**Validation of a method for the determination of 99Tc in environmental samples** **using TK-TcScint resin**

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1. Introduction

99Tc is a beta emitter and one of the most significant 235U fission products, since the reaction yield with thermal neutrons is 6 % and its period is 211.5 · 103 years. Therefore, it is under control in the environmental compartments around nuclear power plants (NPPs), undergoing operation or decommissioning, as it is one of the most common isotopes in the radioactive inventory of NPPs.

Thus, this work deals with the validation of a procedure for the determination of 99Tc activity in solid and liquid environmental samples using TK-TcScint resin, focusing on the assessment of the linearity, accuracy, precision and reproducibility with different concentrations of 99Tc activity. In addition, the chemical recovery, detection efficiency, background, overall uncertainty, detection limit (DL) – as a function of mass and measurement time – and specificity are analysed.

2. Material and methods

For the validation of the 99Tc method, two sets of 5 water samples were prepared with an activity concentration between 10 and 100 times the expected DL and treated according to the following steps: addition of a few mL of 30 % H2O2, heating to 90 °C for 1 hour, adjustment to 0.1M HCl and loading in the cartridge containing TK-TcScint resin at 1 mL min-1.

Then, the cartridges were placed into polyethylene vials and measured by the Quantulus 1220 Ultra Low Level Liquid Scintillation Spectrometer from Revvity for 3 hours and the C-14 protocol.

Once the validation samples were measured, the linearity, accuracy, precision and reproducibility of the results were assessed; and the uncertainties and achievable DL were established.

A 99Tc standard solution is used to obtain the detection efficiency and a traced sample to obtain the overall efficiency and the chemical recovery.

Finally, the specificity was analysed by environmental solid samples from some intercomparisons, containing other radionuclides and varying amounts of 99Tc.

3. Results and discussion

The accuracy has been assessed using a t-test, confirming no significant differences between added and measured activity. The results are reproducible, since the dispersion between the mean and partial results is less than 15 %, and overlapping uncertainty bands are observed.

The linear character of the method is consistent, and the DL values are of the order of 0.08 Bq kg-1, for 0.1 L of liquid samples and sample and blank measurement times of 3 and 12 hours, respectively.

Regarding the spectral interferences, they are affordable by the window narrowing or deconvolution.