

METHODS FOR TREATMENT OF SPENT NOVEL DECONTAMINATION SOLUTIONS

High volumes of the decontamination solutions are generated as a secondary waste during the process of decontamination of NPP facilities. Organic complexing agents (e.g. HOx, HCit, EDTA) are the main components of the solutions used for the decontamination procedure. Nitrilotriacetic acid (NTA) is one of frequently used complexing agents in modern decontamination solutions. This study deals with potential treatment of spent decontamination solutions for final disposal. The treatment is based on the degradation of organic substances followed by separation of radionuclides.

Photocatalysis is one of simple nonthermal methods of degradation of organic compounds. Decomposition occurs mainly due to reactions of organic substances with OH radicals generated by interaction of UV radiation with catalyst. The influence of various parameters (pH value, irradiation time, temperature, catalyst amount, salinity, initial concentration of NTA, hydrazine amount and type of catalyst) on photocatalytic degradation of NTA has been studied. The comparison of heterogeneous and homogenous catalysts was one of the major studied objects as well as the determination of optimal NTA degradation conditions. Titanium dioxide (P25) was used as a heterogeneous catalyst and photo-Fenton agent ($\text{Fe}^{3+}/\text{H}_2\text{O}_2$) as a homogenous catalyst. The efficiency of the various combinations and modifications of both mentioned catalysts was also studied. It was verified that the process is strongly affected by the type of the applied catalyst. The influence of pH value as well as influence of catalyst amount and hydrazine amount was found to be significant in both, titanium dioxide and photo-Fenton catalyst. Comparing irradiation times of the same NTA degradation degree achieved, the photocatalytic efficiency of photo-Fenton agent was found to be much higher than the efficiency of titanium dioxide.

The effect of the degradation of organic complexants on sorption of various radionuclides from the simulated spent decontamination solutions was studied. Distribution coefficients of various sorbents were measured at the volume-to-mass ratio $V/m = 100 \text{ ml/g}$ (time of contact 24 hours).

The results of these experiments offer potential direction in the efforts for the minimisation of such radioactive wastes.

Keywords: Decontamination; Nitrilotriacetic acid; Photocatalysis; Degradation; Sorption; Distribution coefficient.