DECOMPOSITION OF PERSISTENT PHARMACEUTICALS IN WASTEWATER BY IONIZING RADIATION

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The environmental movement and risk evaluation of some pharmaceuticals are studied recently, and the concentrations of the pharmaceuticals in the water environment increased gradually because of population growth and the diversification of advanced medical worldwide. Some anti-inflammatory medications, anticonvulsant drugs, antiviral drugs, antilipemic agents and so on were detected at the downstream of water treatment plant, and could not be decomposed by the activated sludge system completely. However, it is difficult to manage the environment risk of the pharmaceuticals having great benefits for human life. The development of new treatment method is required to minimize their risk.

The purpose of this work is to treat the pharmaceuticals in combination of the activated sludge and the ionizing radiation. Oseltamivir, aspirin and ibuprofen at 5 μmol dm^{-3} in wastewater were decomposed by activated sludge at reaction time for 4 h. Carbamazepine, ketoprofen, mefenamic acid, clofibric acid, and diclofenac were not biodegraded completely, but eliminated by γ-ray irradiation at 2 kGy. The rate constants of the reactions of these pharmaceuticals with hydroxyl radicals produced by water radiolysis were estimated by the competition reaction method to be 3.4 - 10 × 10^9 mol^{-1} dm^3 s^{-1}. Decompositions of the pharmaceuticals in wastewater by ionizing radiation were simulated using parameters of the obtained rate constants and the amount of total organic carbon. Simulation curves of concentrations of these pharmaceuticals as function of dose were responsible for the experimental data, and the required dose for the elimination of them in wastewater by ionizing radiation can be estimated by this simulation.