Electronic Supplementary Material (ESI) for RSC Advances

Energy Production, Use and Saving in a Bioelectrochemical Desalination System

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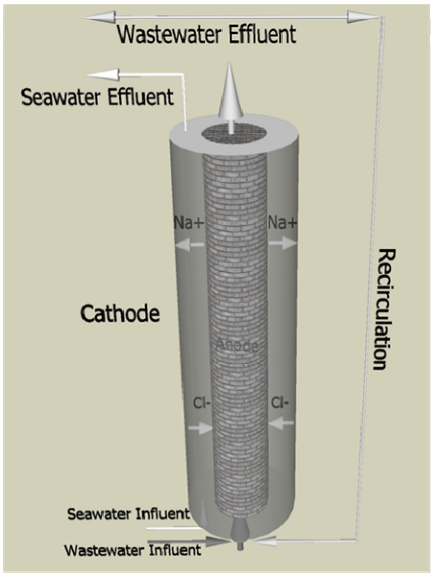
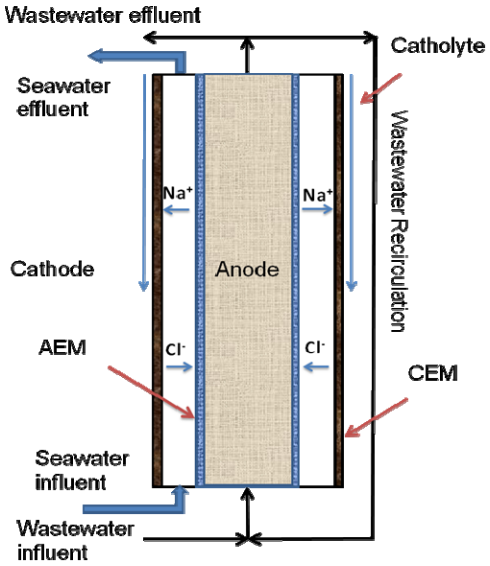
Supplementary data

UMDC set up

The UMDC was constructed as a tubular bioreactor with two compartments (the anode and salt chamber). Carbon brushes were used as the anode electrode materials. The UMDC consisted of one anode tube made of anion exchange membrane (AEM, AMI-7001, Membrane International, Inc., Glen Rock, NJ) within a larger cation exchange membrane tube (CEM, CMI-7000, Membrane International, Inc.). The diameters of the AEM and CEM tubes were 6 cm and 7 cm, respectively, and the effective lengths of both tubes were ~ 70 cm, resulting in an anode liquid volume of 1.9 L (excluding the anode electrode) and a saline water volume of 0.85 L.





The above schematic of the UMDC was adopted from Jacobson, K.S., Drew, D. and He, Z. (2011) Use of a liter-scale upflow microbial desalination cell as a platform to study bioelectrochemical desalination with salt solution or artificial seawater. Environmental Science & Technology. Vol 45, pp 4652-4657.

Calculation of the energy stored in an ultracapacitor

When an ultracapacitor was charged from V_d (discharging voltage, close to zero) to V_c (charging voltage), the energy (E_c) stored in the capacitor was calculated as:

$E_c=0.5\times C\times(V_c^2-V_d^2)$

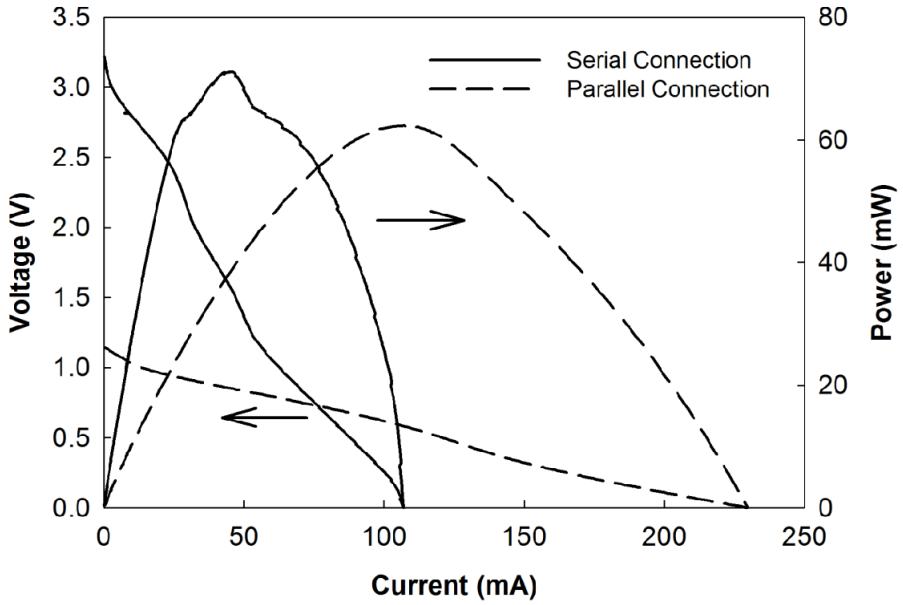


Figure S1. Polarization curves of the UMDC system in serial and parallel connections.

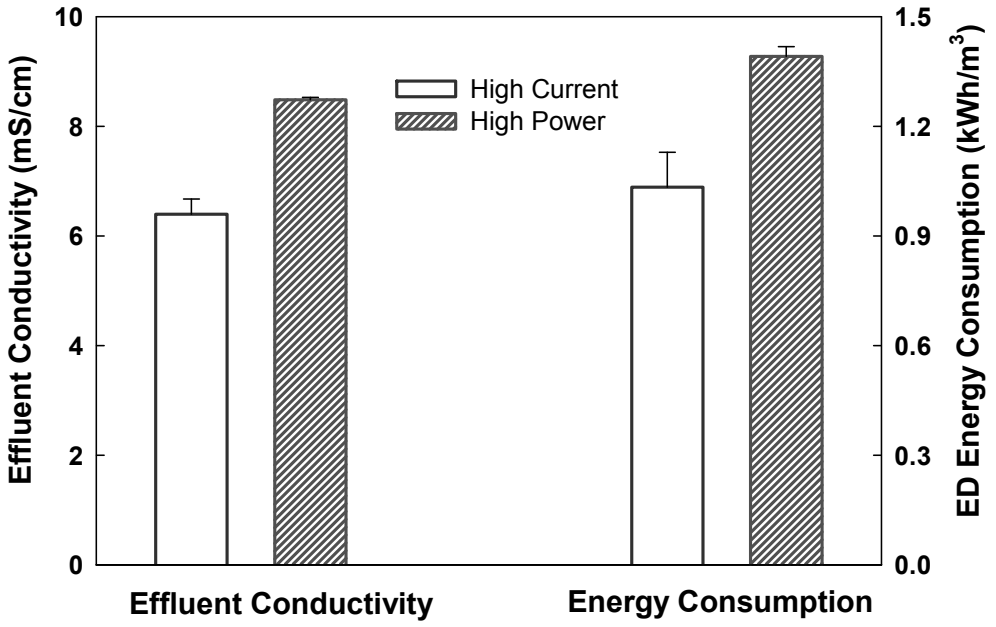


Figure S2. The conductivity of the salt effluents from the UMDC system in parallel connection and the energy consumption by the ED for desalinating those effluents. The salt solution was fed in batch during the 18-h testing period.

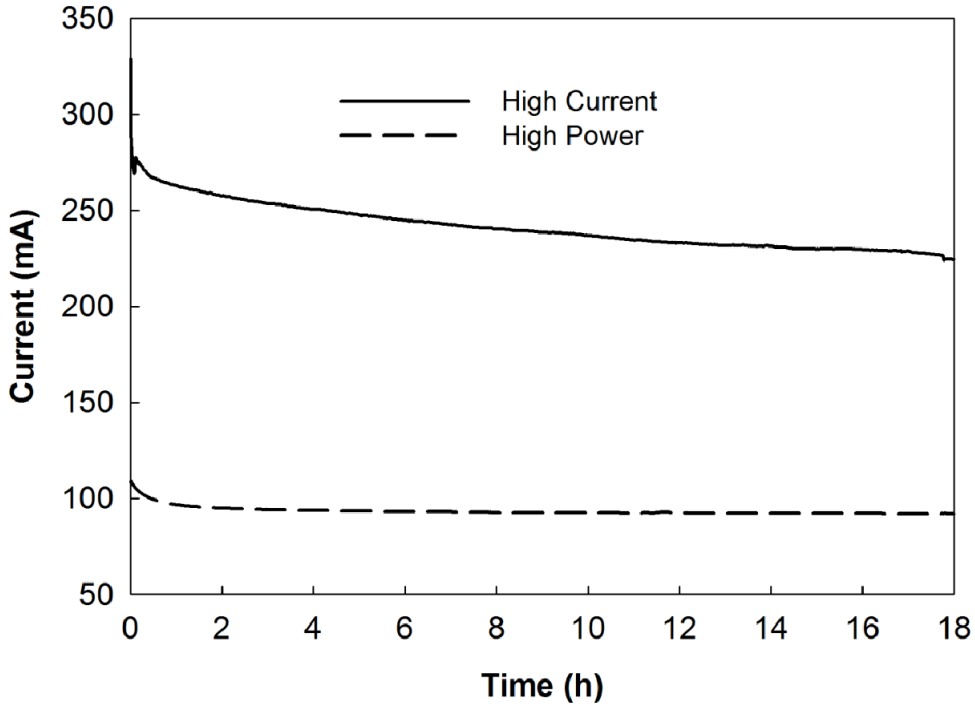


Figure S3. Current generation of the UMDC system in parallel connection. The salt solution was fed as batch during the 18-h testing period.

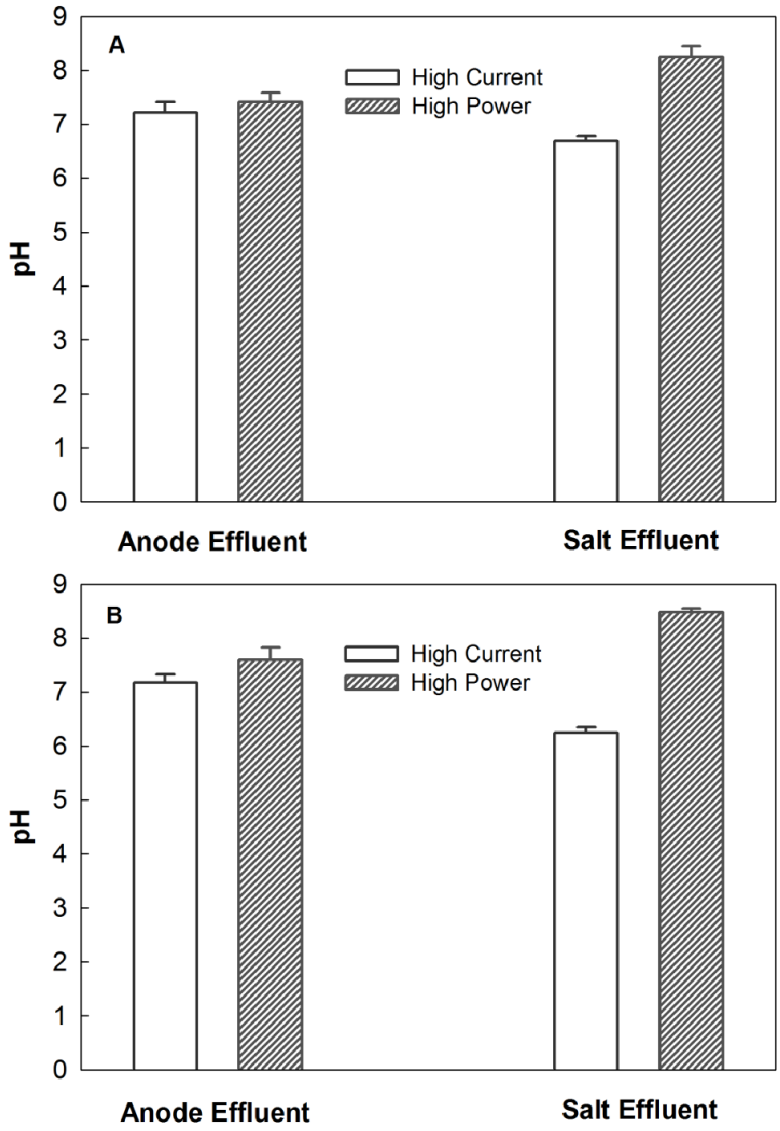


Figure S4. The pH of the effluent from the anode and salt chambers of the UMDC system: (A) in serial connection and (B) in parallel connection. The salt solution was fed in batch during the 18-h testing period.