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Determination of Strontium Radionuclide Using Flow-Injection Analysis with ICP-MS Detection

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Flow analysis is considered an efficient and universal technique of analytical science. Its wide range of advantages as compared to other known techniques is the argument for its increasing use. Thus, there may be distinguished a simple apparatus construction, which provides low sample use, together with an opportunity to implement many measurement concepts which are not always possible to achieve with common laboratory methods. Generally, this is understood as a variety of system constructions which are adapted to the analysts' ideas and can assure that a sample in the flow is processed chemically i.e. by derivatization, even by multistage reactions, and also physically, for example by sample preconcentration. Another facility of the flow analysis is its automation ability, which means a full control over the fluid flow, its volumes, flow rates and timing.

The main objective of the study is to develop and apply flow systems based on MSFIA - LOV (Multi-syringe flow injection analysis—Lab-on-Valve) to radioanalysis of strontium-90 in reactor coolant samples. The initial stage of research is to optimize the method of mechanized processing of samples. What is worth to remark, is that the construction of the system has been miniaturized enough to allow all the processes of sample preparation to take place in a several centimeters big reaction valve (LOV). The analytical procedure included a couple of stages—firstly, the column in the LOV was loaded with Sr-resinTM and conditioned. In the further stages, a sample was injected and its proceeding—the separation and concentration—took place in the LOV. The proposed analytical procedure included also the elimination of interferences from the elements disturbing detection (with similar affinity to Sr-resin i.e. Ba and isobaric interferences of ⁹⁰Sr) as well as from the elements present in the coolant (boric acid). The optimization of the process included: selection of the solution and its volume to elute the retained strontium on a column with Sr-resin, the selection and optimization of the solution volume for the elution of interfering elements. The results of optimization were checked by using inductively coupled plasma mass spectrometry (ICP MS).

The wide scale of implementation of this technique to monitoring and determination of radionuclides is a promising idea especially for continuous monitoring of radionuclides in the reactor coolant.

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