GEOPOLYMER FROM DOMESTIC WASTE PRODUCTS FOR THE MANAGEMENT OF LIQUID RADIOACTIVE WASTES.

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Immobilization of radioactive waste is an essential process in the isolation of radioactive materials from the environment. The goal of this process is to ensure long-term containment to prevent the release of harmful radiation or contamination into the biosphere. One of the key methods of immobilization is cementation - process in which waste is mixed with cement and other additives, forming a solid concrete-like material. However, limitations of the cementation is relatively low resistance to certain chemical attacks and limited durability over very long periods.

Using geopolymers (GPs), inorganic polymers formed by the reaction of aluminosilicate materials with an alkaline activator, as a matrix for immobilizing radioactive waste has recently gained significant attention due to their excellent chemical and physical properties. At the same time, GP production leaves a significantly smaller CO_2 footprint than cement production.

The raw materials used in our group for the GP synthesis were fly ash, an industrial waste from a local heat/power coal-fired plant, and quartz sand. An initial part of the work presented here was checking optimum conditions of the GP synthesis: dosage of the raw materials, synthesis duration, time and temperature of curing the product.

The geopolymer obtained under optimum conditions was subjected to the tests of metal binding ability. The batch sorption of metals from aqueous solutions was taken as a measure of their binding capacity. Mono-, di-, and trivalent metallic radionuclides were represented by cesium-137, strontium-85, cobalt-60 and americium-241 cations. We have also tested affinity of our GP towards technetium-99m, occurring as TcO_4^- anion in aqueous solutions. In addition, the influence of solution salinity and the presence of metal complexing agents, always present in the decontamination liquids, was also checked.

The results show that GP obtained from the easily available domestic materials can be successfully used as a matrix for storing liquid radioactive waste. Long-term tests of leaching radionuclides from the matrix are ongoing under the IAEA procedure. Preliminary results are promising.

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