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# The Mechanisms and Process of Acephate Degradation by Hydroxyl Radical and Hydrated Electron

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## ABSTRACT

The degradation process of acephate in aqueous solution with  $\cdot\text{OH}$  and  $e_{\text{aq}}^-$  produced by  $^{60}\text{Co}$ - $\gamma$  irradiation and electron pulse radiolysis was studied in the present paper. In the aqueous solution, acephate reacted with  $e_{\text{aq}}^-$  and transformed to transient species which can absorb weakly in the wavelength range of 300nm to 400nm and decay very fast. According to the decay of hydrated electron, the reaction rate constant of  $e_{\text{aq}}^-$  and acephate is  $(3.51 \pm 0.076) \times 10^9 \text{ dm}^3 \cdot \text{mol}^{-1} \cdot \text{s}^{-1}$ . The transient species produced in the reaction of  $\cdot\text{OH}$  and acephate do not distinctly absorb the light in the wavelength range of 300nm to 700nm, so the decay and kinetics of the transient species cannot be determined directly. The competing reaction of KSCN or acephate with  $\cdot\text{OH}$  were studied to obtain the reaction rate constant of  $\cdot\text{OH}$  and acephate, which is  $(9.1 \pm 0.11) \times 10^8 \text{ dm}^3 \cdot \text{mol}^{-1} \cdot \text{s}^{-1}$ . Although acetylamine and inorganic ions were determined in the products of the reaction of acephate with  $\cdot\text{OH}$  or  $e_{\text{aq}}^-$ , the concentration of inorganic ions in the products of the reaction of acephate with  $\cdot\text{OH}$  is higher than that in the product of the reaction of acephate with  $e_{\text{aq}}^-$ . Moreover, there were sulfide in the products of the reaction of acephate with  $e_{\text{aq}}^-$ . The degradation pathways of acephate by  $\cdot\text{OH}$  and  $e_{\text{aq}}^-$  were also proposed based on the products from GC-MS.

**Keywords:** Acephate; Electron pulse radiolysis; Reaction kinetics; Degradation pathway

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