A Novel Reaction System for Cogeneration of Chemicals and Electric Energy by Electrochemical Reduction of Nitrobenzene with Iron

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We report a novel green route for generate electric energy by simultaneously electrochemical reduction of nitrobenzene with iron which is carried out in a home-made diaphragm electrolytic cell using iron as reducer. The result shows that nitrobenzene can be reduced to aniline and its derivatives, with the main products of aniline, *p*-oxyethyl aniline and *p*-chloro aniline. During the reaction, iron will be oxidized to iron salt and simultaneously release electric energy. Effects of electrolyte, temperature, concentration of nitrobenzene, and electrodes gap on the performance of cell are studied. The corresponding open circuit cell potential is determined to be around 0.9V as the different reaction conditions. The current density varies from 1.25 to 16.25 mA cm⁻² with the change of external load. The maximum power density is 2 mW cm⁻² at 8.75 mAcm⁻². When cell's capacity reached to 1000 mAh, seven products are detected with 69% conversion of nitrobenzene and 86% of productivity at 70°C. The main products of nitrobenzene are aniline, *p*-oxyethyl aniline and *p*-chloro aniline, while iron is converted into iron ion.

Keywords: Electric energy; Cogeneration; Electrochemical reduction; Nitrobenzene; Iron

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