SYNTHESIS AND RESEARCH OF STRUCTURE AND PROPERTIES OF COMPLEX COMPOUNDS OF DIVALENT COPPER WITH LIGANDS (HISTIDIN AND ARGENIN)

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Abstract: *new complex copper compounds with ligands (histidine and argenine) with the composition [$CuCl_2L(H_2O)]\ H_2O$, [$CuCl_2L_2$] , [$CuCl_2L\ (H_2O)]\ 3H_2O$ were synthesized. It is shown that the composition of the complexes obtained depends on the ratio of the initial components. The composition and structure of the complexes were studied by chemical analysis, IR spectroscopy, and thermogravimetry. The method of IR and UV spectroscopy showed that the ligands in the composition of the honey (II) complexes enter into the neutral form and are coordinated with the complexing agent through the nitrogen atom. The results of thermogravimetric studies have shown that the final product of the thermal decomposition of all compounds is copper oxide, respectively.*
Keywords: *nistidine, arginine, copper oxide, amine groups, complex compounds.*

СИНТЕЗ И ИССЛЕДОВАНИЕ СТРУКТУРЫ И СВОЙСТВ КОМПЛЕКСНЫХ СОЕДИНЕНИЙ ДВУХВАЛЕНТНОЙ МЕДИ С ЛИГАНДАМИ (ГИСТИДИН И АРГЕНИН)

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Аннотация: *синтезированы новые комплексные соединения меди со лигандами (гистидин и аргенин) с составом [$CuCl_2L(H_2O)]H_2O$, [$CuCl_2L_2]2H_2O$, [$CuCl_2L(H_2O)]3H_2O$]. Показано, что состав полученных комплексов зависит от соотношения исходных компонентов. Состав и строение комплексов исследованы методами химического анализа, ИК и УФ спектроскопии и термогравиметрии. Методом ИК-спектроскопии показано, что лиганды в состав комплексов мед (II) входят в нейтральной форме и координируются с комплексообразователем через атом азота. Результаты термогравиметрических исследований показали, что конечным продуктом термического разложения всех соединений является оксид меди соответственно.*
Ключевые слова: *гистидин, аргенин, оксида меди, аминных групп, комплексные соединения.*

INTRODUCTION

The chemistry of complex compounds of transition metals with multidentate ligands, which simultaneously contains several donor atoms, is not only theoretical but also of practical interest, since in addition to the unusual

properties of such complexes, the structure and types of binding of multidentate ligands with different metals give a new impetus to the development coordination chemistry as a whole. Among the coordination compounds, the complexes obtained on the basis of biomaterials take a special place. This is due to the fact that they play an important role in many biochemical processes and therefore are widely used in plant growing, animal husbandry, and pharmacology. In turn, the study of the properties and structure of coordination compounds of metal ions with organic ligands containing various donor centers was an important factor in the development of new approaches to their physico-chemical research [1-3].

On the other hand, complex compounds of many transition elements, including copper, can possess a wide range of useful properties, for which the chemistry of complex compounds has not yet been sufficiently studied [4-6].

In this paper, we present methods of synthesis and study of the properties of copper (II) complexes with ligands (histidine and argenine)

EXPERIMENTAL PART

The composition and chemical structure of the synthesis products obtained are studied by physical-chemical analysis methods: elemental analysis (İCP-MS); X-ray phase analysis (diffractometer (Germany) D-2 Phaser firm Bruker); IR spectroscopy ("Specord M-80" brand Carl Zeiss). The spectra of the reaction solutions in the IR and UV regions were recorded on the Nicolet IS10 spectrometer and the Evolution 60S spectrophotometer, manufactured by Thermo Scientific Spectronic (USA). Differential thermogravimetric analysis was performed on a derivative (NETZSCH STA 449F3 STA449FSA-0622-M)

Synthesis -[$CuCl_2L_2$]

A sample of 1.71 g (0.001 mole)-$CuCl_2$ $2H_2O$ was dissolved in a two-necked flask under reflux in 30 ml of ethyl alcohol at a temperature of 60 ° C, and 1.55 g (0.001 mole) of ligand L-histidine - (in a molar ratio of 1: 1) previously dissolved in 20 ml of ethyl alcohol. The resulting mixture was heated for 2 hours, then cooled to room temperature, filtered and put on crystallization. The beige-colored crystals were filtered, washed several times with the mother liquor, then 10-15 ml with acetone and dried in a desiccator over sulfuric acid until a constant weight was established.

Synthesis -[$CuCl_2L_2$]$2H_2O$

To a beige color solution obtained by dissolving 0.85 g (0.05 mole) -$CuCl_2$ $2H_2O$ in 20 ml of ethyl alcohol, 1.55 g (0.01 mole) of ligand L- histidine dissolved in 30 ml of ethyl alcohol (in a molar ratio 1: 2). The solution was heated for 2-2.5 hours at a temperature of 60°C. Further, the synthesis process was carried out according to the above described procedure.

Synthesis -[$CuCl_2L(H_2O)$] $3H_2O$

According to the above procedures, 1.74 g (0.01 mol) of ligand L- argenine (molar ratio 1: 1), previously dissolved in 20 ml of ethyl alcohol, was added to 1.71 g (0.01 mole) -$CuCl_2$ $2H_2O$ dissolved in 30 ml of ethyl alcohol, alcohol. The resulting mixture was heated for 2 hours, then cooled to room temperature, filtered, washed several times with the mother liquor, then 10-15 ml with acetone and dried in a desiccator over sulfuric acid until a constant weight was established.

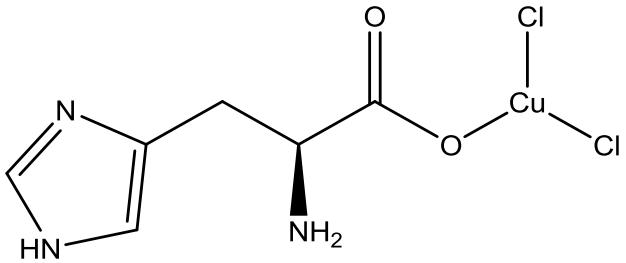


Fig. 1. The molecular structure of the ((L-histidyl)oxy) copper (III) chlorid

Chemical Formula: $C_6H_8Cl_2CuN_3O_2$

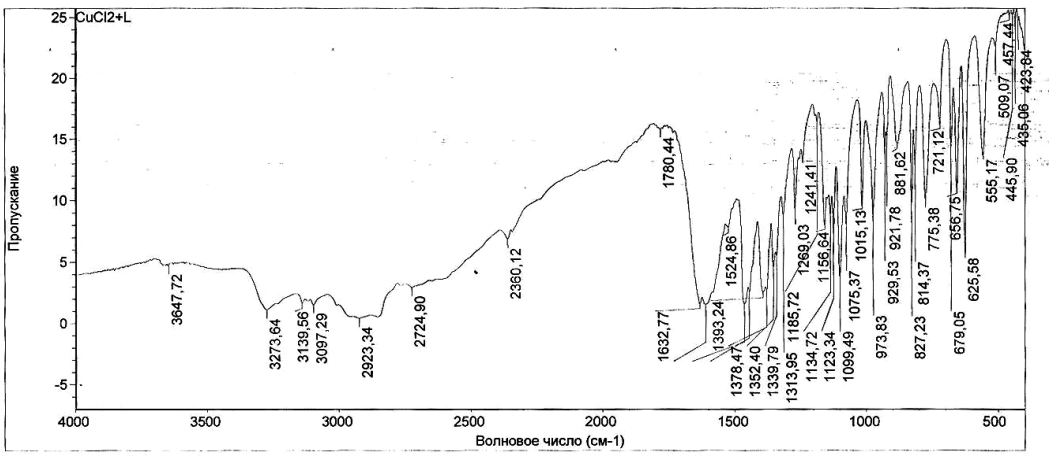
Exact Mass: 286.93

Molecular Weight: 288.60

m/z: 286.93 (100.0%), 288.93 (63.9%), 288.93 (44.6%), 290.92 (28.5%), 290.92 (10.2%), 287.93 (6.5%), 292.92 (4.6%), 289.93 (4.1%), 289.93 (2.9%), 291.93 (1.8%), 287.93 (1.1%) Elemental Analysis: C, 24.97; H, 2.79; Cl, 24.57; Cu, 22.02; N, 14.56; O, 11.09.

RESULTS and CONCLUSION

To determine the coordination character of the synthesized complex compounds formed between the ligand and the coupler, IR spectroscopic analysis was carried out. In the primary amine, the absorption spectra of the covalent vibrations of the NH bond as a function of the spectra of co-ordination absorption oscillations ν_{NH} = 3273.64 cm^{-1}, 3139.56 cm^{-1} shift to the lower area and the intensity is weakened, and ν_{OH} = 3447.72 cm^{-1} refers to the residues of the solvent, alcohol.



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ПОИСК ПИКОВ:
Спектр: CuCl2+L
Область: 4000,00 400,00
Порог: 25,641
Чувствительность80
Таблица пиков:

Положение:	423,84	Интенсивность:	24,712
Положение:	435,06	Интенсивность:	24,980
Положение:	445,90	Интенсивность:	25,221
Положение:	457,44	Интенсивность:	25,150
Положение:	509,07	Интенсивность:	22,655
Положение:	555,17	Интенсивность:	13,596

Fig. 2. IR spectra of complex[$CuCl_2L_2$]·$2H_2O$; L-arginin

When the IR spectra of the free ligand are aligned with the spectra of the complexes obtained, an obvious change is observed. The absorption bands due to the valence vibrations of the OH bond to the carboxyl group of the arginin 3300-3500 cm^{-1} in the mollusk disappear, and instead of the absorption bands ν_{COO} = 1632.77 cm^{-1} ; 1352 cm^{-1} relating to the carboxylate ion.

To determine the composition and thermal stability of the synthesized two complexes [$CuCl_2L$ (H_2O)] H_2O, [$CuCl_2L_2$] $2H_2O$ and [$CuCl_2L_2$] a thermal analysis was carried out and were determined.

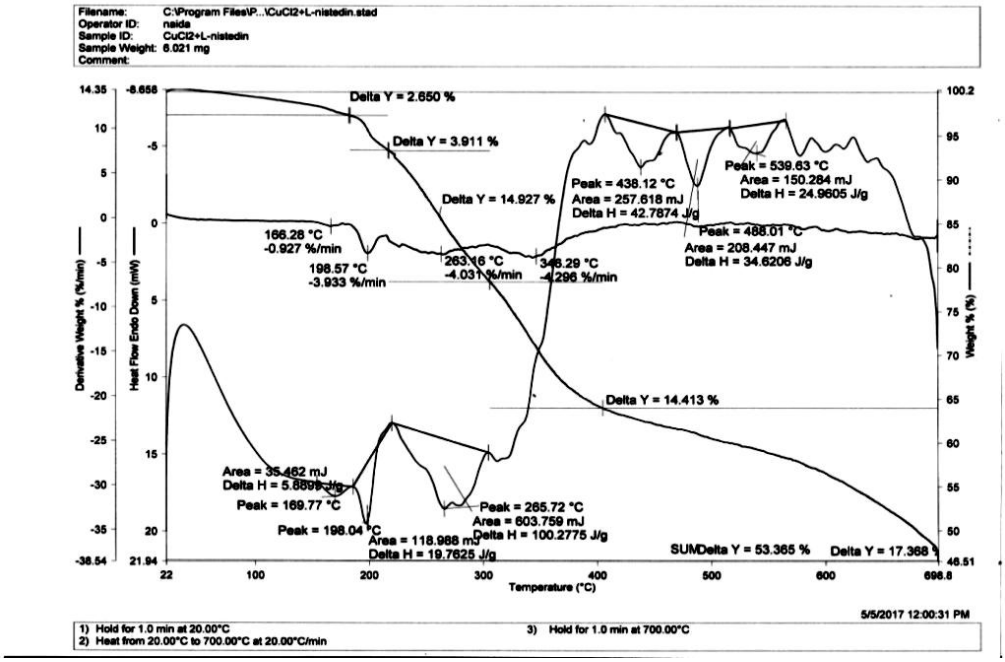

Fig. 3. [$CuCl_2L_2$] • $2H_2O$ complexity thermogrammogram. L - nistidine

Complexes are stable up to a temperature of 170°C. The thermal decomposition of [$CuCl_2L_2$] $2H_2O$ begins at a temperature of 170°C, with a mass loss of 2.65%, in the second stage, a decrease in mass corresponds to (3.91%), and this refers to 1 mole of water. In the third stage, mass loss is 14.93% and this corresponds to 1 mole

of ligand. At a high temperature, the destruction of complexes begins, which passes through several stages and in all cases of thermal processes the final product is CuO.

A solution of the complex $[CuCl_2L_2]\cdot 2H_2O$ in a concentration of 0.01 m and removed the ultraviolet absorption spectrum. It can be seen from the spectrum that the d-d transition refers to a wavelength of 590-620 nm.

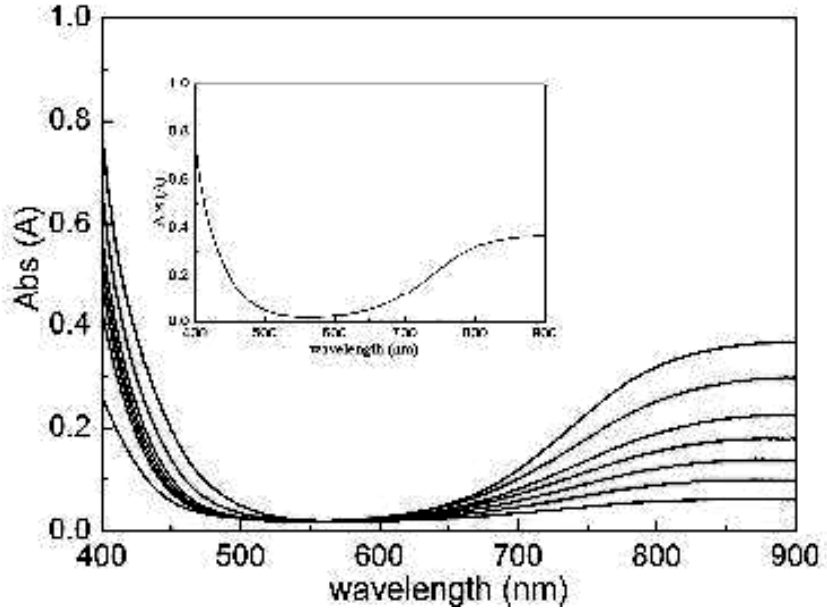

Fig. 4. $[CuCl_2L_2]$ Ultraviolet absorption spectrum of 0.01 M solution of $2H_2O$ complex

Thermocouple analysis was carried out to determine the composition and thermal stability of the complexes under study. Despite the fact that the derivatograms of the complexes are identical, they differ substantially in the nature of the thermal decomposition.

Results of thermogravimetric and X-ray phase studies have shown that the thermal decomposition of complexes occurs in three stages and in all cases the third stage of thermolysis is accompanied by oxidation of copper oxide.

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