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Radiolytic and hydrolytic degradation of a polycarboxylate superplasticizer

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Superplasticizers are organic cement additives often used in construction as they improve the properties of concrete. The engineered barriers in repositories for radioactive waste often include cementitious materials. Superplasticizers and their radiolytic and hydrolytic breakdown products and how they might affect the transport properties of radionuclides represent a concern in the long-term safety assessment of radioactive waste disposal. This study presents the radiolytic and hydrolytic degradation of a commercially available polycarboxylate (PCE) superplasticizer. Superplasticizer samples were irradiated in the Jožef Stefan Institute TRIGA reactor in shutdown conditions to gamma doses up to 3.2 MGy, to identify the degradation products that could affect the mobility of the radionuclides. In addition, a hydrolytic degradation study of the superplasticizer was performed in 0.1 M NaOH. FTIR, NMR and SEC were used to study the degradation of the PCE superplasticizer. The results indicate that backbone crosslinking occurs at an accumulated dose of 0.6–0.8 MGy, followed by cleavage of PEG side chains at 3.2 MGy. Similarly, hydrolytic degradation showed cleavage of ester bonds.

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