黄园英,秦臻,刘丹丹,王晓春.纳米铁还原脱氮动力学及其影响因素[J].岩矿测试,2011,30(1):53~58

纳米铁还原脱氮动力学及其影响因素

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Kinetics and Effect Factors of Reductive Denitrification with Nanoscale Zero-valent Iron

投稿时间： 2010-04-15 最后修改时间： 2010-12-10

DOI：

中文关键词: 纳米铁 硝酸盐 去除率 脱氮

英文关键词: nanoscale zero-valent iron nitrate removal rate denitrification

基金项目:国土资源部公益行业科研专项资助(200911015-05); 水体污染控制与治理科技重大专项资助(2009ZX07424-002); 国家地质实验测试中心基本科研业务费项目资助 (201012CSJ02)

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中文摘要:

饮用水中硝酸盐(NO^-_3)对人体健康有危害。为了去除水溶液中NO^-_3,在实验室制得纳米铁颗粒。它的粒径为20~40 nm,比表面积(BET)为49.16 m^2/g。本研究通过批实验考察了纳米铁对NO^-_3还原脱氮动力学性质和影响NO^-_3脱氮快慢的主要因素,如反应pH、纳米铁投加量和NO^-_3起始浓度。实验结果表明,pH越低越有利于NO^-_3还原。在一定范围内,NO^-_3还原速率随纳米铁投加量增加而增大,而随NO^-_3起始浓度升高而降低,反应遵循准一级反应动力学方程,表面吸附和氧化还原反应是纳米铁对NO^-_3脱氮的主要去除机理。纳米铁对NO^-_3还原过程中可能反应的途径进行了讨论,NO^-_3还原产物取决于反应条件。在本研究条件下,纳米铁对NO^-_3脱氮的最终产物主要为NH^+_4-N而不是N_2,必须进行更多的研究来解决这一问题。

英文摘要:

Nitrate in drinking water is a harmful component to human health. Nanoscale zero-valent iron (NZVI) with 20~40 nm size and Brunauer Emmett Teller (BET) surface area of 49.16 m^2/g was synthesized in the laboratory for removal of nitrate from water. Batch experiments were conducted to investigate the denitrification kinetics of NZVI and the factors affecting the denitrification of nitrate such as pH, NZVI dosage as well as the initial nitrate concentration. Experimental results suggest that the low pH value is more favorable for nitrate reduction. Additional, the test results also showed that in certain limits the reduction rate of nitrate increased with increase of NZVI dosage and decreased with increase of initial concentration of nitrate. The dynamics equation for the pseudo first order reaction was obeyed.Surface adsorption and redox reaction were the principal removal mechanism during the denitrification of nitrate by NZVI. Possible reaction ways for nitrate reduction by NZVI were also discussed. The products from nitrate reduction depended upon the reaction condition. Under the condition of this study, the final product from nitrate reduction did not N_2 but $NH^+{}_4$-N. More studies should be conducted to prevent or solve this problem.

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