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# 纳米铁系双金属复合材料还原水中硝酸盐氮

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摘要 利用液相还原法分别制备了纳米Fe0、纳米Fe/Ni及Fe/Cu粒子，并在无氧条件下将其应用于水中硝酸盐污染物的去除研究，分别考察了负载量、硝酸盐初始浓度等条件对硝酸盐去除速率的影响，并对三种纳米材料还原硝酸盐的产物及反应机理进行了分析和讨论。实验结果表明，铜负载量为5.0%的纳米Fe/Cu粒子（投加量为1.5 g/L）在20 min内对硝酸盐的去除率接近100%，反应过程中有大量亚硝酸盐产生，但随着反应的进行又逐渐消失，反应的最终产物主要为氨氮，占体系总氮的75% ，另有25%的氮损失；在纳米Fe0与Fe/Ni粒子还原硝酸盐产物中，氨氮的转化率均为95%以上。纳米Fe/Cu粒子对产物的选择性优于Fe0和Fe/Ni粒子。

关键词 复合材料,硝酸盐,纳米Fe0,纳米Fe/Cu,纳米Fe/Ni,脱硝

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## Nitrate reduction in water by iron system bimetallic nanoparticles

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**Abstract** Nano scale Fe0, Fe/Ni and Fe/Cu particles were synthesized respectively using liquid phase reduction method. Then these nanoparticles were studied as reactive materials for the reduction of nitrate in groundwater under anaerobic condition. The factors affecting the reduction of nitrate, such as the reactive material, the loading content and the initial nitrate concentration in the water, were investigated. Experiments were carried out to examine the mechanisms and productions of contaminant degradation by the three types of nanoparticles. Results show that the Fe/Cu nanoparticles with 5.0% Cu can significantly enhance the rate of reduction of nitrate, remove almost 100% nitrate within a period of 20 min when the iron concentration was 1.5 g/L. In the progress, nitrate removal was accompanied with NH+4 N increase and NO-2 N undergo the process of from increase to decrease, with final nitrogen loss in the reaction of about 25%. Experiments results also show that the activity and selectivity of bimetallic Fe/Cu to a benign compound (i.e., nitrogen gas) is comparable to that of iron based bimetals (Fe/Ni) and zero valent metals. The ammonium of the denitrification by nano scale Feo and Fe/Ni is above 95%. Bimetallic Fe/Cu could be a promising reactive reagent for the reduction of nitrate.

**Key words** composite material nitrate nano scale Fe0 nano scale Fe/Ni nano scale Fe/Cu denitrification

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