

To reduce disturbing influence of these elements, the sorbents after passing solutions through them, were washed out by alkali. It was shown that at washing out by 1 - 5 % solution NaOH J concentration on the sorbent did not change, but disturbing galloids Na, Cl, Br were washed out to 50 - 60 %, that improves the ratio of signal/background and, respectively, sensitivity of determination.

Determination of iodine concentration is conducted by the relative method using two ways.

In the first way analyzed samples and standard solution with known concentration of iodine are passed through identical microcolumns with the sorbent. After sorption fixed weight sorbents are irradiated (together) and measured. After making the measurements condition equal (entering the corrections for decay), intensities of J^{128} lines in measured samples S_x and S_{st} give a correlation of concentrations of iodine in analyzed and standard solutions.

In the second way only sorption of analyzed samples is conducted and sorbent is irradiated with the dry iodine standard sample of certain weight.

The first way is simple and does not require knowledge and account of sorption degree and can be recommended for single-analyses. The second way is more convenient because it excludes the sorption standard solution, however requires experimental finding of correspondence coefficient between effects from standard solution S_{st} and dry weight of iodine standard sample S_{st}' . This coefficient includes the difference in amount of iodine in both standards, degree of sorption of iodine in the sorbent, as well as geometric factor. Given way is more convenient for performing mass analysis.

Investigations have shown that in described above conditions of analysis a limit iodine determination in hydrogeological samples is 0,1 mg/l that meets the production requirements with the spare.

Investigations are carried out for development of the methods for elemental analysis of intermediate products of iodine production, using additionally adjacent methods. Preliminary results show possibility of determination of Cr, Mn, Fe, Ni, Cu, Zn in the iodine paste which are the main admixtures.



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COMPLEX OF INSTALLATIONS FOR THE X-RAY EMISSION ANALYSIS WITH RADIONUCLIDE SOURCES

G.R.Alimov, Ya.M.Boltaev, S.Kalanov, D.Sh.Rashidova, I.Kholbaev

Institute of Applied Physics at Tashkent State University, Uzbekistan

X-ray emission analysis by excitation of X-ray radiation elements with the help of radionuclide sources is the most accessible and widespread methods to determine element structure of substance in the solution of the different analytical tasks. The broad distribution of this method is stipulated by a simplicity of excitation and analysis of spectra of the X-radiation elements, a simplicity of sample's preparation, a undestroyed kind of the analysis,

express (10^{-2} - 10^{-3} sec) of realization of the multi element analysis in a broad band of their concentration ($\sim 10^{-6} \div 1,0$ gr/gr), a compactness of installation, its low cost and so forth. Principles and areas of the method's use, its varieties, construction of installations, methodical problems of measurements and processing of outcomes are explicitly considered in a large number of the publications.

In the given work, there is described the developed and created complex of installations of the X-ray emission analysis with:

- direct excitation of X-ray radiation elements of the sample by radionuclide gamma radiation;
- two-stage excitation of X-ray radiation elements of the sample by a secondary radiation generated by radionuclides in intermediate targets;
- excitation of X-ray radiation elements of the sample by alpha particles of radionuclide sources.

First two installations intended for the analysis of the "thick" samples, and third one for the analysis of thin samples (films, covers, skin layers and so forth).

Depended on a character of an analytical task, radionuclide sources as ^{59}Fe , ^{109}Cd , ^{241}Am and ^{210}Po were used in the system of the excitation of the X-ray radiation elements.

For the registration of X-ray radiation elements, excited in the sample, Si(Li) detector was used with sensitive surface ~ 25 mm² and thickness ~ 5 mm. The entrance window of detector made of beryllium with: thickness 25 μkm , energetic resolution 290 eV on the line Mn K_{α} . Registration, accumulation and processing of spectra we performed on multi channel analysers LP-4900 and NTA-1024 with built-in mini computer.

In the systems of direct and two-stage excitation are foreseen the simultaneous installations up to four of the same type radionuclide sources (through 90° on the distance 15 mm from axis of the system's symmetry). The tanks of systems made of lead to provide the protection of detector from direct rays of radionuclide sources and from secondary radiation of the intermediate targets as well as for the radiation safety of personnel. In the definite cases for the suppression of Pb lines generating in the tanks of materials, the internal surface of coming out collimators of systems are reveted with layers of copper, iron and aluminium foils.

To install the optimal sizes of direct excitation system of X-ray radiation elements, ratio S_p/S_f are investigated, where S_p and S_f are intensities of photopeak and background respectively, for the Zr K_{α} line, which is excited by ^{241}Am radiation in the measurement standard SP-1 on the distance h "sample-detector" and diameter d of coming out collimator of the system. The maximal ratio of S_p/S_f corresponds to values $h=24$ mm and $d=6$ mm that have been chosen for the work sizes of direct excitation and two-stage excitation systems of the X-ray radiation elements. As intermediate targets in systems of two-stage excitation of X-ray radiation elements were used a metal foil of zirconium and cadmium, and substrate of barium oxide.

Determination of the concentrations - C_{sp} of elements in the sample is performed by relative way - comparison of intensities lines in the spectra of X-ray radiation elements of the sample s_{sp} and appropriate to it on material structure of a standard sample with the known contents C_{st} of the analyzed elements (in the assumption that conditions of excitation of X-ray

radiation elements of the standard and sample are identical). In the cases when the selection of the appropriate standard is not obviously possible, the technique of components is used. This technique represents itself the comparison of intensities of analytical lines in the spectra of sample s_{sp} and in the spectra of sample s_a with additional component of the certain amount "a", which is the analyzed element. The method of corrective action on difference between effective nuclear numbers z_{eff} of the analysed sample and standard sample is also used in this case.

The most important condition for authentic determination of the concentration of the element in the sample, is allocation of the pure intensity of line of the element in the spectra of X-ray radiation elements. For this purpose, the correct account of the contributions of background and a probable superposition of adjacent lines is necessary. For processing spectra of X-ray radiation elements, the program that developed for the mini computer of multi channel analyser LP-4900 is used by us. Input data for the program that recorded in memory of the analyzer are the spectrum of X-ray radiation elements and the data of the analyzed range of spectrum, number and multiplicity of its spectra lines, relative intensities of multiples, half-width and positions of centers gravity lines. A background is depicted by straightforward line $Y(x)=a+bx$, where a and b are defined by program or are entered as input data.

The outcomes of spectra's processing are deduced as the values of amplitudes, squares of lines of each element, parameters of background and residual sums of squares of the weighed deviations of calculated spectrum from measured. The evaluation of a degree corresponding calculated spectrum to measured one can be made and their visual comparison can be displayed on a screen. The check of precision and reproducibility of outcomes on the installations of X-ray radiation elements with direct and two-stage excitation are performed by using three soil and plant samples from which were made by eight parallel samples. The outcomes obtained from the analysis of spectra of parallel samples have allowed us to conclude at dependence on the concentration of elements in samples their definition are changed in the range from 3% to 20%.

Thus the created complex of installations of X-ray radiation elements allows us to select the optimal regime of X-ray radiation elements and to determine the contents of elements in samples up to 10^{-5} g/g with precision not worse than 20% in plant, soil and other samples.

FACILITY FOR STUDY OF THERMAL NEUTRON CAPTURE GAMMA - RAYS SPECTRA

G.A.Aripov, B.I.Kurbanov



UZ9901254

Institute of Nuclear Physics, Uzbekistan Academy of Sciences, Tashkent

The device for study of thermal neutron capture gamma-rays spectra using ^{252}Cf neutron source which allows one to measure both low energy ($E_{\gamma} < 3\text{MeV}$) and high energy ($E_{\gamma} > 3\text{MeV}$) gamma-radiation has been developed.