Choosing The Optimum Conditions For The Determination Of Gallium Ion Using Eriochrome Red B Reagent

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ABSTRACT

In recent years, it is necessary to constantly monitor the amount of heavy and toxic metal ions from environmental objects. For this, there is a need for simple and fast methods of determining the metal ions being detected. In this work, work was carried out on the selection of optimal conditions for the determination of gallium ion using the eriochrome red V reagent using the fluorescent method**.**

Keywords: sorption, immobilization, heavy and toxic metal, fluorescence, optimal conditions.

Enter. One of the global problems in today's era of advanced science, technology and production is environmental pollution with various heavy and toxic metals. As a result of the development of production and industry, the amount of anthropogenic impact on the environment has increased significantly. The biogeochemical cycle of lead and zinc ions was disturbed due to the disposal of production waste into the environment. They entered the human body through the food chain and cause various diseases. As a result of this, it is necessary to develop a reliable, express, highly sensitive and selective analytical method for determining and analyzing trace amounts of lead and zinc ions in various objects of the environment.

The research and literature analysis carried out in recent years show that the most suitable for the above requirements is the use of chemical optical sensor devices. In this case, luminescent organic reagents are immobilized on a solid matrix (carrier). The resulting molecule in the optical sensor forms a complex combination with the detected ions. This method is considered relevant due to the fact that it is express, highly selective, resistant to various external influences, and it is possible to visually notice the change [1-4].

Among the organic fluorescent reagents used in the determination of aluminum ion, oxyazobirims are distinguished by their good metrological properties. The available data and the results of the analysis showed that eriochrome red B is a good reagent for the photometric determination of aluminum ion. The structure of the reagent showed that the complex formed by it with aluminum ion can be luminescent. The dissociation constant pK decreases when the organic reagent molecule is

transferred to an excited state, which requires transfer in a more acidic environment. Therefore, there is increasing interest in studying the use of eriochrome red B as a luminescent reagent. For this purpose, by forming a complex of aluminum ion with eriochrome red B, that is, the development of a fluorescent method of their detection was studied.

Preliminary data on the fluorescence reactions of eriochrome red V with aluminum ion were obtained by carrying out qualitative reactions in different media. Complex formation fluorescent reactions were carried out in the medium of organic solvents (acetone, ethanol, DMFA) that activate the radiation intensity of their complexes.

The main part. Reaction method and fluorimetry: 1-2 ml of $1x10^{-3}$ M reagent solution, 1.5-2.0 ml of pH 1-10 buffer, 0.1 ml of metal solution (Sol=1 mg/ml) in a 10 ml test tube is poured. 4-5 ml of organic solvent and distilled water up to the mark are poured. The prepared complex compound solution is irradiated with UV light and luminescence is observed.

Complex formation in the reagent-metal system was studied by drawing curves of dependence of fluorescence intensity on light filter, pH, time, composition of buffer mixture, nature of organic solvent and concentration of organic reagent.

To study the optimal wavelength of the excitation light for the complexation of the aluminum ion with the eriochrome red B reagent, it was carried out using different light filters. The results are presented in Table 1. The table shows that SZS-24-2 is the best light filter for the Al-Re system.

Table 1

Dependence of the fluorescence intensity of aluminum ion complexes with the studied reagent on the light filter

Light filter	**Fluorescence intensity of complexes**
	$Al\text{-}R_э$
SZS-24-2	80
SZS-7-2	55
FS-1-2	15
FS-1	5
MS-13-2	-
BS-8-2	43
BS-8	52
Hg-546	-
Hg-579	40
Hg-366	54

The dependence of the fluorescence intensity of the aluminum ion complex with the eriochrome red B reagent on the nature of the organic solvent was studied. According to the obtained results, it was found that the fluorescence intensity of the complexes formed as a result of the reaction carried out in DMFA solvent environment is at the maximum level (the results are shown in Table 2).

Table 2

Dependence of the fluorescence intensity of aluminum ion complexes with the investigated reagent on the nature of the solvent (in solution)

Solvent	Fluorescence intensity of the complex
	Al-Rэ
Ethanol	36
Acetone	40
DMFA	70
DMSO	50
DMSO+DMFA (1:1)	51
DMFA+Ethanol (1:1)	37
DMFA+Ethanol (1:2)	35
DMFA+Ethanol (1:3)	39
DMFA+Ethanol (1:7)	33
DMSO+Ethanol (1:1)	39
DMSO+Ethanol (1:2)	38
DMSO+Ethanol (1:3)	37

The dependence of the fluorescence intensity of the formed complexes on the solvent concentration was also studied. It was found that the luminescence intensity is maximum when the reaction is carried out in strongly basic (40-60% um) solvents (Fig. 1).

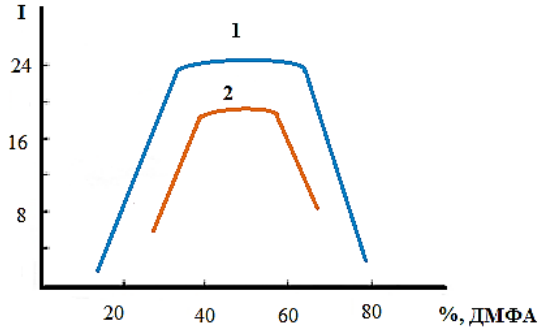

Figure 1. Dependence of complex fluorescence intensity on solvent amount. 1-Al-Re; $C_{Re} = C_{Rm}=1\times10^{-3}$ M; CMe = 1 μg

When the dependence of the luminescence intensity on pH of aluminum ion complexes formed with the investigated reagent was studied (Fig. 2), an increase in intensity was observed in acidic solutions (pH=1-3.5), at the highest level at pH=4-5.3, at 5.5 It remains unchanged at -6.2. If the pH of the solution is increased again, the luminescence intensity decreases sharply.

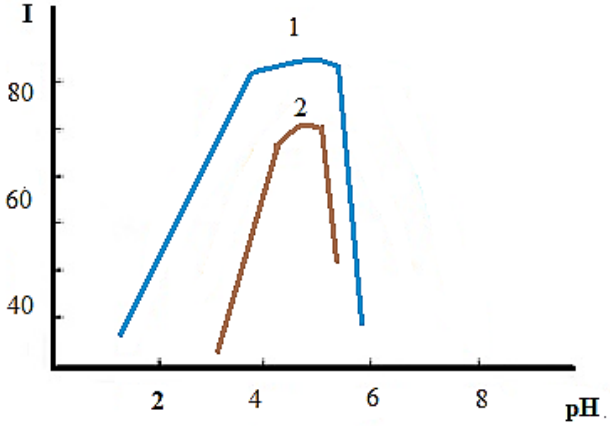

Figure 2. Dependence of complex fluorescence intensity on medium pH.
1-Al-Re; $C_{Re} = C_{Rm} = 1\times10^{-3}$ M; C_{Me} = 1 μg

Figure 3 shows the dependence of the luminescence intensity of aluminum ion complexes with the eriochrome red B reagent on the concentration of the reagent. It can be seen from the figure that the maximum fluorescence intensity of the complex reaches its highest level when the reagent concentration is 2-4 times higher than (0.4-1)x10^{-3} M and then decreases.

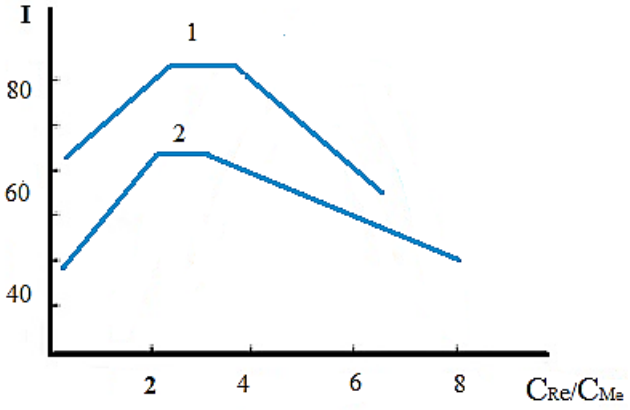

Figure 3. Dependence of complex fluorescence intensity on concentration of organic reagent. 1-Al-Re; $C_{Re} = C_{Rm} = 1\times10^{-3}$ M; CMe = 1 μg

Figure 4 shows the time dependence of the fluorescence intensities of aluminum ion complexes formed with the studied reagent. It can be seen from the picture that the luminescence intensity of aluminum ion complexes with eriochrome red B reagent remains constant for a long time after 5-10 minutes, and the maximum fluorescence intensity is observed.

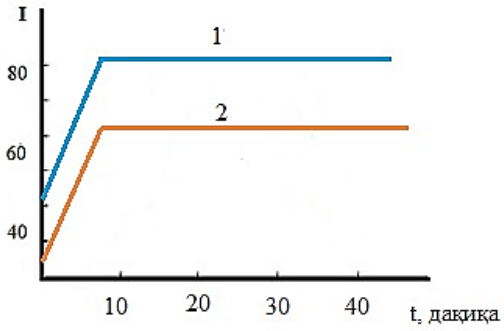

Figure 4. Time dependence of fluorescence intensity of complexes: 1-Al-Re; $C_{Re} = C_{Rm} = 1\times10^{-3}$ M; C_{Me} = 1 μg

The dependence of the fluorescence intensity of the complex on the sequence of injection of reagents was studied. In this case, for the complex of aluminum ion with eriochrome red B, injection in

the order (Me+ reagent + pH + solvent) is considered the most optimal.

The dependence of the fluorescence intensity on the composition of different buffer mixtures was studied. The results show that for aluminum and eriochrome red B complex, maximum intensity is observed when using acetic acid-sodium hydroxide buffer mixture..

Summary. Based on the obtained data, it can be concluded that the complexes of aluminum ion with the eriochrome red B reagent are 40-60% um, pH 4.1-6.1 in DMFA, and the luminescence of the complex formed 5-10 minutes after pouring when the amount of the reagent is 2-4 times excess the intensity will be the brightest. The complex luminesces in the range of 560-590 nm, the range of application is equal to 470-500 nm.

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