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RADIATION-INDUCED DECOMPOSITION AND POLYMERIZATION OF POLYVINYL ALCOHOL IN AQUEOUS SOLUTIONS

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Abstract

Polyvinyl alcohol (PVA) is a typical refractory organic pollutant with low biodegradability and high molecular weight. This paper presents data on the radiolysis of PVA in aqueous solutions by using ionizing radiation. Response surface methodology with Box-Behnken design of experiment was applied to analyze the interactions among initial concentration of PVA, absorbed dose, and initial pH of aqueous solutions on PVA removal efficiency. 9.4-89.4% PVA was removed based on different combination conditions. In addition, absorbed dose and its interactions with PVA initial concentration were determined to be significant in PVA degradation, and both acidic and alkaline conditions were more beneficial to PVA degradation than neutral condition. When PVA initial concentration was 200 mg/L and absorbed dose was 2.75 kGy, PVA removal ratio was obtained to yields of 88.8% and 89.4% at pH 1 and pH 13. Interestingly, polymerization and gelation of PVA in aqueous solution was found during the irradiation, and gel ratio was 67.2% at 9 kGy when PVA initial concentration was 3000 mg/L. Finally, individual effect of hydroxyl radicals, hydrated electrons and hydrogen atoms on PVA radiolysis was studied, respectively.

Key words: gamma radiation, ionizing radiation, microfiltration, polymerization, PVA

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