



## Membrane-free electrodeionization for high-velocity production of high-purity water

Xindi Jin<sup>a</sup>, Chidong Zhou<sup>a</sup>, Zhiqiao He<sup>b</sup>, Xinming Lou<sup>b</sup>, Cheng Yu<sup>b</sup>, Xueming Chen<sup>a,\*</sup>

<sup>a</sup>Environmental Engineering Department, Zhejiang University, 866 Yuhangtang Road, Hangzhou 310058, China, emails: chenxm@zju.edu.cn (X. Chen), jinxindi26@126.com (X. Jin), 404156297@qq.com (C. Zhou)

<sup>b</sup>Zhejiang Zheneng Lanxi Electric Power Generation Co., Ltd., Lanxi 321199, China, emails: hezhiqiao@landideal.com (Z. He), 83188564@qq.com (X. Lou), yucheng@landideal.com (C. Yu)

Received 24 December 2017; Accepted 12 July 2018

---

### ABSTRACT

Membrane-free electrodeionization (MFEDI) has been proven effective in desalination of water similar to the effluent of one-pass reverse osmosis (RO) in our previous work. In this work, we investigated MFEDI for use as a polishing desalination process after two-pass RO. In addition to the difference in simulated feedwater, we increased the flow velocity significantly from previous 15 to 70 m/h. An appropriate resin layer structure was selected to enhance resins regeneration, especially to obstruct the backward migration of cations in resin phase. Parameters of regeneration were adjusted to be more effective and energy efficient. The system was tested for over 60 operational cycles. After such a long-term service, the effluent conductivity still maintained below 0.060  $\mu\text{S}/\text{cm}$ . Water recovery rate and energy consumption of the system were around 93% and 0.14 kWh/m<sup>3</sup> water, respectively. MFEDI was proven to be an economic and quality assured alternative for high-purity water production.

*Keywords:* High-purity water production; Ion-exchange resins; Electrical regeneration; Backward migration prevention; Barrier layers

---

\* Corresponding author.