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Cu^{2+} IONI VA MGXS-5 REAGENTI BILAN HOSIL QILGAN KOMPLEKS FIZIK-KIMYOVIY VA ANALITIK TAVSIFLARI

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Annotatsiya. Tadqiqot ishida Cu(II) ionining MGXS-5 reagenti bilan hosil qilgan kompleks birikmasining fizik-kimyoviy va analitik xususiyatlari o‘rganildi. Kompleks birikmaning optik zichligi pH = 4,3 bo‘lgan asetatli bufer muhitida EMC-31PC-UV spektrofotometri bilan 610 nm to‘lqin uzunligida o‘lchandi. Tolmachyovning grafik metodi asosida kompleksning molyar so‘ndirish koeffitsiyenti va muvozanat konstantasi aniqlandi. Tahlil natijalariga ko‘ra, Cu(II)–MGXS-5 kompleksi uchun molyar so‘ndirish koeffitsiyenti $\varepsilon_{Cu(II)}$=66667 muvozanat konstantasi esa $K_{muvCu(II)}$= $5{,}08\cdot10^{-1}$ ekanligi aniqlandi. Olingan natijalar MGXS-5 reagentining Cu(II) ionini spektrofotometrik aniqlashdagi analitik imkoniyatlarini baholashga xizmat qiladi.

Kalit so‘zlar: mis(II), MGXS-5, spektrofotometriya, molyar so‘ndirish koeffitsiyenti, muvozanat konstantasi.

Abstract. In this study, the physicochemical and analytical properties of the complex compound formed between the Cu(II) ion and the MGXS-5 reagent were investigated. The optical density of the complex was measured at a wavelength of 610 nm using an EMC-31PC-UV spectrophotometer in an acetate buffer medium at pH 4.3. Based on Tolmachyov’s graphical method, the molar extinction coefficient and the equilibrium constant of the complex were determined. The analysis results indicate that for the Cu(II)–MGXS-5 complex, the molar extinction coefficient is εCu(II) = 66,667, and the equilibrium constant is Keq(Cu(II)) = 5.08×10^{-1}. These findings serve to evaluate the analytical potential of the MGXS-5 reagent for the spectrophotometric determination of Cu(II) ions.

Keywords: copper(II), MGXS-5, spectrophotometry, molar extinction coefficient, equilibrium constant.

Kirish. Hozirgi kunda analitik kimyoning muhim yo‘nalishlaridan biri zaharli va og’ir metall ionlarini aniqlashning yuqori sezgir, selektiv, tezkor va ishonchli usullarini ishlab

chiqishdan iborat. Xususan, mis(II) ionlarini suv, oziq-ovqat mahsulotlari, biologik namunalar hamda turli tabiiy obyektlarda aniqlash ekologik monitoring va analitik nazorat nuqtayi nazaridan muhim ahamiyatga ega. Mis tirik organizmlar uchun zarur bo’lgan mikroelement hisoblanadi, biroq uning ortiqcha miqdori biologik tizimlarga salbiy ta’sir ko‘rsatishi mumkin. Shu sababli turli obyektlarda Cu^{2+} ionlarining miqdorini aniqlash uchun samarali analitik usullarni ishlab chiqish dolzarb ilmiy vazifalardan biri bo’lib qolmoqda. Spektrofotometrik usullar metall ionlarini aniqlashning soddaligi, tahlilni qisqa vaqt ichida amalga oshirish imkoniyati, yuqori sezgirligi va laboratoriya sharoitida qo‘llash imkoniyati bilan ajralib turadi. Ushbu usullarning asosini organik reagentlar bilan metall ionlarining rangli kompleks birikmalar hosil qilishi tashkil etadi. Hosil bo‘lgan komplekslarning yorug‘likni yutish xususiyatlarini o‘rganish orqali metall ionlarining sifat va miqdoriy tavsiflarini aniqlash imkonini beradi. [1, 2].

8-gidroksixinolin hosilalari metall ionlari bilan koordinatsion birikmalar hosil qilish xususiyatiga ega bo‘lgan analitik organik reagentlar qatoriga kiradi. Ushbu birikmalarning molekulasidagi donor atomlar metall ionlari bilan koordinatsion bog‘lanish hosil bo‘lishida qatnashadi. Adabiyotlarda 8-gidroksixinolin hosilalarining Cu(II) ionlari bilan kompleks hosil qilish jarayonlari, komplekslarning eritmadagi holati hamda ularning spektroskopik xususiyatlari keng o‘rganilgan [3, 4]. Bunday tadqiqotlarda reagentning tuzilishi bilan uning metall ionlariga nisbatan kompleks hosil qilish xususiyati o‘rtasidagi bog‘liqlikni aniqlashga imkon beradi.

Mis(II) ionining organik reagentlar bilan hosil qilgan komplekslarini tavsiflashda eritmaning pH qiymati, reagent konsentratsiyasi, komponentlarning molyar nisbati, kompleksning maksimal yutilish to‘lqin uzunligi va optik zichligi kabi parametrlar muhim hisoblanadi. Jumladan, 8-gidroksixinolin hosilalari asosida ishlab chiqilgan spektrofotometrik usullarda muhit sharoitlari hamda kompleksning spektral xususiyatlari analitik aniqlash samaradorligiga bevosita ta’sir qilishi ko‘rsatilgan [3, 5]. Shu sababli kompleks hosil bo‘lishining optimal sharoitlarini belgilash uning fizik-kimyoviy va analitik xususiyatlarini to‘liq baholashning muhim bosqichidir.

Kompleks birikmalarning tarkibini aniqlashda Jobning izomolyar seriyalar usuli, molyar nisbatlar usuli va boshqa fizik-kimyoviy usullardan foydalanish mumkin. Xususan, Job usuli eritmadagi komponentlar umumiy molyar konsentratsiyasi o‘zgarmas saqlangan sharoitda optik zichlikning tarkibga bog‘liqligini o‘rganishga asoslanadi. Ushbu yondashuv kompleks tarkibidagi metall ioni va ligandning molyar nisbatini aniqlash imkonini beradi [6, 7]. Kompleks birikmalarning barqarorlik konstantasini baholash esa ularning eritmada hosil bo‘lishi va muvozanat holatini tavsiflashda muhim ahamiyatga ega [8, 9, 10]. Cu^{2+} ionining MGXS-5 reagenti bilan hosil qilgan kompleksini kompleks tarzda o‘rganish uning fizik-kimyoviy xususiyatlari va analitik imkoniyatlari o‘rtasidagi bog‘liqlikni ilmiy asoslashga xizmat qiladi.

Tajribaviy qism: 25 ml hajmli o‘lchov kolbasiga dastlabki komponentlar stexiometrik nisbatlarda kiritildi. Eritmaning muhitini belgilash maqsadida pH qiymati 4,3 ga teng bo‘lgan asetatli bufer eritmasidan 5 ml qo‘shildi. Eritmaning pH qiymati METTLER TOLEDO pH-metri yordamida nazorat qilindi. Shundan so‘ng kolba belgisigacha distillangan suv bilan

to‘ldirildi. Hosil bo‘lgan kompleks birikmaning optik zichligi EMC-31PC-UV spektrofotometri yordamida 610 nm to‘lqin uzunligida o‘lchandi. Taqqoslash eritmasi sifatida metall ionidan tashqari barcha komponentlarni saqlagan eritmadan foydalanildi. O‘lchash natijalari 1-rasm va 1-jadvalda keltirilgan.

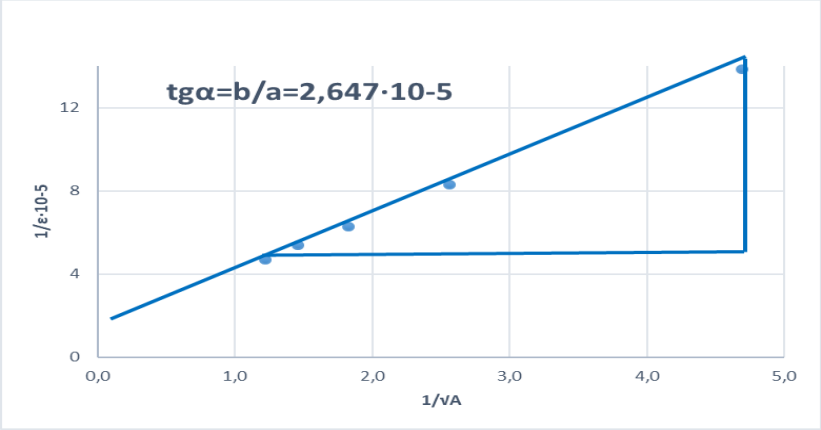
$$\varepsilon = \frac{A}{C \cdot \ell} \quad (1) \qquad \varepsilon_{haq} = \frac{1}{1/\varepsilon \cdot 10^{n}} \quad (2) \qquad K_{muv} = \frac{C_H^n \cdot l^n}{n^n \cdot \varepsilon_x \cdot \epsilon^{n+1}} \quad (3)$$

Bu yerda: ε- molyar so‘ndirish koeffitsient, ε_{haq}- haqiqiy molyar so‘ndirish koeffitsient C_H - H^+ ionlari konsentratsiyasi, ℓ -kyuveta qalinligi, n-stexiometrik koeffisient.

1-jadval

Kompleks birikmalarning haqiqiy molyar so‘ndirish koeffitsient va muvozanat konstantasini Tolmachyovning grafik metodi bilan o‘rganish natijalari(n=5)

№	Me^{2+}ml	HR ml	Cu(II)					
			Ā	√A	1/√A	CM, 10-5	E	1/ε·10-5
1	0,5	1	0,045	0,213	4,69	0,629	7209	13,872
2	1	2	0,152	0,390	2,56	1,259	12075	8,282
3	1,5	3	0,301	0,548	1,82	1,888	15920	6,281
4	2	4	0,467	0,684	1,46	2,518	18563	5,387
5	2,5	5	0,674	0,821	1,22	3,147	21411	4,671



1-rasm. Cu(II) MGXS-5 bilan hosil qilgan kompleks birikmaning molyar so‘ndirish koeffisenti topish grafigi.

$$\varepsilon_{haq} = \frac{1}{1/\varepsilon \cdot 10^{n}} = \frac{1}{1{,}5 \cdot 10^{-5}} = 66667$$

$$K_{muv} = \frac{C_H^n \cdot l^n}{n^n \cdot \varepsilon_x \cdot tg\alpha^{n+1}} = \frac{(5{,}01 \cdot 10^{-5})^2 \cdot 1^2}{2^2 \cdot 66667 \cdot (2{,}647 \cdot 10^{-5})^3} = 5{,}08 \cdot 10^{-1}$$

Xulosa. O‘tkazilgan tajribalar davomida shuni aytish mumkinki, Cu(II), MGXS-5 bilan hosil qilgan kompleks birikmalarning molyar so‘ndirish koeffisenti mos ravishda $\varepsilon_{Cu(II)}$=66667 komplekslarning hosil bo‘lish muvozanat konstantalari quyidagicha $K_{muvCu(II)}$= $5{,}08 \cdot 10^{-1}$ qiymatda ekanligi tadiqotlar orqali aniqlandi. Kompleks birikmaning molyar so‘ndirish koeffitsiyenti qanchalik yuqori bo‘lsa, u kompleksning muvozanat konstantasi

ham shunchalik yuqori bo‘ladi. Cu^{2+} ionining MGXS-5 reagenti bilan hosil qilgan kompleks birikmasining fizik-kimyoviy xususiyatlarini o‘rganish, kompleks hosil bo‘lishining optimal sharoitlarini aniqlash va uning analitik tahlil qilish imkonini beradi.

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