Sorption-Photometric Determination Of Nickel And Cobalt Ions In The Industrial Waste Of "Olmaliq Kmk" Jsc Using Diethyl 2,2'-((1,3,4-Thiadiazole-2,5-Diyl) Bis (Sulfandiyl)) Diacetate Organic Reagent

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ABSTRACT

Currently, sorption-photometric methods are widely used in the determination of heavy metals. This method is of great importance due to its sensitivity, simplicity, and less time spent on analysis. Sorption-photometric methods, one of the most modern physical and chemical methods, are widely used. Sorption-photometry is based on measuring the light absorption of colored and colorless solutions in monochromatic light.

Keywords: Sorption-Photometric, heavy metals

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Currently, environmental pollution, the need for clean drinking water is one of the global problems, and year by year the level of pollution of the environment and water bodies continues to grow, which worries the world community. For example, from 1925 to 1986, water mineralization in the Zarafshan River increased from 0,46 g/l to 1,22 g/l. This means that the mineralization of river water increased by 2,2-6,8 times during the incomplete life of one generation [1].

In recent years, the use of sorbents in photometric analysis has gained practical importance. This makes it possible to create a new, highly sensitive, selective sorption-photometric method. This method of analysis also uses organic reagents known in photometric analysis. The sensitivity and accuracy of sorption-photometric methods is higher than that of test methods. As a result of the combined use of these two methods, it is necessary to determine the amount of toxic substances by the test method, and to measure the exact amount by the sorption-photometric

method. The established test methods are mainly determined by the level of permissible limit value (PDK) [2].

Immobilization is derived from the Latin word "binding" which means "strengthening" and refers to the environment that is forcibly created for the purpose of protecting an injured limb for a certain period of time. In the language of chemistry, it is used in the sense of immobilizing compounds that do not exist stably or have low efficiency, to increase their activity or to maintain their stability, in general, absorption. There are mainly two ways to form groups on the surface of sorbents that allow obtaining complex compounds [3].

The first method is the modification of the sorbent with a covalently bound functional group, and the second is the immobilization of the organic reagent in the matrix as a result of intermolecular interaction. Although the sorbent created in the first way has some advantages, there are some difficulties in its preparation and synthesis of necessary substances. According to the second method, it is usually only required to select the necessary reagent for immobilization [4].

There are different types of immobilization of organic reagents into a polymer matrix: electrostatic, adsorptive, and covalent immobilization. Immobilization increases the resistance of organic reagent layers to leaching and eliminates photochemical degradation. A standard method for preparing such immobilized substances is to achieve absorption at the matrix level of a reagent chosen according to the objective being observed. Ion-exchange fibrous sorbents have an advantage over other granular sorbents due to their large surface area. This feature helps the sorption-desorption process to go well on its surface and absorb ions of very small concentration. The activity of the sorbent is increased by modifying the nitron fiber with hydroxylamine or similar substances to convert it into a chemical state.

The simplest and most commonly used immobilization method is the adsorption of an organic reagent on the fiber. In this case, a new bond appears between certain groups in the fiber and the reagent. The nature of such a bond is greatly affected by slight changes in pH, ionic strength, temperature, and solvent nature of the solution during the analysis. Ignoring these effects can lead to desorption of the reagent from the fiber [5].

Complex formation reactions of metal ions with organic reagents were studied by sorption-photometric method. The optimal conditions were pH=8, λ=360 nm, and the lower limit of detection was determined to be 0,01 [6].

General methodology of work:

1. 0,05 g of 2,2'- ((1,3,4-thiadiazol-2,5-diyl) bis(sulfandiyl)) diacetate was taken from the reagents on an analytical balance, placed in a 100 ml volumetric flask and made up to the mark with alcohol. The prepared solution was diluted and used for further work.

2. 0,05 g of 2,2'-((1 ,3,4-thiadiazol-2,5-diyl) bis (sulfandiyl)) diacetate was taken from the reagents on an analytical balance, placed in a 100 ml volumetric flask and made up to the mark with alcohol. The prepared solution was diluted and used for further work.

3. To prepare a standard 1mg/ml solution of Ni^{+2} ion, 0,5 g of $Ni(NO_3)_2 \cdot H_2O$ salt was taken and placed in a 200 ml flask, 2 ml of nitric acid was also added and brought to the mark with distilled water. This solution was used in subsequent work.

4. To prepare a standard solution of Co^{+2} ion with 1 mg/ml, 0,5 g of $CoSO_4$ salt was taken and placed in a 200 ml flask, 2 ml of sulfuric acid was also added and brought to the mark with distilled water. This solution was used in subsequent work.

5. It was prepared by diluting concentrated hydrochloric acid in the preparation of $1{,}0 \cdot 10^{-1}$ M hydrochloric acid solution.

6. 0,04 M (H_3BO_3, H_3PO_4, CH_3COOH) 0.2 M NaOH solution was added to the universal buffer mixture with different pH (1-12).

7. To prepare discs, 0,2 g of fibers synthesized at the Department of Polymer Chemistry were taken. It was washed with

distilled water until it became neutral. It was kept moist in a Petri dish.

8. The pH of the solutions was measured using the universal ionomer EV-130 and the pH-meter pH/mV/TEMR Meter P25 EcoMet developed in Korea.

9. Spectrocolorimeter "IV-Vis Specord M-40" was used for absorption and reflection spectra of solutions.

10. The absorption spectrum of aqueous solutions of the reagent and the complex was measured on a spectrophotometer-46.

The obtained results and their analysis

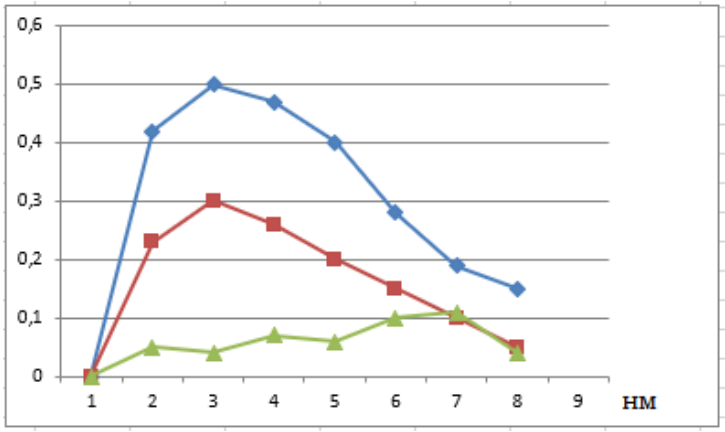
Selection of optimal conditions for immobilization of diethyl 2,2'-((1,3,4-thiadiazol-2,5-diyl) bis (sulfandiyl)) diacetate organic reagent on fiber

To prepare immobilized carriers, diethyl 2,2'-((1,3,4-thiadiazol-2,5-diyl) bis (sulfandiyl)) diacetate was immobilized onto fibrous sorbent PPM-1. Diethyl 2,2'-((1,3,4-thiadiazol-2,5-diyl) bis(sulfandiyl)) diacetate is prepared before the fiber is used to immobilize the reagent on the fiber. For this, 0,2000 g fiber carrier 50,0 ml 0,1 M Diethyl 2,2'-((1,3,4-thiadiazol-2,5-diyl) bis (sulfandiyl)) diacetate - the results of immobilization of the reagent on the fiber were washed with HCl and transferred to the form of anion exchange Cl-, the next washed with distilled water (repeated 2–3 times). Ready fiber for immobilization is stored in a wet state. **Immobilization method**: 10 ml of 0,1% Diethyl 2,2'-((1,3,4-thiadiazol-2,5-diyl) bis (sulfandiyl)) diacetate reagent was poured into 50,0 ml measuring cups and 0,2000 g of fiber was added and mixed with a glass rod for 7–10 min. The fiber was then washed with distilled water and the amount of reagent deposited on the fiber was measured, the results are shown in Table 1 and Figure 1.

Table 1

Diethyl 2,2'-((1,3,4-thiadiazol-2,5-diyl) bis(sulfandiyl)) diacetate reagent immobilization level as a function of wavelength dependence

Λ, нм	ΔA reagent	ΔA immobilized reagent	ΔA complex
360	0,26	0,16	0,05
400	0,34	0,23	0,05
440	0,36	0,18	0,05
490	0,32	0,14	0,06
590	0,25	0,11	0,08
660	0,11	0,08	0,11
730	0,10	0,05	0,05



1-figure. Absorption spectrum of complex (3) before (1) and after (2) immobilization of diethyl 2,2'-((1,3,4-thiadiazol-2,5-diyl) bis (sulfandiyl)) diacetate reagent.

As can be concluded from the table, for the diethyl 2,2'-((1,3,4-thiadiazol-2,5-diyl) bis (sulfandiyl)) diacetate reagent, λmax = 440 nm, and when PPM-1 was immobilized, a change was observed at λmax = 660 nm . In this case, due to complex formation, D l = 220 nm was different.

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