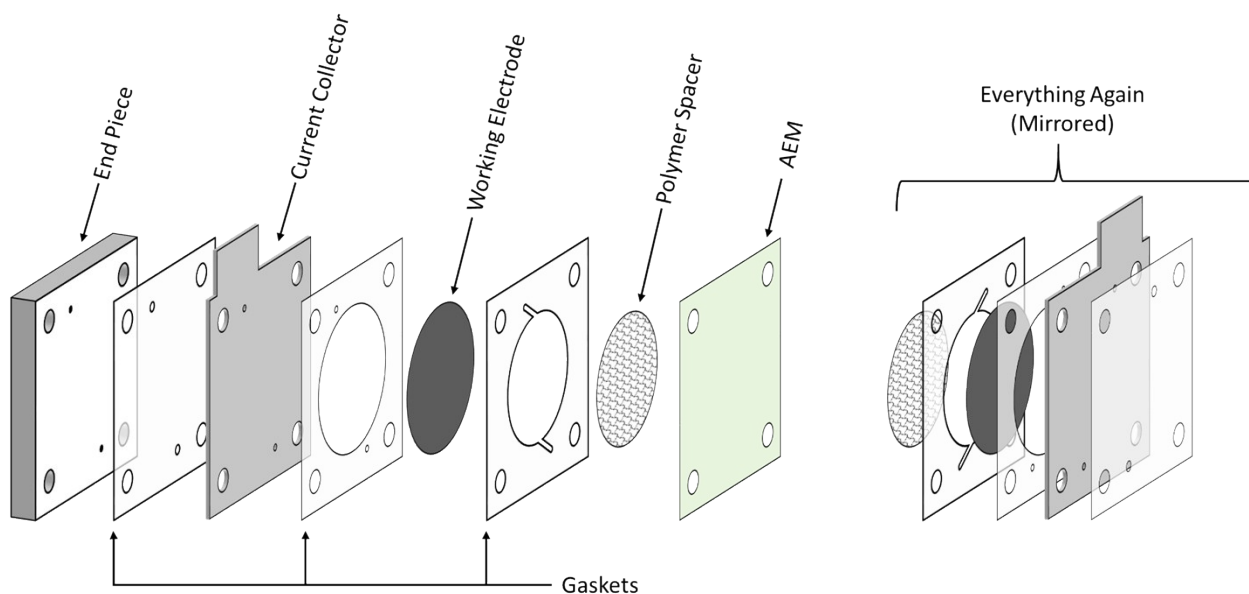


Fig. S1 Schematic of the flow cell assembly. Redrawn image from previous work.^{S1} The effective membrane area was 7 cm².

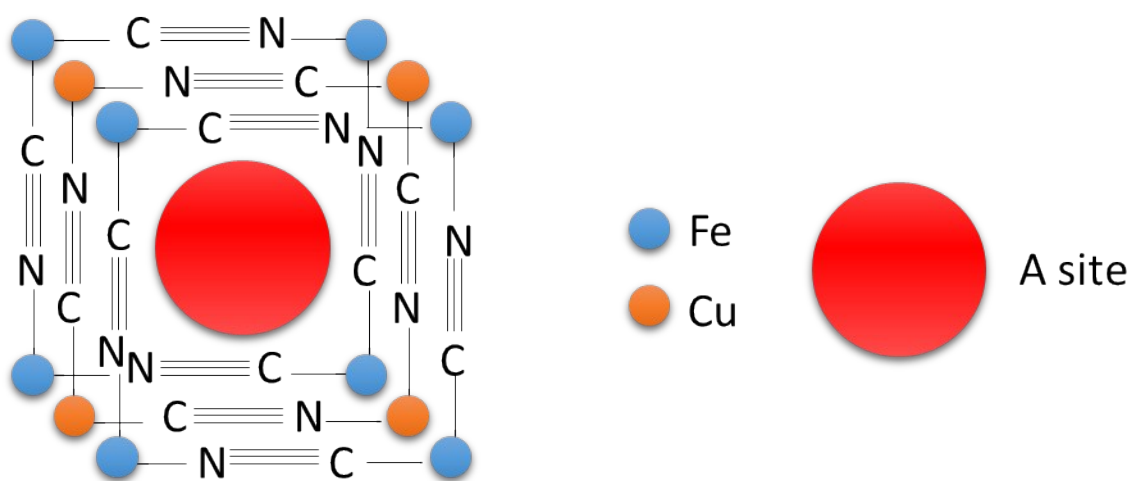


Fig. S2 (a) Structure of copper hexacyanoferrate (CuHCF). The size of the interstitial sites (A site) is 3.2~4.6 Å. Redrawn image from previous work.^{S2}

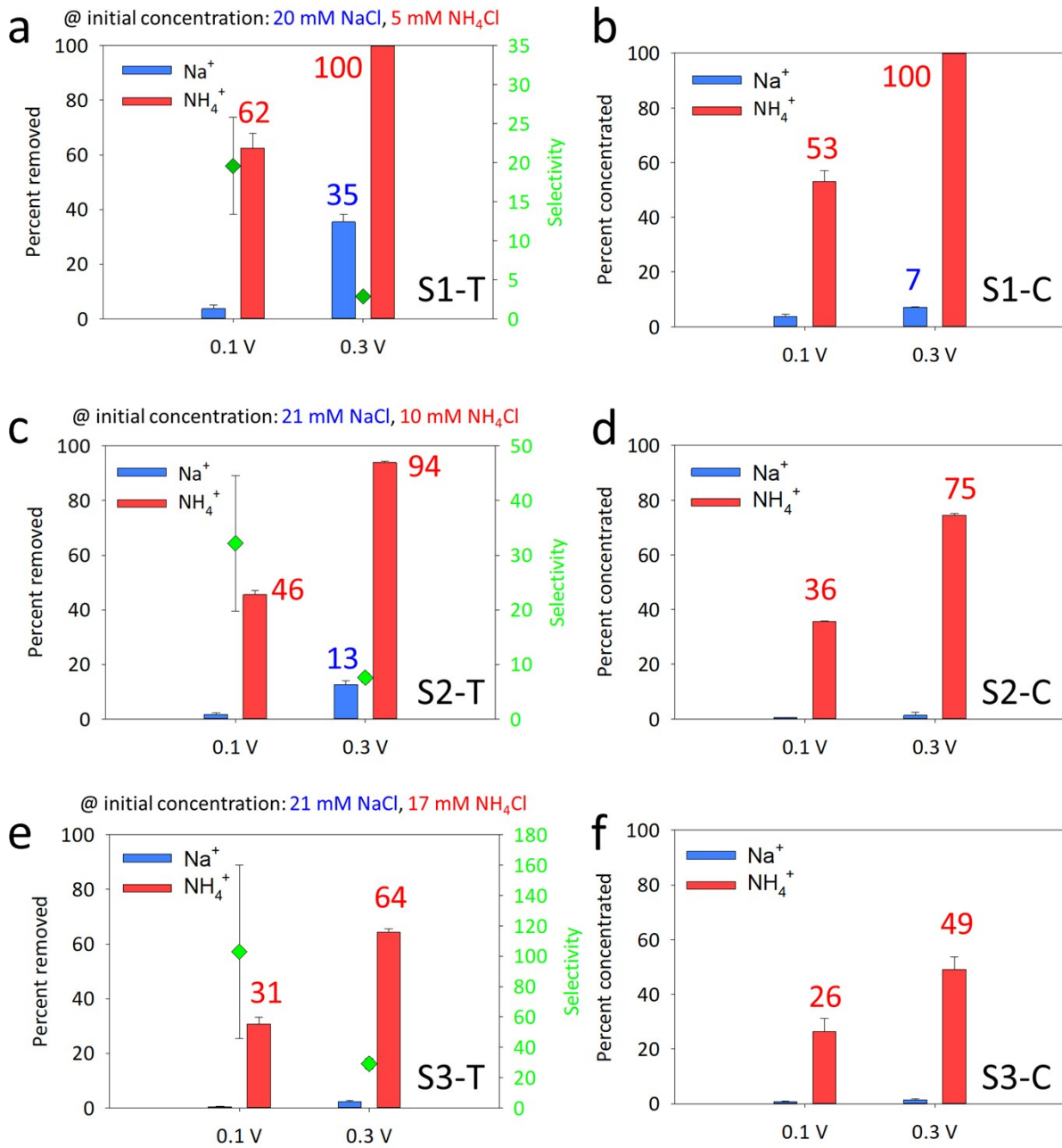


Fig. S3 Percent removed or concentrated of Na⁺ and NH₄⁺ of (a–b) S1, (c–d) S2, and (e–f) S3 as a function of the cell voltage from 0.1 to 0.3 V. Selectivity of ions removal (NH₄⁺/Na⁺) is also shown for the treated stream.

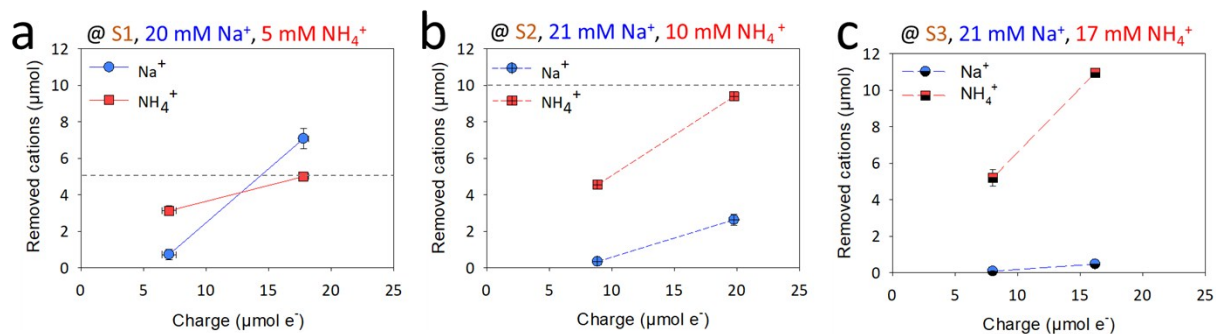


Fig. S4 Removed cations of (a) S1, (b) S2, and (c) S3 as a function of the amount of charge. Concentration of the feed waters was varied depending on the effluent concentration of the previous stage (S1: 20 mM NaCl and 5 mM NH_4Cl , S2: 21 mM NaCl and 10 mM NH_4Cl , and S3: 21 mM NaCl and 17 mM NH_4Cl). Dash lines indicate initial NH_4^+ concentration present in the solution.

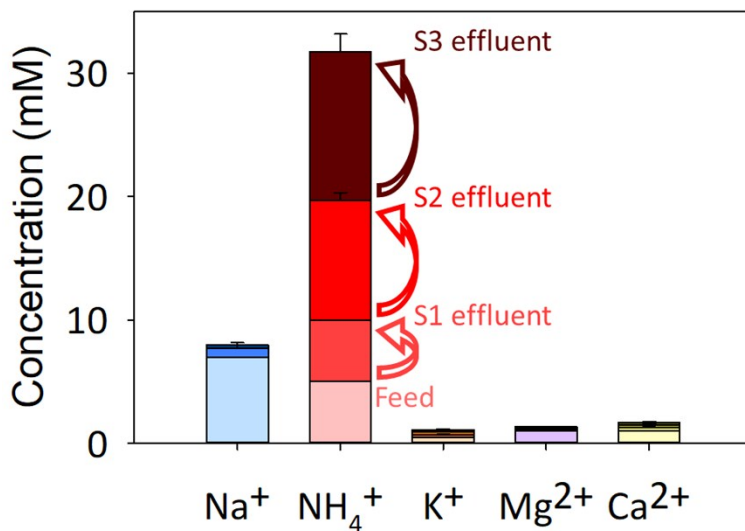


Fig. S5 Concentration of the feed and concentrated effluents of each stage of cations over three stages at an applied voltage of 0.3 V using synthetic wastewater.

References

- S1. T. Kim, C. A. Gorski and B. E. Logan, Ammonium removal from domestic wastewater using selective battery electrodes, *Environ. Sci. Technol. Lett.*, 2018, **5**, 578-583.
- S2. C. D. Wessells, S. V. Peddada, M. T. McDowell, R. A. Huggins and Y. Cui, The effect of insertion species on nanostructured open framework hexacyanoferrate battery electrodes, *J. Electrochem. Soc.*, 2011, **159**, A98-A103.