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# Determination of <sup>210</sup>Po and uranium in high salinity water samples

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Among of the naturally occurring radionuclides in the different types of water the long lived uranium isotope <sup>238</sup>U, two radium isotopes: <sup>228</sup>Ra, <sup>226</sup>Ra, and <sup>210</sup>Po are of practical importance due to their radiotoxicity. The observed levels of these radionuclides in underground water depend on the chemical compositions of the adjacent geological formation. Under favourable conditions, for example in the presence of chloride and bicarbonate anions, solubility of mineral rock components including trace amounts of radionuclides increases. A role of the underground water supplying systems including geothermal water is recently rapidly growing as they are used not only for energetic, balneological or recreational purposes but as well as a source of drinking water that should be in accordance with EU Directive 98/83/EC and WHO recommendation.
The aim of these study was to elaborate a fast and efficient method for simultaneous determination of uranium and <sup>210</sup>Po in high salinity water samples.
<sup>210</sup>Po and uranium radionuclides were preconcentrated from 0.5 dm<sup>3</sup> saline media by co-precipitation with hydrated MnO<sub>2</sub>, followed by dissolution of the precipitate in 200 ml of 1 M HCl. Uranium radionuclides can be directly determined by ICP MS method, using part of this solution because the total salinity decreases below 1 g/dm<sup>3</sup>. From the second part of solution, before <sup>210</sup>Po separation for liquid scintillation counting, majority of naturally occurring α-emitting radionuclides (uranium, thorium and protactinium) are stripped by extraction with 50 % solution of HDEHP in toluene. Finally <sup>210</sup>Po is simply separated from other interfering nuclides by direct transfer to an extractive scintillator containing 5 % of trioctylphosphine oxide (TOPO) in Ultima Gold F cocktail and determined by a α/β separation liquid scintillation technique. The detection limits are <1 mBq/dm<sup>3</sup> for <sup>210</sup>Po and 0.01 ppb for <sup>238</sup>U.
Quality assurance of the worked out method was checked out in two ways:
1) participation in the IAEA interlaboratory studies (see Table 1) for <sup>210</sup>Po determination in water samples
2) determination of uranium and <sup>210</sup>Po in Standard Reference Material IAEA-381 –Irish Sea water. Uranium recovery for these samples was in the range 0.88±0.05. <sup>210</sup>Po activity is not reported for this SRM, therefore its activity determined by elaborated method was compared with that obtained by direct <sup>210</sup>Po deposition on silver discs and α spectrometry counting. These two methods gave practically the same value 30.5±2.3 mBq/dm<sup>3</sup> and 30.0±3.0 mBq/dm<sup>3</sup>, respectively.
Table 1 Results (in Bq/kg) of interlaboratory studies <sup>210</sup>Po in acidified water
Sample IAEA value IAEA unc. Measured value Measured unc. Measured/IAEA
1 52.8 1.4 52.0 0.6 0.99
2 101.6 2.8 95.3 1 0.94
3 52.8 1.4 52.1 0.7 0.99
4 101.6 2.8 99.3 1 0.98
5 blank - 0.3 0.03 -

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