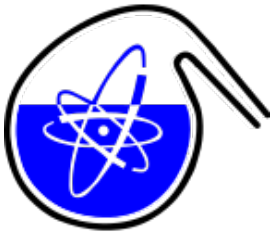

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Separation and determination of molybdenum-93 in concrete and steel leachate and other waste from nuclear power plants

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Molybdenum-93 (T½ = (4.0±0.8)·103 years) is significant long-lived radionuclide contained in the treatment of nuclear waste. 93Mo is formed when a molybdenum rich material is exposed to thermal radiation, especially by neutron capture by 92Mo. Molybdenum occurs as an impurity e.g., in steels in the core area, in the coolant, etc.
Several studies were published with procedures of separation of molybdenum in a simple matrix such as water, but only few of them studied more complex matrices as concrete or steel which are the main components in decommissioning of nuclear power plant. The aim of this study was to develop a procedure to separate molybdenum from concrete and steel leachate and other radioactive waste. There is no possibility to obtain a reference material containing 93Mo. That's why simulated samples were prepared. They were composed of three parts, the first part contained the matrix itself i.e., a pure water, or a leachate of concrete or steel, the second part contained a liquid radioactive waste (concentrate) containing high activity of 14C, 54Mn, 60Co, 63Ni, 90Sr, 134Cs, 137Cs and the third part was addition of known amount of natural Mo tracer.
Only two methods achieved satisfactory results i.e., high radiochemical purity and high separation yield. The first method is based on ion exchange chromatography, where is the first step separation on anion exchange resin and the second step is separation on Aliquat 336 based resin. The second method is based on extraction, where molybdenum is extracted from the aqueous phase by a complex with alpha-benzoin oxime into the organic phase of chloroform. The last step for both methods is gravimetric determination by precipitation of lead molybdate which leads to 75% yield in average for first method for concrete and 85% for steel and 90% for pure concentrate, and 85% for second method in average for concrete and 90% for steel and 95% for pure concentrate respectively. Prepared samples on a thin layer on filter were measured by low energy gamma ray spectrometry. 93Mo has two emission lines at 16.5 keV (62% emission yield) and 18.6 keV (9% emission yield). All prepared samples were radiochemically pure, which was one of the aims of this work.

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