SORPTION MECHANISMS OF ^{137}Cs IN SOIL: IMPLICATION AND OPPORTUNITY FOR ENVIRONMENTAL REMEDIATION

KATARZYNA SZARŁOWICZ[1], FILIP JĘDRZEJEK[1,*], MICHAŁ SKIBA[2]

[1] AGH University of Krakow, Faculty of Energy and Fuels, Mickiewicza 30, 30-059 Krakow, Poland
[2] Jagiellonian University, Institute of Geological Sciences, Gronostajowa 3a, 30-387 Krakow, Poland

** Corresponding author email: jedrzejek@agh.edu.pl*

Natural radioactivity is a baseline component of the environment, while artificial radionuclides from nuclear accidents and weapon tests – especially ^{137}Cs—present heightened risks due to their long half-lives and tendency for bioaccumulation. ^{137}Cs, a fission product of uranium and plutonium, is a strong gamma emitter with a half-life of approximately 30 years, exhibiting the potential for significant atmospheric mobility and environmental deposition. When released into the environment during an accident or incident, it presents significant challenges and warrants consideration within the framework of public and environmental protection.

This study focuses on the sorption and retention of ^{137}Cs in the soils of Karkonosze National Park, a protected area with minimal artificial interference, offering a unique setting to investigate natural cesium retention processes. Research material was selected based on the measurement grid in the study area, locating potential points with increased cesium accumulation. Gamma spectrometry and X-ray diffraction were employed to seek the specific soil fractions and obtain ceasium ions absorption centers. The highest radioactive concentrations were located in clay minerals fraction where values were several times higher. The extracted fraction of clay minerals possess effective sorption properties, capable of immobilizing cesium ions and reducing environmental mobility.

The results furnish significant insights into the mechanisms of cesium retention in soils, highlighting the potential of clay minerals for environmental decontamination. Their natural abundance and minimal environmental interference make them ideal for use in remediation strategies. These findings offer a promising approach to enhancing decontamination efforts, emphasizing the potential of using natural sorbents to restore contaminated ecosystems effectively. By understanding cesium-soil interactions, particularly the role of clay minerals, we can devise more sustainable and efficacious remediation techniques for regions strategies for areas impacted by radioactive fallout.

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