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Progress and Status of Radioanalytical Chemistry of Radionuclides

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In the studies of radioecology, investigation of environmental radioactivity and environmental processes using radionuclide tracer, as well as characterisation of nuclear waste for decommissioning of nuclear facilities and depository of radioactive waste, nuclear forensics and geological dating using radioisotopes, the key issue is to accurate determination of concentration of various radionuclides and their speciation in different environmental, biological and geological materials. Radioanalytical chemistry therefore plays a central and critical role in these works. Since the discovery of radioactivity a century ago, many separation and detection methods have been developed and successfully applied in the determination of various radionuclides. With the development of new separation and detection techniques, significant improvement of the traditional analytical techniques, as well as the increased requirement for the knowledge and information on the speciation of radionuclides, a significant development on radioanalytical chemistry has been achieved in the past decade, this mainly focus on three aspects including the synthesis and commercialization of various extraction chromatographic resins and application of them in the separation of specific radionuclide or groups of radionuclides; sensitive detection of long-lived radionuclides using mass spectrometric techniques including ICP-MS and accelerator mass spectrometry; development of various approaches for rapid determination of radionuclides of difficult to measure in order to quick responses in the emergency preparedness and analysis of large numbers of samples for decommissioning of nuclear facilities.

In the past years, our laboratory has developed a series of radiochemical analytical methods aiming at characterization of various decommissioning waste; improved our traditional analytical methods for determination long-lived radionuclides in the environment focusing on improving the detection limit, automation of analytical operation, and rapid determination; developed many analytical methods for speciation analysis of various radionuclides in environmental and biological samples for radioecology researches, and developed and applied mass spectrometric methods for rapid and sensitive determination of long-lived radionuclides. This presentation gives an overview of these analytical methods, mainly on the present status, progress and perspectives.

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