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Fast Initiation of Electroconvection on an Ion Exchange Membrane by Coupled Redox Potential[1] MINCHAN KIM, RHOKYUN KWAK, JUNBEOM LIM, Hanyang Univ — In electromembrane processes (e.g. electrodialysis), the use of overlimiting currents has been spotlighted with accelerated ion transport through ion exchange membranes. To trigger this overlimting regime, we generally apply a relatively high voltage (>1.5V) to initiate electroconvective vortices (EC) on the membrane, and they facilitate convective ion transport on there. In this scenario, one of the most tantalizing problems in using this overlimiting current is how we can initiate EC in a lower voltage. Here, we suggest the way to accelerate the EC's occurrence by utilizing electrochemical reactions of metals (i.e. Iodine and Zinc) coupling with majority salts (i.e. sodium and chloride ions). During electrodialysis process followed by two chemical reactions, $Zn+2Cl \rightarrow ZnCl_2$ and $NaI_3 \ \ +2Na^+ \rightarrow 3NaI$ with redox potential of $E_0 = 1.3V$ *vs* SHE, we can shift the critical voltage of EC initiation forward up to 0V; accordingly, the overlimiting current regime is also started at 0V. As we utilize the overlimiting currents and EC under a lower voltage, power consumption and a required energy of desalination are achieved as 0.82mW and 1.37kwh/m^3, significantly reduced from typical ED system (1.47mW and 2.45kwh/m^3). Also, even we take into account the cost of chemical fuels to facilitate EC initiation (i.e. Iodine and Zinc), the products (i.e. $ZnCl_2$ and NaI) are more economically valuable than the reactants.

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