

放射性离子交换树脂的超临界水氧化处理研究

秦强 彭红花 乔延波 马洪军 钱正华 王帅*
中国科学院上海应用物理研究所, 上海市, 201800

摘要: 放射性离子交换树脂是核设施产生的主要放射性废物之一, 本研究将超临界水氧化技术应用用于离子交换树脂的处理, 研究了过氧比、停留时间和温度对有机物去除率的影响, 并在45s内获得了高于95%的处理效率, 气体产物中大部分是CO₂ (81.06%), 少量的CO (16%), 微量的CH₄ (0.04%) 和H₂ (2.86%), 而随着反应时间的增加, 这些又都可以氧化成为CO₂和H₂O。超临界水氧化技术可快速、高效的将离子交换树脂无机化, 实现树脂的减容处理, 在放射性离子交换树脂的处理上表现出了极大的前景。

关键词: 超临界水氧化; 离子交换树脂; 降解

Study on Supercritical Water Oxidation of Radioactive Ion Exchange Resin

Qin Qiang, Peng Honghua, Qiao Yanbo, Ma Hongjun, Qian Zhenghua, Wang Shuai*

Shanghai Institute of Applied Physics, Chinese Academy of Sciences, Shanghai 201800

Abstract: Radioactive ion exchange resin is one of the main radioactive wastes produced in nuclear facilities. In this study, supercritical water oxidation technology was applied to the treatment of ion exchange resins. The SCWO experiments were carried out under the temperature of 400-550 °C, oxidant stoichiometric ratio of 0-200%, and pressure of 23 MPa for 15-60 s. The resin degradation rate can reach above 95% within 45s. Most of the gas product is CO₂ (81.06%), and others were small amounts of CO (16%), CH₄ (0.04%) and H₂ (2.86%), which could be further oxidized to CO₂ and H₂O as the reaction time increases. So supercritical water oxidation technology can degrade the ion exchange resin rapidly and efficiently, to achieve the volume reduction of resin, which showed great application prospects in the treatment of radioactive ion exchange resin.

Keywords: Supercritical water oxidation; Resin; Degradation

*通讯作者: 王帅, Email: wangshuai@sinap.ac.cn; Tel./Fax. 021-39194017