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Accelerator mass spectrometry of uranium: titanium dioxide matrix and homogeneous precipitation

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In the environmental studies the determination of low concentrations has always been a key issue and therefore, the concentration step is usually a crucial part of the sample processing. For the extraction of uranium, sorption materials based on titanium dioxides have been proposed and studied for years with promising results. Implementing titanium dioxide materials as a sorption material and as a target matrix into classic methods of sample preparations for ?

$^{236}\text{U}/^{238}\text{U}$ measurements using Accelerator Mass Spectrometry (AMS) would mean a significant reduction of separation steps in procedures and big simplification of the whole method.

This research focused on the uranium separation by homogenous precipitation using tetra-n-butylorthotitanate as a precursor of titanium dioxide and on the potential of titanium dioxide as the AMS target matrix. In order to optimize this method, the experiments with different uranium concentration and amount of TBOT were performed. Last experiments were dedicated for AMS measurements to observe the behaviour of TiO_2 based matrix in $^{236}\text{U}/^{238}\text{U}$ measurements using in-house standard Vienna-KkU with $^{236}\text{U}/^{238}\text{U}$ isotopic ratio of $(6.1 \pm 0.4) \times 10^{-11}$. The isotopic ratio of $^{236}\text{U}/^{238}\text{U}$ in the sample containing uranium from in-house standard and titanium dioxide was calculated as $(6.16 \pm 0.04) \times 10^{-11}$ which is in very good agreement with the value of the standard. This means that the titanium dioxide based matrix does not influence the measurement of $^{236}\text{U}/^{238}\text{U}$ isotopic ratio and is suitable for AMS targets. In addition, it was proved that tetra-n-butylorthotitanate contains no anthropogenic ^{236}U and therefore, can be used in the preparation methods of AMS targets from environmental samples.

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