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制备条件及水中常见离子对Pd-Cu/AC 催化还原去除硝酸盐的影响

Effect of preparation conditions and several common ions on catalytic reduction of nitrate over Pd-Cu/AC

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中文摘要:

以浸渍法制备Pd-Cu/AC催化剂,以氢气为还原剂对催化还原硝酸盐进行研究,考察了制备条件及水中常见离子对催化还原的影响。结果表明,在200~500℃、30~240 min焙烧条件下,适宜的焙烧温度为300℃,时间为2 h;在100~300 W,1~5 min的微波条件下,微波功率引起的催化剂活性变化比微波照射时间显著,微波处理综合效应不利于催化性能的提高。活性炭经0.01~0.1 mol/L EDTA处理后催化剂的活性随EDTA浓度增加,氨氮生成率没有明显变化。反应过程中氨氮的生成受NO_2^-的浓度影响明显,较高NO_2^-浓度有利于选择性的提高。在初始NO_3^-浓度100 mg/L的条件下, Pd-Cu/AC催化还原硝酸盐的反应为一级反应。水中共存离子影响研究表明,CO_3^{2-}、HCO_3^-的存在不仅会硝酸盐的去除效率明显降低,同时导致氨氮生成率明显增加,S^{2-}存在使催化剂中毒,催化效率极低,Cl^-、SO_4^{2-}的存在对硝酸盐的去除影响较小;水中阳离子存在时催化活性大小顺序为$K^+ < Na^+ < Ca^{2+} < Mg^{2+} < Al^{3+}$,氨氮的生成率大小顺序为$K^+ > Na^+ > Ca^{2+} > Mg^{2+} > Al^{3+}$。

英文摘要:

In this study, the catalyst of Pd-Cu/AC was prepared by impregnation and hydrogen was used as the reducing agent to catalyze nitrate. The influence of preparation conditions and several common ions in water on catalytic reduction of nitrate was investigated. The results showed that the most suitable temperature was 300℃ under 200~500℃ conditions; the most suitable roast time was 2 h in 30~240 min. After treated by 100~300 W microwave radiation for 1~3 min, microwave power caused more obvious variation of catalyst activity than the irradiation time,this way was not conducive to improving catalysis. The activity increased with the increasing of the concentration of EDTA when AC was treated by EDTA of 0.01~0.1 mol/L,however, ammonia generation rate did not change significantly. The result showed that the ammonia nitrogen productivity was obviously influenced by the concentration of NO_2^-, and the relatively high concentration of NO_2^- was benefit to the improvement of reaction selectivity.The kinetic equation of Pd-Cu/AC fitted first order linear relation when the initial concentration of nitrate was 100 mg/L.The study of coexisting ions shown that CO_3^{2-}, HCO_3^- wouldn't significantly reduce the removal efficiency of nitrate, additionally, they leaded to a significant increase in the rate of ammonia generation. The decrease of activity and selectivity owes to the existence of CO_3^{2-} and HCO_3^- in water, the catalyst poisoning happened in the presence of S^{2-}, Cl^- and SO_4^{2-} had little effect on nitrate's removal. For positive ions, the order of the catalytic activity was $K^+ < Na^+ < Ca^{2+} < Mg^{2+} < Al^{3+}$, and the productivity of ammonia nitrogen ordered as $K^+ > Na^+ > Ca^{2+} > Mg^{2+} > Al^{3+}$.

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