ADSORPTION OF LANTHANUM BY SOLID SOLUTIONS OF FATTY ACIDS IN PARAFFIN

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Today rare earth metals are rightfully considered a very scarce commodlty on international markets. Therefore, the active search for alternative channels for the extraction of rare earth metals is one of the main tasks for all the leading states of the world today. There are prospects in this direction in Ukraine. One of the sources of such metals is technological waste from metallurgical and other enterprises, as well as dumps of coal mines, where there are a lot of scarce elements - scandium, niobium, lanthanum, etc.

Practice shows that a part of the rare earth elements is lost during the processmg of ores containing rare-earth metals that enter sewage and can be contained therein in an amount of 50 ÷ 100 mg/dm^3. Therefore, the separation of rare-earth elements, in particular lanthanum, froin wastewater as a valuable component is an urgent task.

Below are the results of studies aimed at studying the patterns of adsorption of lanthanum by the surface of finely dispersed solid solutions of fatty (caprylic, lauric and myristic) acids in paraffin.

The subjects of the study were diluted aqueous solutions of lanthanum chloride containing 10 to 100 mg of metal in 1 dm3 ((0.72 ÷ 7.19)·10^{-4} mol/dm^3) and having pH = 3. As adsorbents of lanthanum compounds, a 1% aqueous suspension of 0.3 molar solid solutions of fatty acids (FA) in paraffin was used. Dispersing of solid solutions of FA in paraffin was carried out with ultrasonic disperser UZG13 - 01/22 with an operating frequency of 22 kHz striker for 5 minutes.

The carried out investigations showed that finely dispersed solid solutions of FA in paraffin are sufficiently effective adsorbents of lanthanum ions from aqueous solutions with different pH values (their adsorption capacity for lanthanum reaches 1.5 mmol/g).

The kinetics of adsorption of lanthanum ions by solid solutions of capric, lauric and myristic acids in paraffin is described by an equation analogous to the first-order equation.

$$\ln \frac{C_0}{C} = kt \quad ,$$

where C_0 is the initial concentration of lanthanum ions in solution, corresponding to the time moment $t = 0$; C is the concentration of lanthanum ions in the solution at the time point t; k is the rate constant of the adsorption process.

It has been experimentally established that the isotherms of adsorption of lanthanum ions by particles of solid solutions of FA in paraffin are complex. According to Giles's classification [1], they can be attributed to L- and S-type isotherms. The type of isotherms indicates the polymolecular character of adsorption, the result of which can be the formation of polymeric forms of surface compounds.

The characteristics of the adsorption process are calculated. The applicability of the Langmuir, Hill-de Boer, BET and Frumkin-Fowler-Guggenheim (FFG) models to adsorption in the systems under investigation is shown.

Also was studied the influence of the pH of the medium and temperature in the range 18-40 °C on the adsorption of lanthanum ions by highly disperse solid solutions of FA in paraffin. It is shown that the value of adsorption increases with increasing temperature, which indicates the chemical nature of adsorption.

Thermodynamic parameters of adsorption are determined. It has been found that the standard differential changes of the Gibbs free energy, enthalpy, and entropy of adsorption of lanthanum ions by highly dispersed FA particles in paraffin lie within the limits of: for the Langmuir model: ΔG_{ads} = - (24.12 ÷ 32.45) kJ/mol, ΔH_{ads} = -25.09 ÷ 5.83 kJ/mol, ΔS_{ads} = 16.86 ÷ 229.60 J/(mol·K); for the FGF model: ΔG_{ads} = - (23.09 ÷ 32.55) kJ/mol, ΔH_{ads} = -13.50 ÷ 54, 27 kJ mol, ΔS_{ads} = -11.28 ÷ 268.42 J/(mol·K).

The adsorption mechanism associated with the formation on the surface of particles of solid solutions of FA in paraffin of middle and basic alkyl carboxylates of lanthanum, confirmed by the results of IR spectroscopy of samples of lanthanum-containing sublates is proposed.

[1] G. Parfitt, and K. Rochester, *Adsorption from Solution at the Solid–Liquid Interface*, 1986, Word, Moscow.