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Degradation Characteristics and Transformation Products of Iodinated Contrast Media Using Ionizing Radiation

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In the present study, the degradation of iodinated X-ray contrast media (ICMs) using ionizing radiation was investigated. ICMs, radiocontrast agents containing iodine for enhanced visibility of vascular structure and organs, are one of the widely used diagnostic pharmaceutical compounds. ICMs are considered as persistent pollutants in watershed due to continuous release into aqueous ecosystem and low degradation efficiency in conventional treatment processes. Therefore, various advanced oxidation processes (AOPs) have been currently applied to treat non-degradable pharmaceuticals including ICMs. Radiolysis is a new treatment technology to eliminate a variety of non-degradable compounds, showing higher degradation efficiency. Although studies considering degradation of non-degradable compounds with AOPs have been increased, there has been insufficient information of byproducts produced by the treatment, especially ionizing radiation. Therefore, the aims of this study was to evaluate the degradation characteristics of ionizing radiation treated ICMs, and to identify the radiolytic transformation products. The target compounds were treated using ionizing radiation, with the absorbance doses from 0.1 to 5 kGy (1 kGy = 1 kJ kg-1). Ionizing radiation was achieved using a high level 60Co source at the Korean Atomic Energy Research Institute (KAERI, Rep. of Korea). LC-QTOF-MS (Agilent Technologies, USA) and LC/ESI-MS/MS (Agilent Technologies, USA) were used for qualification and quantification analysis of degradation byproducts. In order to confirm that the byproducts of irradiated ICMs were originated from the radiolysis, the variation of parent compounds in dark control was estimated. There was no relevant change of target compounds in dark control for 40 days, indicating that hydrolysis of target compounds were negligible. Target compounds were rapidly declined with absorbance doses, showing the rate constants (kr) of 1.7299 kGy-1 (ioversol), 1.5485 kGy-1 (iohexol), 1.3745 kGy-1 (iopromide), 1.3522 kGy-1 (diatrizoate), and 1.2726 kGy-1 (iopamidol) (r2>0.99). Degradation of ICMs led to sequential release of iodide, indicating that reductive deiodination is one of the major degradation mechanism of ICMs. Deiodinated degradation byproducts of iopromide including TP665 (C18H25I2N3O8), TP540 (C18H26IN3O8), TP414 (C18H27N3O8) were also detected in qualification analysis.

Country/Organization invited to participate

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