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Improve Determination of ^{99}Tc in Environmental Samples by ICP-MS using TRU® Resin

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Technetium-99 (^{99}Tc) is one of the most important fission products of ^{235}U (~6% yield). It is a long lived radioisotope ($2.11X10^5$ years half-life), which decays by emiting beta radiation. ^{99}Tc is of environmental concern because it is very mobile in the environment as Tc(VII) (TcO_4^-) and can be bio-accumulated in some plants and animals. ^{99}Tc can be measured by ICP-MS, but ruthenium (Ru) ($^{99}Ru^+$) and molybdenum (Mo) ($^{98}Mo^1H^+$) interfere and have to be chemically removed. ^{99}Tc is frequently purified from these interferents using an anion exchange or TEVA® resin. The main issue regarding these resins is that ^{99}Tc is eluted with a high acid concentration solution, which cannot be directly introduced into an ICP-MS without causing corrosion issues. The acid solution has to be evaporated, but Tc(VII) is partially volatile in acidic solutions. Also, there is no adequate long-lived Tc isotope that could be used as a tracer to correct the recovery losses.

We have demonstrated that ^{99}Tc can be rapidly and selectively extracted on a TRU resin. It can be easily eluted from the resin using near boiling water, a solvent compatible with ICP-MS instrument. Rhenium (VII) (Re) has a similar chemical behavior to Tc(VII) on the resin in some conditions and can be used as a recovery tracer. Ru and Mo interferents can be removed effectively. A method was developed to determine ^{99}Tc in environmental waters. ^{99}Tc was pre-concentrated from a 1 L water sample using an anion exchange resin and then purified with a TRU® resin. There was no heating step for this method.

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