УДК 544.77

THE METHOD OF TURBIDITY SPECTRUM IN DETERMINING THE SIZE AND NUMBER OF THE PARTICLES OF SILVER IODIDE SOLS

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The method of turbidity spectrum has been used to determine the average particle size (r, nm) and the numerical concentration of particles of silver iodide sols. The optimal concentration of potassium iodide and silver nitrate solutions which comprises 0.01 mol/l has been defined as well as the volume proportion equal to 10:7 (at obtaining sols with negatively charged micelles) or 7:10 (at obtaining sols with positively charged micelles), which makes it possibly to produce small sized particles included in the interval of true colloidal systems at their highest quality.

Keywords: *lyophobic sol, turbidity spectrum, silver iodide.*

At preset the ultradisperse systems in the form of colloidal solutions, powders and nanocomposites are widely used in various fields of science and technology such as medicine, nanoelectronics, environmental protection and so on [1]. One of the most important problems which face the investigations producing disperse systems with micro – and nanosized particles of the disperse phase is the estimation of the size and numerical concentration of the obtained particles [2].

The present paper has the aim to determine the effect of the size and numerical concentration of positively and negatively charged micelles of silver iodide sols at different concentration of initial solutions of potassium iodide and silver nitrate and their volume proportion by the turbidity spectrum method. Colloidal solutions of silver iodide have been chosen as investigation object due to their use in medicine as a highly effected anticeptic agent [3], in the production of cinema and photomaterials, in weather control and so on.

Experimental

Positively charged micelles of AgI (AgI-1) sol were obtained by mixing the excess of 0.001–0.02 mol/l solutions of silver nitrate with 0.001–0.02 mol/l solution of potassium iodide in different volume proportions, negatively charged sol micelles – by mixing the excess of 0.001–0.02 mol/l solutions of potassium iodide with 0.001–0.02 mol/l solutions of silver nitrate in different volume proportions.

The optical density of AgI-1 and AgI-2 sols was measured on the concentration photocolorimeter KFK-2MP in the wave length range of λ=400–750 nm at t=25 °C.

To determine the average particle size (r, nm) and numerical concentration (N, cm–3) of the particles of AgI sols the method of turbidity spectrum has been used [4]. The analysis of turbidity (τ, cm–1) was conducted by the formula: τ= 2.3Dav/ld, were ld is the length of the dish, cm.

The size and numerical concentration of particles were calculated by the formula:

$$r = a\lambda av/2\pi\mu 1; \ N = \frac{1.26\cdot 10^{17}\cdot\tau}{(\lambda')^2\cdot K\cdot\alpha^2},$$

were μ1 is the index of disperse medium refraction; λ1= λav/μ1, A0 is the length of the light weave in the solution which is represented by the average value of the used wave length range divided by the index of disperse medium refraction; α and K are characteristic functions of light scattering.

Results and discussion

The advantage of the turbidity spectrum method at determining the characteristics of particles of the disperse phase of with sols are expressivity, the absence of complex instrumentation and the possibility of calculating the particles size, their numerical concentration and, respectively the total surface area.

The investigation of the dependence of turbidity of the studied silver iodide colloidal solutions on the disperse phase concentration demonstrated its rise at increasing the disperse phase concentration, which may be due to both the growth of particle size and the increase of their number. Actually, in the case of producing silver iodide sols with positively charged micelles at increasing the concentration of potassium iodide and silver nitrate initial solutions from 0.001 mol/l to 0.02 mol/l and at changed their volume proportion from 10:0.1 to 10:7 there is observed the growth of the particle size from 40 nm to 500 nm. For sols with negatively charged micelles the dependence of the particle size on disperse phase concentration is of the similar type. In the case of determining the particles number it has been established that both at low (up to 0.0004 mol/l) and at high enough (0.004–0.008 mol/l) concentration of the disperse phase the numerical concentration of particles doesn't exceed 10IIcm–3, while at disperse phase concentration of 0.004 mol/l corresponding to the concentration of initial solutions of potassium iodide and silver nitrate of 0.01 mol/l and to their volume proportion of 10:7 or 7:10 the numerical concentration of particles is an order of magnitude higher.

Hence, at producing silver iodide sols the optimal concentration of potassium iodide and silver nitrate comprising 0.01 mol/l has been defined as well as the volume proportion equal to 10:7 or 7:10. These parameters result in obtaining particles small size included in the interval of true colloidal systems at their highest numerical concentration.

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Received 02.03.2016.