Application of layered double hydroxides for ^{99}Tc immobilization.

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^{99}Tc is a long-lived ($T_{1/2}$=2.13·10^5 y) fission product (FP) of the nuclear fuel cycle (NFC). As a component of nuclear wastes it remains a FP of concern for the final disposal option in case of uncontrolled FP release. Stabilized as $Tc(VII)O_4^-$, it is well soluble, poorly sorbed and hence, highly mobile anion in the environment. A number of strategies have been proposed to reduce ^{99}Tc mobility by incorporating it into the structure of mineral phases ubiquitous and durable in the given environment. We have recently demonstrated the incorporation of TcO_4^- in layered double hydroxides (LDH) that were earlier proposed for ^{79}Se and ^{129}I remediation in water treatment technology.

This work is focused on the ^{99}Tc(VII) incorporation into Pyroaurite (PyA) and Hydrotalcite (HTC) - Mg-Fe and Mg-Al LDHs correspondingly, on simplified CO_2- and O_2-free conditions. Earlier experiments with Re(VII), considered to be a chemical analogue for ^{99}Tc(VII), have demonstrated little to no uptake of Re(VII). Similar experiments with ^{99}Tc(VII) have shown a significant increase in ^{99}Tc uptake on LDHs even in the concurrency with CO_3^{2-} ions. Following leaching experiments have revealed the irreversible character of ^{99}Tc(VII)-LDH interaction. Modern spectroscopic methods are applied in order to understand how ^{99}Tc is accommodated in between the brucite layers of LDHs and whether ^{99}Tc(VII) undergoes redox transformation to Tc(IV). This information will help to verify, whether LDHs can be used as a host phase for ^{99}Tc long-term and safe storage. Additionally, these data aquired on controlled conditions can be used for modelling of ^{99}Tc geochemical behavior in more complex repository relevant systems.

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