BAKI UNİVERSİTETİNİN XƏBƏRLƏRİ

№1 *Təbiət elmləri seriyası* *2021*

KİMYA

UDCT 543.4:542.61:546.812

NEW SIMPLE SPECTROPHOTOMETRIC METHODS FOR THE DETERMINATION OF TRACE LEVEL SILVER(I) USING 1- [2- (ALLYLAMINO) -1-METHYLETHYL] THIOCARBAMIDE

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Ag(I) with 1- [2- (allylamino) -1-methylethyl] thiocarbamide the rapid reacts to form brownish-yellow complex and also it to form to form brownish complexes in presence of the phenanthroline(Phen)and α,α' - dipyridine (α,α' -dip). The absorption spectra of the Ag (I)-AMTICsystem is a curve with the maximum absorbance at 460 nm and molar absorption coefficient of $1.8{\cdot}10^4$ *l* mol^{-1} cm^{-1}*. The absorption spectra of the Ag(I)-AMTIC- Phen and Ag(I)-AMTIC- α,α'-dip systems is a curve with the maximum absorbances at 476 nm and 473 nm and molar absorption coefficients of* $2.53{\cdot}10^4$ *l* mol^{-1} cm^{-1} *and* $2.38{\cdot}10^4$ *l* mol^{-1} cm^{-1}*, respectively. The absorbance was linear for 0.234–2.31mkg* ml^{-1} *of Ag (I) in the Ag(I)- AMTIC system and 0.168–2.242 mkg* ml^{-1} *and 0.176–2.232 mkg* ml^{-1} *of Ag (I) in the Ag(I)-AMTIC-Phen and Ag(I)-AMTIC- α,α'-dipsystems, respectively. The proposed methods was successfully used in the determination of Ag(I) in several synthetic mixtures. The relative standard deviation (n = 5) was 0%–2.0%, for Ag(I), indicating that this methods are highly precise and reproducible. The results obtained agree well with synthetic mixture samples analyzed by inductively coupled plasma optical emission spectrometry(ICP-OES).*

Keywords: spectrophotometric, Ag(I), determination,1-[2-(allylamino)-1-methylethyl] thiocarbamide, phenanthroline and α,α' - dipyridine

Introduction

Silver is a useful element in many respects, other than in currency and as an investment medium, silver is used in solar panels, water filtration, jewellery, ornaments, high-value tableware,soils,natural and waste waters, rocks, pharmaceutical preparations in photographic materials and utensils, in electrical contacts and conductors, in specialized mirrors, window coatings, in catalysis of chemical reactions, as a colorant in stained glass and in specialised confectionery [1]. Thus, separation, preconcentration and determination of silver ion is of increasing interest.

Although many sophisticated techniques, such as electrothermal AAS [2-3], flame AAS[4-5], graphite furnace AAS[6], liquid chromatography[7], electrophoresis[8] are available for the determination of silver at trace levels in numerous complex materials.

Factors such as the low cost of instrument, technical know-how, consumable and costly maintenance of technique restrict the wider applicability of these techniques, particularly in laboratories with limited budget in developing countries and for field work lack of any requirement for consumables and almost no maintenance, have caused extraction-spectrophotometric methods to remain a popular technique.

In the literaturs wide variety of spectrophotometric methods for determination of Ag(I) have been reported, each chromogenic system has its advantages and disadvantages with respect to sensitivity, selectivity and convenience [8-13]. Many reagents used in photometric methods for the determination of silver contain sulfur in the molecule.Therefore, the synthesis of new sulfur content of organic reagents, the study of their complexation with Ag (I) is an urgent task. In this work, a reagent 1- [2- (allylamino) -1-methylethyl] thiocarbamide (AMTIC) was synthesized according to the method of [14] and a color reaction of AMTICwith Ag(I) in aqueous and in the presence of the phenanthroline (Phen) and α,α′ - dipyridine was carefully studied. The aim of present study is to develop a simpler spectrophotometric method for the trace determination of silver(I) with AMTICand in the presence of phenanthroline and α,α′ - dipyridine solutions.

Experimental Section

Instrumentation

The absorbance of solutions was measured with a Perkin Elmer (United States) (Model: Lambda-40) double-beam UV/VIS spectrophotometer and with a KFK-2 photoelectrocolorimeter (Russia), with 1 cm matched quartz cells. The pH values of solutions was controlled on the ionomer I-121 with glass electrode customized by standart bufer solutions.

A Perkin Elmer (United States) (Model: Optima-2100DV) Inductively Coupled Plasma Optical Emission Spectrometer (ICP-OES) was used for comparing the results.

Chemicals and Reagents

All of the chemicals used were of analytical reagent grade or the highest purity available. Distilled deionized water, which is non-absorbent under ultraviolet radiation, was used throughout. Glass vessels were cleaned by soaking in acidified solution of $KMnO_4$ or $K_2Cr_2O_7$ followed by washing with concentrated HNO_3 and rinsed several times with deionized water. Stock solutions and environmental water samples (1000 ml each) were kept in polypropylene bottles containing 1ml of concentrated HNO_3. More rigorous contamination control was applied when the silver(I) levels in the specimens were low.

Standard silver solution (1×10^{-2} M)

A stock solution 1×10^{-2} M, 100 ml of silver (I) was prepared by dissolving 0.1575 g of silver nitratein 100 ml of distilled deionized water and added 0.1 ml con. HNO_3 . The working standard of silver solution was prepared by suitable dilutions of this stock solution.

1- [2- (allylamino) -1-methylethyl] thiocarbamide

The 1- [2- (allylamino) -1-methylethyl] thiocarbamidereagent was synthesized according to the method of [14]. The NMR spectroscopic data of 1-[2- (allylamino) -1-methylethyl] thiocarbamide: ^{1}H NMR spektrum: (*CCL_4*, **δ**.m.h) 9.48$_3$(2H,NH_2), 7.21d(1H, NH), 3.22m(2H,CH_2), 2.01m (1H, NH), 2.64-2.89 d(2H,CH_2), 1.50-3.03 m (1H,CH), 1.10 s (3H,CH_3), 1.10 s (3H$_1$, CH_3), 5.15 m (1H-C-N- sis), 5.17m (1H$_1$-C-N-trans), 5.83 m (1H-C-N). ^{13}C NMR Spektrum: 186, 52.0, 53.7, 55.5, 116.2, 134.2, 184.7.

The solution of 1- [2- (allylamino) -1-methylethyl] thiocarbamidereagent was prepared by dissolving the requisite amount of AMTICin a known volume of ethanol. More dilute solution of the reagent was prepared as required.

Phenanthroline (Phen)and α,α′ - dipyridine (α,α′ - dip)

$1\cdot10^{-2}$ Msolutions of phenanthroline and α,α′ - dipyridine was preparing by dissolving the requisite amounts of these substancies in distilled water and ethanol(1:1).

Aqueous ammonia solution

A 100 ml solution of aqueous ammonia was prepared by diluting 10 ml of concentrated NH_3 (28%–30%) ACS grade with distilled water. The solution was stored in a glass bottle.

EDTA solution

A 100 ml stock solution of EDTA (0.1% w/v) was prepared by dissolving 128 mg of ethylenediaminetetraacetic acid, disodium salt dehydrate in 100 ml distilled water.

Other solutions

Solutions of a large number of inorganic ions and complexing agents were prepared from their grade, or equivalent grade, water soluble salts.

RESULTS AND DISCUSSION

Ag(I) with 1- [2- (allylamino) -1-methylethyl] thiocarbamidethe rapid reactsto form brownish-yellow complex and also it to form brownish complexes in presence of phenanthroline and α,α′ - dipyridine solutions.

Absorption spectra

The absorption spectra of the Ag (III)- AMTIC is a curve with the maximum absorbance at 460 nm and an average molar absorption coefficient of $1.8\cdot10^4$ l mol^{-1} cm^{-1} in aqueous media. The absorption spectra of the Ag(I)-AMTIC- Phen and Ag(I)-AMTIC- α,α′-dipsystems is a curve with the maximum absorbances at 476 nm and 473 nm and average molar absorption coefficients of 2.53·10^4 l mol^{-1} cm^{-1} and 2.38·10^4 l mol^{-1} cm^{-1} in micellar media, respectively (Figure 1).

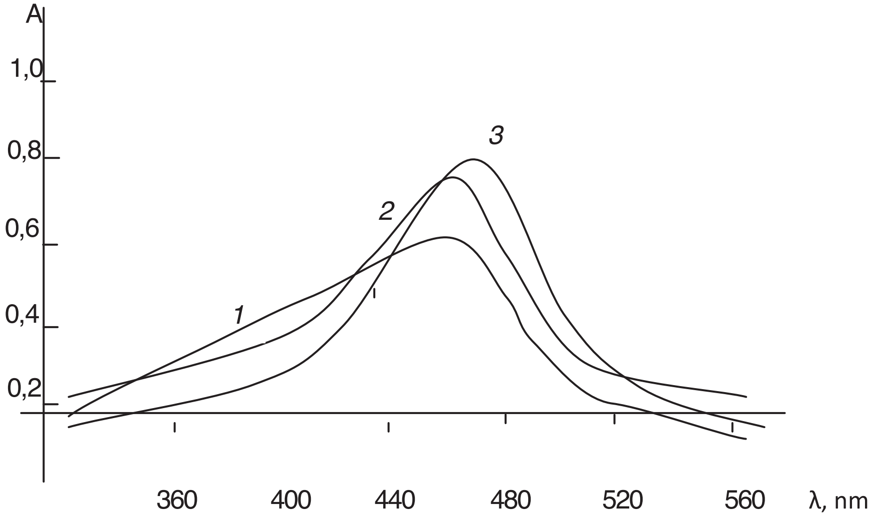

Fig.1. Absorption spectra of Ag(I)- AMTIC(1), Ag(I)-AMTIC-α,α′-dip (2) and Ag(I)-AMTIC- Phen(3).

Effect of acidity. Of the various pH 0-12 studied, pH 5,0-6,0 found to be the best acid for the Ag(I)- AMTIC system and pH 4,0-5,0 found to be the best acid for the Ag(I)-AMTIC- Phen and Ag(I)-AMTIC-α,α′-dipsystemsat room temperature (25±5)^{0}C. The absorbance of the reagent solution and the all systems depends on the medium pH; therefore, the absorption spectra are studied relative to a blank experiment against the background of control experiment (R and R+X), which was prepared in the same conditions.

Effect of time. The reaction is fast. Constant maximum absorbance was obtained after 10 min for Ag (III)-AMTICsystem in aqueous media and 5 min for Ag(I)-AMTIC- Phen and Ag(I)-AMTIC- α,α′-dipsystems in micellar media, respectively. The reaction is fast. There were dilution to volume of systems at room temperature (25±5)^{0}C and remained strictly unaltered for 24 h.

Effect of temperature. The absorbance at different temperatures, 0–80^{0}C, of a 25 ml solution of all systems was measured according to the standard procedure. The absorbance was found to be strictly unaltered throughout the temperature range of 10–40^{0}C. Therefore, all measurements were performed at room temperature (25 ±5)^{0}C.

Stoichiometry. The component ratio in the complexes was found using the isomolar series method, the relative yield method by Starik and Barbanel and the equilibrium shift method . All the methods showed that the component ratio were 1:2 in the Ag(I)- AMTIC system and 1:2:2 in the Ag(I)- AMTIC-Phen and Ag(I)-AMTIC- α,α′-dipsystems.The number of protons displaced upon complexation was determined by the Astakhovs method, and the indicated component ratio in the complexes was confirmed.

Effect of the reagent andphenanthroline and α,α′ - dipyridine concentration. Different molar excesses of AMTICand phenanthroline and α,α′ - dipyridine were added to a fixed Ag(I) concentration and the absorbance was measured according to the standard procedure. It was observed that a 1 mkg/ml of silver metal (optical path 1 cm in length), the reagent and phenanthroline and α,α′ - dipyridinemolar ratios produced a constant absorbance of Ag(I)-AMTIC-Phen and Ag(I)-AMTIC- α,α′-dipsystems. For all subsequent measurements, 2 ml of $2\cdot10^{-4}$ M AMTICreagent and 4ml of $2\cdot10^{-4}$ M phenanthroline and α,α′ - dipyridinewas added.

Table 1

Selected analytical parameters obtained by optimization experiments

		Selected value		
Parameters	Studied range	Ag(I)- AMTIC	Ag(I)-AMTIC- Phen	Ag(I)-AMTIC- α,α′ - dip
Wavelength,λ_{max}(nm)	200-800	460	476	473
Wavelength ,λ_{opt}(nm)	-	440	440	440
pH	0 - 12	5-6	4-5	4-5
Time , h	1 - 24h	5 - 10 min	5-6 min.	5-6 min.
Temperature ,^{o}C	0 - 80 ^{o}C	25 ± 5 ^{o}C	25 ± 5 ^{o}C	25 ± 5 ^{o}C
Ag(I): AMTIC:X	1:10- 10:1	1:2	1:2:2	1:2:2
Molar absorption coefficient , l mol^{-1} cm^{-1}	-	1.82×10^{4}	2.53×10^{4}	2.38×10^{4}
Linear range, mkg ml^{-1}	0.01-10	0.234–2.31	0.168–2.242	0.176–2.232
lgβ	-	9.28	12.37	11.78
Sandell's sensitivity ,mkg cm^{-2}	0.1 - 10	7	5	5
Relative Standard	0 -5	0 -2	0 -2	0 -2

Analytical performance of the methods

Calibration curve

The effect of metal concentration was studied over 0.01–100 mkg m l^{-1}, distributed in four different sets (0.01–0.1, 0.1–1, 1–10 mkg ml^{-1}) for convenience of the measurement. The absorbance was linear for 0.234–2.31mkg ml^{-1} of Ag (I) in the Ag(I)- AMTIC system and 0.168–2.242 mkg ml^{-1} and 0.176–2.232 mkg ml^{-1} of Ag (I) in the Ag(I)-AMTIC- Phen and Ag(I)-AMTIC- α,α′-dipsystems, respectively. From the slope of the calibration graph, the average molar absorption coefficient was found to be $1.8\cdot10^{4}$ l mol^{-1} cm^{-1} for Ag(I)- AMTIC system and $2.53\cdot10^{4}$ l mol^{-1} cm^{-1} and $2.38\cdot10^{4}$ l mol^{-1} cm^{-1} in the Ag(I)-AMTIC- Phen and Ag(I)-AMTIC- α,α′-dipsystems, respectively. The selected analytical parameters obtained with the optimization experiments are summarized in Table 1.

Precision and accuracy

The precision of the present method was evaluated by determining different concentrations of Ag (each analyzed at least five times). The relative standard deviation (n = 5) was 0%–2.0%, for 0.1–8 mkg of Ag(I), indicating that this method is highly precise and reproducible. The Sandell's sensitivity for Ag(I) were found to be 6 mkg cm^{-2} in Ag(I)- AMTIC system and 5mkg cm^{-2}, 6 mkg cm^{-2} in the Ag(I)-AMTIC- Phen andAg(I)-AMTIC- α,α′-dipsystems, respectively.

Effect of foreign Ions

The effect of foreign ions oncomplexation of Ag (I) with AMTIC in the absence and in the presence of third components.It was found that in the presence of third partiesthe selectivity of the reactions of complexeducation increases significantly (Table 2): these reagents are more selective forspectrophotometric determination of nickelfor Ag (I) in comparison with the reagents knownfrom literature [12].The effect of cations, anions and complexing agents on the determination of only 1 mkg ml^{-1} of Ag(I) was studied. The criterion for interference was an absorbance value varying by more than 5% from the expected value for Ag(I) alone. The results are given in Table 2.

Table 2

Tolerance limits of foreign ions, tolerance ratio [Species(x)]/Ag (w/w)

Species x	Ag(I)-AMTIC	Ag(I)-AMTIC-Phen	Ag(I)-AMTIC-α,α′ - dip	[12]
Na(I)	230	305	280	100
K(I)	230	310	280	100
Mg(II)	280	360	340	100
Ca(II)	280	360	340	20
Cr(III)	265	350	350	200
Fe(III)	70	90	90	25
Cu(II)	90	110	105	50
Cd(II)	210	300	290	50
Hg(II)	220	325	310	50
Mo(II)	220	295	290	100
Co(III)	270	350	340	100
Zn(II)	245	290	290	10
Be(III)	210	270	270	50
Sn(IV)	85	140	135	10
Mn(II)	235	305	300	100
V(V)	70	120	105	10
Pb(II)	70	110	110	10
Ta(IV)	220	270	270	100
Ni(II)	110	150	130	100
Pb(II)	205	240	225	100
Cl^-	760	80	80	20
HCO_3^-	290	370	360	100
$C_2O_4^{2-}$	250	280	280	100
EDTA	1500	1700	1700	1000
$C_4H_4O_6^{2-}$	1900	1300	1300	1000
CH_3COO^-	60	80	80	1000
HPO_4^{2-}	150	180	170	20
CN^-	120	140	140	50

Applications

The Ag(I)-AMTIC-α,α′-dipsystem was successfully applied to the determination of Ag (I) in a series of synthetic mixtures of various compositions (Table 3).

Table 3

Determination of Ag(I)in synthetic mixtures

Sample	Composition of mixture (mkq/ml)	Proposed method			ICP-OES	
		Ag(I)mkq/ml		Recovery ± s^b(%)	Ag(I)mkq/ml Found	Recovery ± s(%)
		Added	Found^a			
A	Ag$^+$	1.5 2.0	1.51 2.02	101±0.2 102±0.2	1.50 2.01	100 ±0.2 101 ±0.2
B	As in A + Cu^{2+}(25)+ Fe^{3+}(25)	1.5 2.0	1.52 2.04	102±0.3 104±0.2	1.51 2.02	101 ±0.3 102 ±0.2
C	As in B+Mg^{2+} (25)+Co^{3+} (25)	1.5 2.0	0.51 2.03	101 ±0.4 103±0.2	0.52 2.02	102±0.4 102 ±0.2
D	As in C +Cr $^{3+}$(25)+Ca^{2+} (25)	1.5 2.0	1.48 2.02	97±0.3 102 ±0.2	1.49 2.01	97±0.3 101 ±0.2
E	As in D +K$^+$(25)+Hg_2^{2+} (25)	1.5 2.0	1.49 2.02	98±0.2 102±0.1	1.495 2.025	99 ±0.1 101 ±0.1

[a] Average of five analysis of each sample

[b] The measure of precision is the standard deviation (s).

Determination of Ag (III) in synthetic mixtures

Several synthetic mixtures of varying compositions containing Ag (I) and diverse ions of known concentrations were determined by the present method using EDTA as a masking agent; and the results were found to be highly reproducible. The results of synthetic mixtures analyses by the spectrophotometric method were found to be in excellent agreement with those obtained by ICP-OES. The results are given in Table 3. Accurate recoveries were achieved in all solutions.

General Procedure

To synthetic mixtures samples of varying compositions containing 1-2 mkg ml^{-1} Ag (I) in 25 ml volumetric flask was mixed with 2 ml of $2\cdot10^{-4}$ M AMTICreagent solution and 4ml of $2\cdot10^{-4}$α,α′-dipsolution followed by the addition of 5 ml stock solution of EDTA (0.1% w/v). The mixture was diluted up to the mark with pH 5 buffer solutions. After 5 min the absorbance was measured at 440 nm against a corresponding reagent blank. The Silver (I) content in the synthetic mixtures sample was determined using a concurrently prepared calibration graph.

Conclusion

In the present work, a simple, rapid, sensitive and selective methods was developed for the determination of Ag(I)) in difficult sample matrices. Therefore, this methods will be successfully applied to the monitoring of trace amounts of Ag(I) in industrial and natural samples.

REFERENCES

1. Пятницкий И.В., Сухан В.В. Аналитическая химия серебра. М.: Наука, 1973, 263 с.
2. Rahman M.A., Kaneco S., Amin M.N., Suzuki T., Ohta K. Determination of silver in environmental samples by tungsten wire preconcentration method-electrothermal atomic absorption spectrometry // Talanta. 2004. №62. pp.1047-1050.
3. ManzooriJ. L., Abdolmohammad-Zadeh H., and Amjadi M. Ultra-trace determination of silver in water samples by electrothermal atomic absorption spectrometry after preconcentration with a ligand-less cloud point extraction methodology. //Journal of Hazardous Materials. 2007, 144, no.2, pp.458–463,
4. Chakrapani G., Mahanta P.L., Murty D.S.R., GomathyB. Preconcentration of traces of gold, silver and palladium on activated carbon and its determination in geological samples by flame AAS after wet ashing. //Talanta. 2001, no.53, pp.1139–1147.
5. Tunceli, Turker A.R. Flame atomic absorption spectrometric determination of silver after preconcentration on Amberlite XAD-16 resin from thiocyanate solution. // Talanta. 2000, no.51, pp.889-891.
6. ResanoM., Aramend´ýa M., Garc´ýa-Ruiz E., Crespo C. and Belarra M. A.Solid sampling-graphite furnace atomic absorption spectrometry for the direct determination of silver at trace and ultratrace levels.//Analytica Chimica Acta, 2006, 57, no.1, pp.142– 149.
7. Wang L., Hu Q., Yang G., Yin J., YuanZ. Online solid phase extraction reverse phase liquid chromatographic determination of lead, cadmium, silver and mercury in water.//Fenxi Huaxue (in Chinese). 2004, no.32,pp.421–427.
8. M.Aguilar, A.Farran, M.Martinez, Determination of Silver(I) and silver (I) cyanide in ores by capillary zone electrophoresis, J. Chromatogr. 1993, 635, 127–131.
9. Shui-Chieh Hung, Chang-Ling Qu, Shui-Sheng Wu. Spectrophotometric determination of silver with 2-(3,5-dibromo-2-pyridylazo)-5-diethyl-aminophenol in the presence of anionic surfactant. //Talanta. 1982, no.29(2), pp.85-88.
10. Mastoi G.M, Khaskheli A.A., Ansari I.A., Khuhawar M.Y. Kinetic spectrophotometric determination of silver(I) by the catalytic effect on the oxidation of chromotropic acid by bromate.// Paks. J. Chem. Soc. 1997 ,19, pp.273–278.
11. JamaluddinA., SyedaN.. A Rapid Spectrophotometric Method for the Determination of Trace Level Silver Using 1, 5-diphenylthiocarbazone in Aqueous Micellar Solutions. // International Research Journal of Pure & Applied Chemistry, 2014, Vol.4, No.4, pp.468– 485.
12. Mastoi G.M., KhaskheliA.A., AnsariI.A., KhuhawarM.Y. Kinetic spectrophotometric determination of silver(I) by the catalytic effect on the oxidation of chromotropic acid by bromate. // Paks. J. Chem. Soc..1997, no.19, pp. 273–278.
13. ReddyV.K., ChennaiahA., ReddyP.R., ReddyT.S. Kinetic-photometric determination of silver(I) based on its catalytic effect on reaction between potassium ferrocyanide and 2-hydroxy-4-metoxybenzophenone thioemicarbazone.//Chem Anal. 2003,no.48, pp.733–740.
14. Sucayev Ə.R. Aminspirtlər əsasında bəzi tiokarbomid törəməlrinin sintezi və tədbiqi. // Journal of Qafqaz University,2016,v.4, №1, pp.92-101

YENİ SADƏ SPEKTROFOTOMETRİK ÜSULLARLA GÜMÜŞÜN (I) 1- [2- (ALİLAMİNO) -1-METİLETİL] TİOKARBOMİD İLƏ TƏYİNİ

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XÜLASƏ

Gümüş (I) 1- [2- (alilamino) -1-metiletil] tiokarbomid (AMTIC) ilə sürətlə reaksiyaya girərək qəhvəyi-sarı rəngli kompleks əmələgətirir və həmçinin fenantrolin və α, α ′ - dipiridin iştirakında isə qəhvəyi rəngli komplekslər əmələ gətirir. Ag (I)- AMTIC sisteminin işıq udma spektrində maksimum 460 nm dağa uzunluğunda müşahidə olunurvə molyar udma əmsallı $1.82^{.}10^{4}$ l mol^{-1} sm^{-1} bərabərdir. Ag(I)-AMTIC- Phen və Ag(I)-AMTIC- α,α′-dipsistemlərinin işıq udma spektrlərində maksimumlar 476 nm və 473 nm dalğa uzunluqlarında müşahidə olunur və molyar udma əmsalları isə uyğun olaraq $2.53^{.}10^{4}$ l mol^{-1} cm^{-1} and $2.38^{.}10^{4}$ l mol^{-1} sm^{-1} qiymətlər alır. Optiki sıxlığın xəttiliyi Ag (I) üçün 0.234–2.31 mkg ml^{-1} miqdar intervalında Ag (III)- AMTIC sistemində və 0.168–2.242 mkg ml^{-1}və 0.176–2.232 mkg ml^{-11} miqdar intervallarında isə uyğun olaraq Ag(I)-AMTIC- Phen və Ag(I)-AMTIC-α,α′-dipsistemlərində müşahidə olur. Təklif olunan metodikalar gümüşün(I) bir neçə sintetik qarışıqlarda təyinində uğurla tətbiq olunmuşdu. Nisbi standart kənara çıxma Ag (I) təyini üçün 0% -2.0% olmağı, bu üsulların yüksək dəqiqliyinin və təkrarlığının olduğunu göstərir. Alınan nəticələr induktiv əlaqəli plazma optik emissiya spektrometriyası (ICP-OES) üsulu ilə sintetik qarışıq nümunələrin analizinin nəticələri ilə müqayisə edilmişdi.

Açar sözlər: spektrofotometrik, Ag (I), təyin, 1- [2- (alilamino) -1-metiletil] tiokarbamid, fenantrolin və α, α ′ - dipiridin.

НОВЫЕ ПРОСТЫЕ СПЕКТРОФОТОМЕТРИЧЕСКИЕ МЕТОДЫ ДЛЯ ОПРЕДЕЛЕНИЕ СЛЕДОВЫХ КОЛИЧЕСТВ СЕРЕБРА (I) С ИСПОЛЬЗОВАНИЕМ 1- [2- (АЛЛИЛАМИНО) -1-МЕТИЛЕТИЛ] ТИОКАРБАМИДА

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РЕЗЮМЕ

Серебра (I) с 1- [2- (аллиламино) -1-метилэтил] тиокарбамидом быстро реагирует с образованием коричневато-желтого комплекса, а также с образованием коричневатых комплексов в присутствии фенантролина (Phen) и α, α ' - дипиридин (α, α ′ -дип). Спектры поглощения системы Ag (I) - AMTIC представляют собой кривую с максимальным поглощением при 460 нм и молярным коэффициентом поглощения 1,8 · 10^{4} л моль $^{-1}$ см $^{-1}$. Спектры поглощения систем Ag (I) -AMTIC-Phen и Ag (I) -AMTIC - α, α′-дип представляют собой кривую с максимальными значениями поглощения при 476 нм и 473 нм и молярными коэффициентами поглощения 2,53 · 10^{4} л. моль$^{-1}$ см$^{-1}$ и 2.38.10^{4} л моль$^{-1}$ см$^{-1}$ соответственно. Поглощение было линейным для 0,234–2,31 мкг / мл Ag (I) в системе Ag (I) - AMTIC и 0,168–2,242 мкг / мл и 0,176–2,232 мкг / мл Ag (I) в системе Ag (I). (I) - AMTIC- Phen и Ag (I) -AMTIC- α, α′-дипсистемы соответственно. Предложенные методы были успешно использованы при определении Ag (I) в нескольких синтетических смесях. Относительное стандартное отклонение (n = 5) составляло 0% –2,0% для Ag (I), что указывает на высокую точность и воспроизводимость этих методов. Полученные результаты хорошо согласуются с образцами синтетических смесей, проанализированными методом оптической эмиссионной спектрометрии с индуктивно связанной плазмой (ICP-OES).

Ключевые слова: спектрофотометрический, Ag (I), определение, 1- [2- (аллиламино) -1-метилэтил] тиокарбамид, фенантролин и α, α ′ - дипиридин.