Isolation and quantification of a $^{93}$Mo isotope solution from proton irradiated niobium - DTU Orbit (08/08/2019)

$^{93}$Mo ($4000$ y half-life) formed through the $^{93}$Nb(p,n)$^{93}$Mo reaction was isolated from a niobium target foil previously used in a low energy medical cyclotron. $^{93}$Mo has identical characteristic x-ray emission and mass as the isomer $^{93m}$Nb and stable Nb present in the target foil at much higher concentrations. This makes distinction between $^{93m}$Mo, $^{93m}$Nb and stable Nb difficult using radiometric or mass spectrometric methods. An anion exchange method in combination with x-ray spectrometry and ICP-MS/OES enabled quantitative isolation of about $0.4 \mu g$ $^{93m}$Mo ($14$ kBq) from $^{93m}$Nb with a separation factor $>10^4$ on a single column. An extraction chromatography column (TEVA) was used to reach an $^{93m}$Nb/$^{93}$Mo activity ratio of $<10^{-6}$ and an atom ratio $^{93m}$Nb/$^{93}$Mo $<1\%$ making the $^{93}$Mo suitable for both radiometric and mass spectrometric testing. $^{93}$Mo is the only radioisotope of molybdenum with a long enough half-life suitable for this purpose. Calibration of the $^{93}$Mo isotope solution was done through x-ray spectrometry using a characterized BEGe-detector in combination with a $^{99m}$Tc solution. This is the first reported isolation of a $^{93}$Mo solution in the literature and the first time a LSC spectrum of $^{93}$Mo is shown.

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