Comparative Study of Selected Decontamination Agents for Surface Decontamination of Radionuclides

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This study focuses on the experimental evaluation of three decontamination agents for removing surface contamination from metal materials. Following ISO 7503 standards, stainless steel test plates made of austenitic (AISI 304) and ferritic (AISI 430) steel, each measuring 5×5 cm and differing in surface roughness, were intentionally contaminated. The applied radionuclides included technetium-99m ($^{99m}TcO^{4-}$ and ^{99m}Tc labeled human albumin nanocolloid) and iodine-123 (^{123}I-ioflupane), commonly used in nuclear medicine.

The tested decontamination agents were Incidin (an alcohol-based disinfectant), Neodekont with water (an abrasive dermocosmetic cleaning agent), and a 0.5% aqueous solution of citric acid. The experiment involved measuring surface activity before and after three decontamination cycles using both direct and indirect methods. Based on the measured values, decontamination efficiency and decontamination factors were calculated relative to the regulatory limits for environmental release and surface use in controlled workplaces.

Decontamination results varied depending on the type of radionuclide, surface finish, and the cleaning agent used. In several cases, the remaining activity fell below the regulatory threshold, which allowed the material to be reused or released. On smooth steel, contaminants were removed more easily -probably because the surface held less material and the cleaning agent spread more evenly. Rougher surfaces tended to have more contamination and often required multiple cleaning steps to reduce activity below acceptable limits.

These results underscore that decontamination effectiveness depends not only on the properties of the radionuclide and the agent chemistry, but also on the physical condition of the contaminated surface. Choosing an appropriate cleaning method requires consideration of all these factors. Calculated decontamination factors provided a more reliable basis for determining whether the cleaned surface met legal requirements compared to efficiency alone.

Keywords: austenitic steel, decontamination, decontamination factor, ferritic steel, radionuclides, surface contamination.

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