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Rapid radiochemical analysis using membrane-adsorption method

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A rapid chromatographic method of radiochemical analysis based on adsorption of radionuclides onto selective pellet sorbents is successfully used for rapidly determining gamma-emitting radionuclides in water [1]. The paper presents a membrane-adsorption method for rapid determination of a- and β-emitting radionuclides. Like the above analysis for gamma-emitters, the proposed method separates individual radionuclides or radionuclide groups from water samples and produces radiation emitters for measuring activity of extracted radionuclides.

The difference is in that sorbent pellets which have large self-absorption of a- and β radiation are replaced by planar sorbent geometries with minimum self-absorption. Porous membranes modified by addition of sorbents with selective adsorbing ability are offered as planar alternatives to pellets. To remove radionuclides on suspended matter from NPP water, the analysis scheme with selective adsorption membranes additionally includes microfiltration membranes as "mechanical"filters. A cellulose acetate membrane with pore size of 0.45 μm is used for mechanical filtration by analogy with separation of suspended and "conditionally dissolved" forms of heavy metals from natural water samples.

Three types of modified adsorption membranes are suggested for use in radiochemical analyses for nuclear applications. These membranes differ in type of modifier: 1) membranes impregnated with elementary silver, 2) membranes impregnated with potassium ferrocyanide or cobalt ferrocyanide, and 3) membranes impregnated with manganese hydroxide. A cellulose acetate membrane with pore size of (0.65 –0.75) μm is preferably used as solid substrate for all three membrane types. The first type membranes are suited for selective separation of radioiodines and Po-210. The total activity of radioiodines is determined by measurement of β-radiation and Po-210 activity is determined by measurement of a-radiation. The second type membranes selectively remove radiocesium from water flows where salt concentration can reach the level of seawater salt concentration. The total radiocesium activity is determined by measurement of β-radiation. The third type membranes adsorb Pu, Am, and Cm from the coolant water and the activity of these radionuclides is determined by measuring the spectrum of a-radiation from the adsorption membrane.

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