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Characterization of water soluble products formed by polymer degradation in the context of waste management

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Polymers are widely used in the nuclear industry and will be found in Intermediate Level Waste Long Lived (ILW-LL) nuclear waste packages. In the French context, the ILW-LL packages are to be disposed of in a geological repository. During long term disposal, hydrosoluble degradation products (HDPs) can be formed from radio-oxidation and alkaline hydrolysis of polymers. For the safety assessment of the repository it is important to characterize and identify the products that are able to increase the mobility of radionuclides. In this study, different polymers are irradiated with γ rays under air at doses higher than 1 MGy: polyurethane, polyvinyl chloride, polyethylene and cellulose are the most common polymers and are mainly used as gloves, bottles or glove box bags. Non-irradiated and irradiated materials are hydrolyzed in alkaline or pure water, at 60°C under anaerobic conditions. Concentrated HDP solutions are obtained, analyzed and studied with the objective to understand the degradation process in presence of water. The aim is to identify the water-soluble compounds formed and to explain the impact of oxidative ageing on the hydrolytic degradation of the polymers. The ionic chromatography is used to quantify small carboxylic acids. The gas Chromatography – Mass Spectrometry coupling allows us to identify the volatile organic molecules. Then, the electrospray source coupled with Quadrupole – Time of Flight is used to characterize the most polar water-soluble molecules. As the total organic carbon and organic molecules are quantified, mass balances are established and mechanisms can be introduced.

Biography

Legand Solene has completed her Master's (Instrumentations and methods of chemical, spectroscopic, electronic and nuclear analyses) from Strabourg University in France. This young Research Engineer is working in the Laboratory of Radiolysis and Organic Matter (LRMO) at the French Alternative Energies and Atomic Energy Commission (CEA) in the last 10 years. As a specialist in Analytical Chemistry, she contributes to the research program conducted by the CEA in collaboration with AREVA, EDF and ANDRA and devoted to polymer degradation in the context of ILW-LL waste management. She has published 8 papers.

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