Electrochemistry and Spectroscopy Study on Nitrate Reduction Catalyzed by Iron and Cobalt Protoporphyrin Immobilized Pyrolytic Graphite

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The nitrogen-cycle is one of the most important material cycles in biosphere. With the high nitrate concentration in ground water, it is important to find methods to reduce its content. Otherwise, it will be harmful for human healthy. The electrochemical reduction of nitrate is an effective technique to accomplish the goal. With iron and cobalt protoporphyrins acting as heterogenous catalyst, the nitrate ions have been reduced to hydroxylamine and ammonia efficiently. The process is highly dependent on pH as the real active reactant of the reaction is NO which comes from the disproportionation reaction of nitrite and also nitrate concentration. The detailed investigations on the influence of pH and nitrate concentration on the electrochemical reduction of nitrate on cobalt protoporphyrin illustrate that the formation of ammonia probably goes through two different pathways, one of which is a direct pathway without going through hydroxylamine and the other is a sequential pathway which is from hydroxylamine reduction. FTIR spectra confirm that the most valuable intermediate of the reaction is adsorbed HNO (M-HNO).

Keywords: Nitrate reduction; pH dependent; NO; M-HNO

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