ABSTRACT

The treatment of low level radioactive liquid wastes containing caesium-137, cobalt-60 or europium-(152+154) that arises from the different applications of nuclear energy was established using certain industrial solid wastes: homra (H), fly ash (F.A), silica fume (S.F), ceramic (C) and window glass (W.G) as sorbents. The study showed that, the industrial solid wastes used, could remove these radioactive cations from their solutions. The enough time for complete sorption was found 40 min. Homra gave the highest uptake values with all investigated radioactive cations due to its high surface area. The uptake values were in the range 93.1 - 99.1% for Eu^{3+}, 85.9 - 94.2% for Co^{2+} and 56.8 - 93.1% for Cs^{+} with the experimented industrial solid wastes. The sorption order of the investigated radioactive cations came with their cationic charge $Eu^{3+} > Co^{2+} > CS^{+}$.

The sorption process was found to increase around the alkaline medium and to decrease in the acidic medium due to 1-1 $^{+}$ competition. The sorption process of Cs^{+} and Co^{2+} increased by increasing the particle size of the investigated industrial solid waste, which was not found with Eu^{3+} due to its smallest ionic size. The sorption process of Cs+ and Co^{2+} also increased by increasing the solid weight, which was not found also with Eu^{3+} due to its smallest ionic size .

The study also covered the fixation of the investigated cations after their treatment using the industrial solid wastes: homra, fly ash, silica fume, ceramic and window glass mixed with ordinary portland cement (OPC) and evaluating the change in certain physical, mechanical and

chemical properties of each solidified waste form. It was concluded that, the addition of such industrial solid wastes to OPC improved its initial and final setting times, its bleeding capacity and compressive strength due to the formation of additional amount of calcium silicate and aluminosilicate hydrates.

Cement mixed pastes also reduced the amount of radioactive cations that leached (leachability of the studied radioactive cations from the solidified forms). This could be attributed to that all solids added materials (pozzolanic materials) contain silica and alumina which react with calcium hydroxide (lime) that produced during the hydration of cement to form calcium silicates which reduce the movement and diffusion of the radionuclides from the immobilized waste forms.

The cumulative fractions of the solidified waste forms were arranged in the following sequence:

OPC > (OPC+S.F) > (OPC+F.A) > (OPC+C) > (OPC+H) > (OPC+W.G) due to the respective properties of each solidified form.