The Influence of Ionizing Radiation for the Stability of ^{137}Cs Natural Sorbent Based on Dioctahedral Vermiculite

Szarłowicz Katarzyna,[1,*] Jędrzejek Filip,[1] Stobiński Marcin, [1] Krzysiek Mateusz[2] and Michał Skiba[3]

[1]AGH University of Krakow, Faculty of Energy and Fuels, al. A. Mickiewicza 30, 30-059 Krakow, Poland
[2] Institute of Nuclear Physics PAN, ul. Radzikowskiego 152 31-342 Kraków, Poland
[3]Jagiellonian University, Institute of Geological Sciences, Gronostajowa 3a, 30-387 Krakow, Poland

** e-mail: szarlowi@agh.edu.pl*

Radioactivity is an intrinsic component of the environment. However, environmental threats arise when radionuclides are released into the environment in an uncontrolled manner. Consequently, all ecosystems and their constituents become susceptible to contamination. One significant environmental threat and radioecological challenge is posed by the long-lived radionuclide ^{137}Cs. This isotope's environmental presence is linked to nuclear failures and accidents, such as those at Chernobyl or Fukushima. Elements of the environment that have become contaminated undergo various decontamination procedures to mitigate contamination.

The focal point of this study is the exploration of the potential applications of dioctahedral clay minerals. These minerals are inherently present in the environment. They possess the capability to sorb radioactive ^{137}Cs. Nonetheless, the challenge lies in determining whether this sorption is enduring and non-destructive. Consequently, the objective of the research was to examine the influence of ionizing radiation on the structure of dioctahedral vermiculite. Natural vermiculite was saturated with stable Cs, encapsulated in a membrane, and the entire material was immersed in water and exposed to external radiation. A Cs-137, ZCs-10 source (IBJ, Świerk, A_0 = 155.59 MBq) was employed for this purpose.

Periodically, the composition of the solution containing the mineral was assessed by quantifying Cs, Al, and Na using the ICP-MS method. The analyses enable the determination of these elements' presence within the solution. A this moment, we can observe that there is an amount of the ions in solution, but, subsequent mineralogical analyses upon the conclusion of the experiment will provide insights into whether and how the mineral's interlayer structure has been disrupted or destroyed. This research is of significant importance and plays a pivotal role in the advancement of environmental decontamination methods.

Acknowledgements

The work was created as a result of research project no. 2021/43/B/ST10/00632 financed by the National Science Centre.