ISSN 2181-3187

SORPTION-SPECTROSCOPIC POSSIBILITIES OF COPPER (II) IONS USING IMMOBILIZED ORGANIC REAGENTS.

YulchiyevaS.T(PhD) , Xolboyev Yu.H. (DSc)

Andijan State Medical Institute

Annotation

This paper describes the quantitative analysis of copper and the analysis of the results obtained using sorption spectroscopy methods. In addition, the quantitative detection limit was described in the analysis of the immobilization of the organic reagent in the SMA-1 fiber sorbent and its IR spectral results. Immobilization properties of indigo reagent with copper ions were shown. A method for the determination of copper ions in water has been proposed.

Keywords: immobilized reagent, organic reagent, sorption spectrophotometric methods of analysis, IR spectroscopy.

Introduction. Detection of heavy metal ions in environmental objects is one of the most important tasks of analytical chemistry. The role of spectrophotometry in the determination of metal ions in water is an important method. Compared to other methods, spectrophotometry is one of the simplest, fastest and cheapest methods.

Copper is necessary for life, but is toxic to organisms above certain limits, such as some algae, fungi, and many bacteria or viruses [1, 2]. In addition, the accumulation of copper in the human liver causes Wilson's disease, which is manifested through neurological and mental defects. [3]. There are traditional methods of copper detection (II) [4-6]. However, spectrophotometric methods are often preferred because they involve cheaper instruments and show faster results.

Copper is necessary for life, but is toxic to organisms above certain limits, such as some algae, fungi, and many bacteria or viruses [1, 2]. In addition, the accumulation of copper in the human liver causes Wilson's disease, which is manifested through neurological and mental defects. [3]. There are traditional methods for the

ISSN 2181-3187

determination of copper (II) [4-6]. However, colorimetric methods are often preferred because they involve cheaper instruments and show faster results.

Sorption-spectrophometric methods, one of the most modern equipment physicochemical methods for the detection of heavy metals, are widely used today, and new immobilized organic reagents are used to solve this problem [7,8-10].

Methods of using immobilized organic reagents are being rapidly developed. Their rapid development is due to the simplicity and expressiveness of the hardware design, as well as the possibility of using immobilized organic reagents in the field outside the laboratory [11-12].

Objects and methods of research. IR spectra of carriers and immobilized organic reagents were recorded by Thermo Scientific spectrometer Nicolet IR 200 (USA). research was conducted using. Category A glassware, analytical balance (measuring range: 0.0001g to 220g) Model: CY 224 CITIZEN (India) pH meter (pH measuring range: -2,000 ... + 20,000, temperature -5. .. + 105.00 S, error ± 0.10 S Model: WTW 7110 (Germany).

Solutions, reagents, sorbents.

Standard metal alloys were prepared by melting a chemically pure grade. diluted Metals in acids (1: 1), then diluted with distilled water.

To prepare the Cu^{2+} solution, dissolve 1,000 g of copper metal in 15 ml of HNO_3 (1: 1) and add up to 1000 ml of distilled water. Concentrated sulfuric acid was diluted in the preparation of 0.1 M sulfuric acid solution.

The buffer solution was prepared by adding 0.2 M NaOH solution of 0.04 M (H_2BO_4, H_3PO_4, CH_3COOH) 0,2 M NaOH to a universal buffer mixture of different pH (1–12) [11].

For the preparation of fibers, 0.2000 g of fibers synthesized at the Department of Polymer Chemistry were weighed and prepared for use.

Immobilization mechanism: The fibers obtained for analysis were weighed from 0.2 g before preparation for immobilization and placed in separate beakers of 50.0 ml and then shaken in 0.1 M HCl solution for 5-10 minutes. In this case, the fiber is

ISSN 2181-3187

converted into chlorine form. The fiber prepared for immobilization is stored in a wet Petri dish. These polymers are insoluble in PAN solvents due to modification of ethylenediamine groups [13].

Results and its discussion.

The finished fibers were added separately to the solutions of the indigo reagent at a certain concentration, and the optical densities of the reagent before and after immobilization were measured.

Table 1

	λ, nm	A reagent until immobilization	A reagent after immobilization	ΔA reagent
1	315	-	-	-
2	364	0,40	0,13	0,27
3	400	0,50	0,20	0,30
4	440	0,40	0,15	0,25
5	490	0,35	0,13	0,22
6	540	0,30	0,10	0,20
7	590	0,22	0,1	0,12
8	670	0,18	0,06	0,12

ISSN 2181-3187

9	750	0,11	0,05	0,06
10	870	0,10	0,02	0,08
11	980	0,07	0,01	0,06

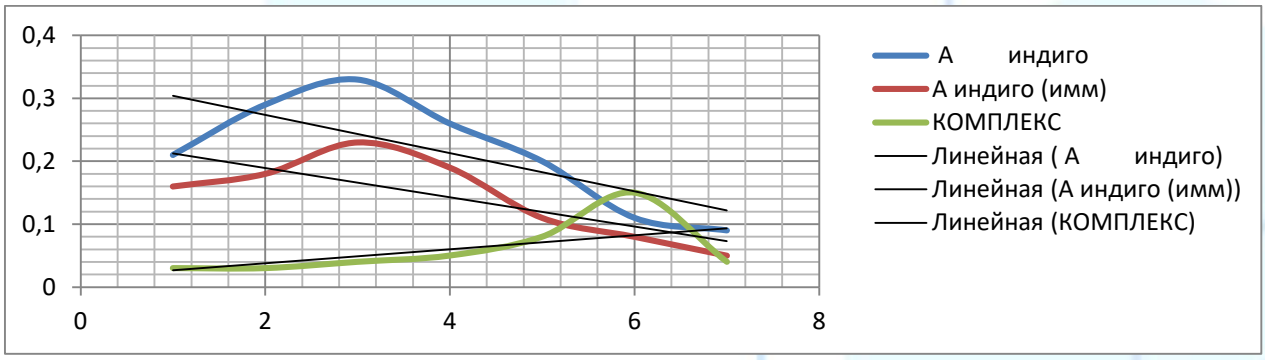
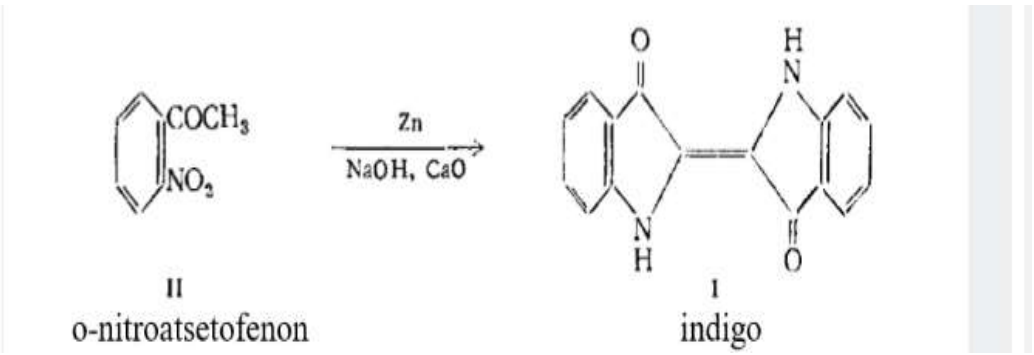


Figure 1. The degree of immobilization depends on the wavelength

For the first time indigo Emirlingom and Englerom with very low yields by o-nitroacetophenone catalysts zinc, sodium hydroxide and synthesized in the presence of calcium oxides.



ISSN 2181-3187

We poured 800ml of distilled water on 100 g of indigo leaf and kept it in hot water at 70 -80 C for 7-10 minutes. Then the liquid part of the crushed leaves was separated. We kept the aqueous mass in the open air for 24 hours and a precipitate formed. We filtered and dried the sediment. We then gave him an IQ test. [20]

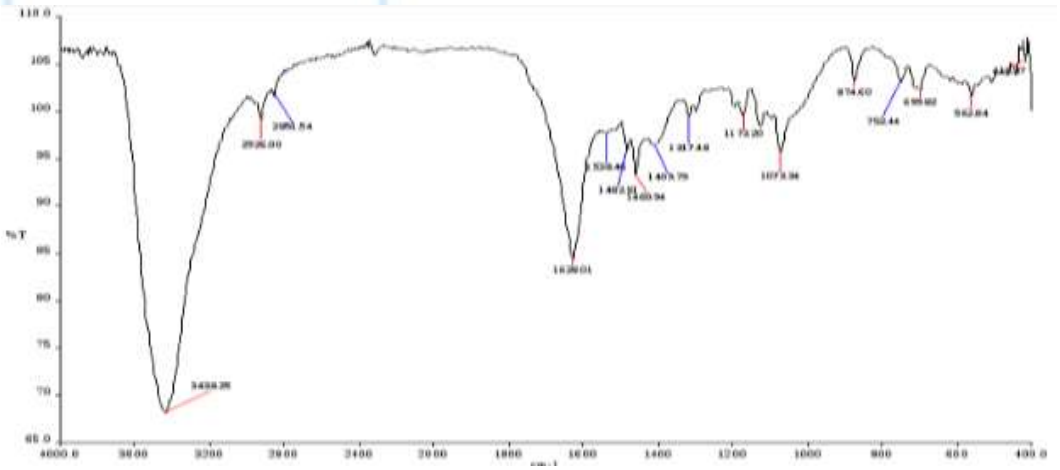


Figure 2. IR spectrum of indigo reagent.

From the results of IR spectra of indigo obtained under normal conditions - –C-C-(400-900 cm^{-1}), C-O-C (900-1200 cm^{-1}), C-N (500-1400 cm^{-1}), -C=O (1500-1800 cm^{-1}), (2100-2300 cm^{-1}), -OH (3600±50 cm^{-1})) functional groups SMA-1 - orange fiber, obtained by modifying hexamethylenediamine to PAN fiber .

ISSN 2181-3187

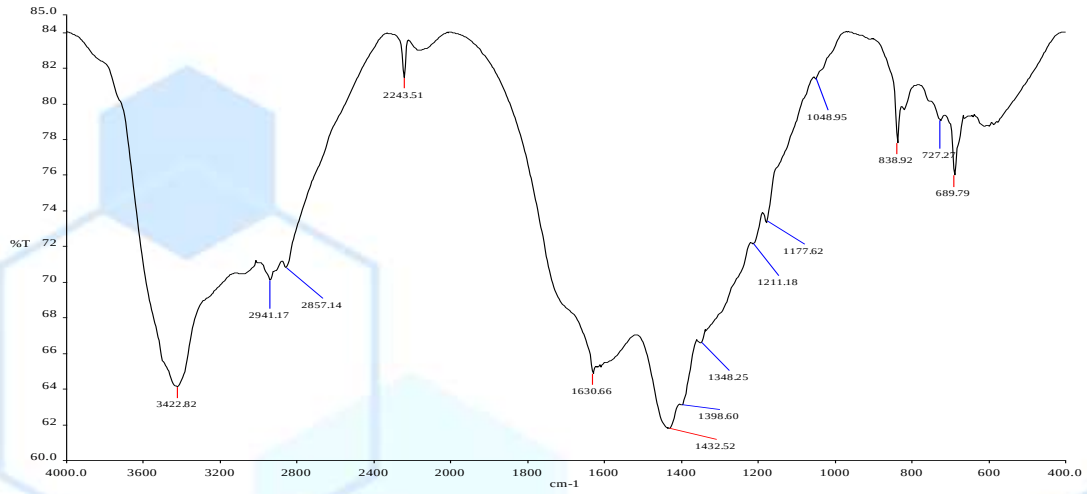


Figure.3 SMA1 IK spectrum

The IR spectrum of the SMA-1 fiber showed corresponding oscillations at frequencies 3200-3500 cm^{-1}, 1600 cm^{-1} and 1580 cm^{-1}, which oscillations belong to the NH-group. The main modification refers to the intensity of light absorption of nitron -C≡N-, a decrease in the intensity of light absorption of 3200-3800 cm^{-1} indicates the formation of strong intermolecular hydrogen bonds. The vibrations of the reagent belonging to the -N = O group appear to be of intensity at 1580-1600 cm-1. : [14]

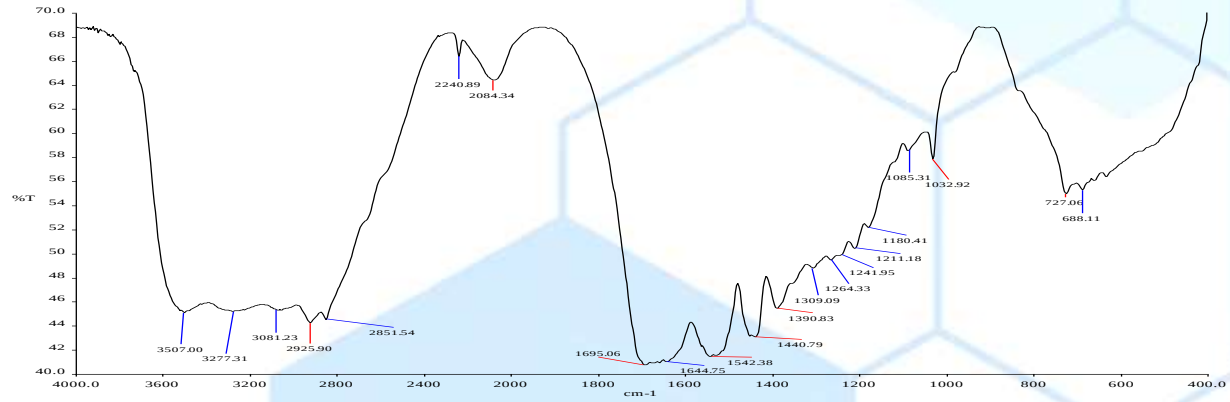


Figure 4. Two spectra of immobilized fiber

The appearance of an intensity of 3501–3277 cm^{-1} in the immobilized fiber indicates that it is formed due to intermolecular O-N (H does not form a bond) bonds. When comparing the IR spectrum of the SMA-1 fiber and the complex immobilized

ISSN 2181-3187

on it, the main changes were observed in the valence oscillations of the ON and N-H groups.

Conclusion.

Indigo dye was isolated from local plant raw materials, physical and chemical properties of indigo dye were studied by IR spectroscopy and compared with the literature. The structure and composition of analytical active and functionally active groups of natural dye indigo were studied. Optimal conditions for obtaining the copper complex of indigo were determined. The structure of the copper complex was analyzed using indigo spectroscopy. In addition, the quantitative detection limit is SMA-1. analysis of the immobilization of indigo reagents in a fibrous sorbent and their IR spectral results. The immobilizing properties of indigo reagent for a particular fiber have been demonstrated. A method for the determination of copper ions in water has been proposed.

References:

1. Yulchieva S.T., Smanova Z.A. Sorption-spectroscopic possibilities of copper (II) ions using immobilized organic reagents// Композицион материаллар. 2021, №4 – 11 б. (02.00.02; №4)

2. Эрматова О.А., Йўлчиева С.Т., Гафурова Д.А., Сманова З.А. Разработка сорбционно-спектроскопического метода определения ионов свинца иммобилизованным сульфарсазеном // O’zbekiston kimyo jurnali. 2021- №4 -79-б. (02.00.02; №6)

3. Йўлчиева С.Т., Эрматова О.А., Сманова З.А. Сорбционно- фотометрическое определение меди с помощью 1-(5-метил-2-пиридилазо)-5-диэтиламинофенола // O’zbekiston kimyo jurnali. 2021- №6- 67-б. (02.00.02; №6)

4. Юлчиева С.Т., Сманова З.А. Сорбционно-фотометрическое определение ионов меди (II) в объектах окружающей среды с новым иммобилированным реагентом // Фан ва технологиялар тараққиёти. Илмий - техникавий журнал №5/2021- 108-112 б. (02.00.02; №14)

5. Юлчиева С.Т., Сманова З.А. Иммобилизованные органические люминесцентные реагенты для определения некоторых тяжелых металлов// Развитие науки и технологий. Научно-технический журнал. 2021, №6. 46-50 б. (02.00.02; №14)

6. Юлчиева С.Т, Исакулов Ф.Б, Янгиева С.Б, Сманова З.А. Разработка сорбционно-спектрофотометрической методики определения ионов железа (III) // Universum: химия и биология: электрон. научн. журн. 2021. №11-Т.89. URL: https://7universum.com/ru/nature/archive/item/12488 55-бет (02.00.02; №2)

7. Юлчиева С.Т., Кулдашев Л.С., Сманова З.А. Мониторинг загрязнений химическими веществами объектов окружающей среды// Научно–технический журнал ФерПИ. 2021. Том 25. (05.00.00 № 20)

8. Yulchiev, M. E., & Qodirov, A. A. O. (2020). Electricity Quality And Power Consumption In Low Power (0.4 Kv) Networks. *The American Journal of Engineering and Technology*, *2*(09), 159-165.

9. Yulchiev, M. E. (2023). POWER QUALITY IN THE LOW-VOLTAGE AIR NETWORK. *Spectrum Journal of Innovation, Reforms and Development*, *15*, 79-84.

10. Эралиев, А. Х., Юлчиев, М. Э., & Латипова, М. И. (2020). ЭКСПЕРИМЕНТАЛЬНЫЕ МЕТОДЫ И ОБЪЕМ ИСПЫТАНИЙ ТРАНСФОРМАТОРОВ ТОКА. *Universum: технические науки*, (12-5 (81)), 39-43.

11. Mash'albek, E. (2022). CONTENTS, PROBLEMS AND DIDACTICAL BASIS OF TEACHING THE SUBJECT" ELECTRIC NETWORKS AND SYSTEMS" IN THE ELECTRONIC EDUCATIONAL ENVIRONMENT. European International Journal of Multidisciplinary Research and Management Studies, 2(04), 341-349.

12. Yulchiyev, M. E., & Salokhiddinova, M. (2023). ORGANIZATION OF MULTI-STAGE ENHAT FOR MEDIUM AND LARGE POWER INDUSTRIES OR ENERGY SYSTEM. World scientific research journal, 20(1), 13-18.

13. Erkinovich, Y. M. A., & Sirojiddin, X. (2024). WHAT DOES IT DEPEND ON TO ENSURE THE CONTINUITY OF ELECTRICITY CONSUMPTION. *Лучшие интеллектуальные исследования*, *14*(2), 100-104.

14. Erkinovich, Y. M. A., & Umurzoqbek, D. (2024). APPLICATION OF HYBRID SYSTEM IN MULTIFUNCTIONAL DEVICES USING BOTH RENEWABLE AND CONVENTIONAL ENERGY RESOURCES. *Лучшие интеллектуальные исследования*, *14*(2), 226-233.

15. Erkinovich, Y. M. (2024). TYPES OF LIGHTING LAMPS AND THEIR CHARACTERISTICS. *Лучшие интеллектуальные исследования*, *14*(2), 28-34.

16. Igual-Muñoz A., García-Antón J., Guiñón J.L., Pérez-Herranz V. Galvanic study of zinc and copper in lithium bromide solutions at different temperatures. Corrosion. 2001;57:516–522. [Google Scholar]

17. Grimnes S., Martinsen O.G. Academic Press; New York: 2000. Bioimpedance and Bioelectricity Basics. [Google Scholar]

18. Halter R.J., Hartov A., Paulsen K.D., Schned A., Heaney J. Genetic and least squares algorithms for estimating spectral EIS parameters of prostatic tissues. Physiol. Meas. 2008;29:S111–S123. doi: 10.1088/0967-3334/29/6/S10. [DOI] [PubMed] [Google Scholar]

19. Yo‘lchiyev Mash’albek Erkinovich, Xolmirzayev Jasurbek Yuldashboyevich OLIY TA‟LIM MUASSASALARIDA “FIZIKA” FANINI O‘QITISHNING USLUBIYOTI. ―PEDAGOGIK MAHORAT‖ ilmiy-nazariy va metodik jurnal. 2024, № 6

1. U. Borgmann, K. M. Ralph, Complexation and toxicity of copper and the free metal bioassay technique, Water Research, 17, 1697–1703 (1983).

2. Y. M. Nor, Ecotoxicity of copper to aquatic biota: A review, Environmental Research, 43, 274–282 (1987).

3.G. J. Brewer and V. Y. Gurkan, Wilson's disease, Medicine, 71, 139–164 (1992).

4. D. Blair, H. Diehl, Bathophenanthrolinedisulphonic acid andathocuproinedisulphonic acid, water soluble reagents for iron and copper, Talanta, 7, 163–174 (1961).

5. Y. Shijo, H. Sato, N. Uehara, S. Aratake, Simultaneous determination of trace amounts of copper, nickel and vanadium in sea-water by high-performance liquid chromatography after Extraction and Back-Extraction, Analyst, 121, 325–328 (1996).

6 Y. Shijo, N. Uehara, T. Kudo, S. Aratake, Simultaneous determination of copper, iron and nickel by high-performance liquid chromatography after preconcentration with extraction and back-ectraction, Anal. Sci., 10, 951–953 (1994)

7 .P. C. C. Oliveira, J. C. Masini, Sequential injection determination of iron (II) in antianemic pharmaceutical formulations with spectrophotometric detection, Anal. Lett., 34, 389–397 (2001)

8. Remezova T.B. Medicinal chemistry of elements. L., 1978.S.95.

9. Zolotov Yu. A., Kuzmin N. Concentration of microelements. M .: Chemistry, 1982. S.288.

10.Tixonov V.N. Analytic chemistry of elements. Jelezo. M. 1979. S. 265.

11. Bibliographic description: Ashirov M.A., Smanova Z.A., Gafurova D.A. Razrabotka sorbtsionno-spektrosko- picheskoy metodiki opredeleniya // Universum: Ximiya i bioliya: elektron. nauchn. jurn. 2020. № 1 (67). URL: http://7universum.com/ru/nature/archive/item/8642

12.Martin, R. Some questions of toxicity of ionic metals. / R. Martin –M .: Mir. –1993. –25s.

13.Smanova Z. A. Sorption - photometric determination of iron immobilized with chromosurol. // Chemistry and chemistry. Technol. - Tashkent, 2011. №5. S. 27 -31.

ISSN 2181-3187

14.Musaev U.N., Muxamediev M.G., Ikramova M.E. Synthesis of modified sorbents on the basis of polyacrylonitrile fibers // Scientific Bulletin NamGU.-2001.-№2.-117-119s.