DETECTION OF ^{40}K CONTENT IN NATURAL WATERS BY SCINTILLATION METHODS

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At present determination of natural radionuclide content in natural waters is one of the important problems. The ^{40}K is a basic contributor to natural gamma-ray activity of natural objects Gamma-ray spectrometers having large volume semiconductor detectors with a high energy resolution ensure the highest accuracy and sensitivity for detecting natural radionuclide content in samples. However, a wide use of them is limited by their high cost.

Taking into account that gamma-ray spectra of natural radioactivity have easy resolvable E=1461 keV photopeak of ^{40}K and a low resolution of the scintillation detectors can be partly compensated by their high detecting efficiency we have developed the scintillation method to detect content of ^{40}K in water samples.

Low natural radioactivity of natural samples causes principal difficulties for their analysis and for such measurements it is necessary to use massive samples to properly subtract background. A measured sample spectrum. $R=P+K_pf+\varphi$, besides the sample spectrum itself, P, has contributions of background radiation incident on a detector surface through the sample, f, (K_p – coefficient of absorption in the sample), of detector radiation itself and background radiation incident on a detector surface passing the sample, φ The contributions of K_f and φ can be determined making measurements of "inactive" sample (with very low activity, $P_0=0$), $R_0=k_p+\varphi$. Then spectrum of the analyzed sample can be found as a spectra difference, $P=R-R_0$ It is obvious that measuring accuracy of the P depends on radiation contribution intensities, K_pf and φ, in the measured spectrum R. Background radiation can be significantly reduced if the detector will be placed into a lead shield. In this case measurement accuracy of the P will depend on detector and a shield radioactivity.

In our investigations we used the scintillation detector having NaJ(Tl) d63x63mm crystal and photomultiplier placed into the lead shield with thickness of 20 cm To graduate the spectrometer we used chemically pure salt solutions of KCl poured in Marinelly's vessels of 1 litter. Water, in which K content was less then 8 μg/l, was used as an "inactive" sample.

The measured spectra areas of ^{40}K are presented in table The lead shield should reduce external background more than 10^4, but in our case it was reduced by 38 times only It is obvious that residual background was due to own radioactivity of the detector and shield. ^{40}K gamma-ray detecting efficiency defined on KCl solutions spectra taking into account quantum output of ^{40}K was $6,8x10^3$. A photopeak of the "inactive" sample spectrum was used

to evaluate background. In this case, $3NN_{background}$ criterion spectrometer accuracy was 0.18g of KCl or 2.9 Bk of ^{40}K.

Table

The 1461 keV photopeak intensity of ^{40}K in sample spectra (pulses/day)

The measurement without shield and without sample	The measurement with shield				
	without sample	with an "inactive" sample	0 25g KCl.	0.5g KCl	1.0g KCl
727980	19779	19180	197750	20276	2144

EXPLOITATION OF SORPTION VERSION OF FAULT SOLUTION PURIFICATION

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We studied many factors impacting upon the state of radio-nuclide (RN) extraction from the liquid radioactive solution (LRS) containing complex ions, Surface-Active-Substances (SAS) and Turbine Oils. We found the optimal concentration of absorbed complex ions and radio-nuclides, the condition of destruction KM_nO_4 and sorbing side by the complex ions.

The method was tested under the laboratory conditions for extraction of some quantity of RN from LRS and conversion of RN into solid waste for burying.

The efficiency of purification of LRS from RN by the designed method is equal to 99 3% per operation. The application of the sorption method of purification LRS from RN enables to decrease the volume of SAS waste and conversion of LRS into solid waste to protect better the environment from radioactive waste