

CONTRIBUTIONS REGARDING SOME RADIOACTIVE ISOTOPES REMOVAL FROM SIMULATED NUCLEAR WASTEWATER USING RAW AND MODIFIED CLAYS

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Radioactive waste has a global impact on the environment. The treatment of radioactive liquid waste has as objective both the decontamination process (for its evacuation into environment) and the volume reduction (for its storage or disposal). Treatments by ion exchange are applied on the fluids with low and medium radioactive level and low salts content. Generally, for radioactive effluents decontamination by ion exchange were used the natural and synthetic exchangers with mineral or organic origin. Among natural mineral exchangers, clays (kaolinite, montmorillonite, vermiculite, illite) are very used. In this study, the raw and modified clays from Valea Chioarului area (Romania) were used for decontamination of the simulated wastewaters with medium and low radioactivity. The average oxide composition of the raw clay from Valea Chioarului is: SiO₂ 69.61%, Al₂O₃ 19.7%, Fe₂O₃ 1.27%, CaO 0.90%, MgO 2.41%, Na₂O 1.31%, K₂O 0.18%, LOI 5.35% (weight percents). The CEC (cation exchange capacity) value was found 92 meq/100g clay. The specific surface area was about 140 m²/g. Several single (Fe-clay, Al-clay, V-clay) pillared clays have been prepared by exchange of the charge compensating cations between the clay layers with the larger hydroxycations, which are, particularly, oligomeric hydroxy metal cations formed by hydrolyse of metal salts. The oxide pillars, obtained after calcination, sustain the clay sheets and lead to the formation of a bi-dimensional porous network. The specific area of the Fe-pillared clay, and Al-pillared clay was 117 and 280 m²/g, respectively. The experiments were con-

ducted with solutions that were simulated the liquid radioactive effluents with low medium activity. The water was contaminated with different solutions of radioactive isotopes, which frequently there are in the liquid radioactive overflowing: ¹³⁴Cs, ¹³⁷Cs, ¹³³Ba and ⁶⁰Co. The gamma spectra were analysed taking into account the peak can be ascribed to only one isotope exclusively and a sufficiently high quantum yield, which allows detecting the peak even at low content of an isotope.

The experiments were conducted at ambient temperature and atmospheric pressure, in batch condition, solid-liquid ratio = 1/10 g/ml; pH = 1–2.

The retention of ¹³⁷Cs on clay samples reached equilibrium in the following order Fe-pillared clay < raw clay < Al-pillared clay. The uptake percentage of ¹³⁷Cs value tends to increase proportional with increasing surface area of the samples. The uptake percentage of radioisotopes was considerably affected by initial value of solution activity. This experimental finding is related to the diffusion process, knowing that the cationic transit is much faster in diluted solutions.

References

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