STUDY OF THE CU(II) COMPLEX WITH ACYCLOVIR (2-AMINO-9-((2-HYDROXYETHOXY)METHYL)-1,9-DIHYDRO-6H-PURINE-6-OH)

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Abstract: In this article, the complex formation of acyclovir ($C_8N_5O_3H_{10}$) with Cu (II) and the physicochemical study of the complex compound [$(C_8N_5O_3H_9)_2Cu$] are studied.
Keywords: complex, copper, acyclovir, IR-spectroscopy, thermal analysis, ligand.

Introduction

In various fields of science and technology, the number of complex compounds themselves is increasing and expanding. In this article, the complexation of acyclovir (C8N5O3H10) with Cu(II) and the physicochemical study of the complex compound [(C8N5O3H9)2Cu] have been studied.

The interaction between acyclovir (ACV), an antiviral drug used to treat infection caused by the herpes simplex virus, and beta-cyclodextrin (beta-CD) was studied in solution and in the solid state. Binding in solution was evaluated using solubility and nuclear magnetic resonance spectroscopy (NMR). Solid-state X-ray diffraction, differential scanning calorimetry (DSC), and thermogravimetric analysis (TGA) were used. Solubility studies have shown that ACV and beta-CD exist in the complex in a 1:1 ratio. NMR spectroscopy studies have shown that the resulting complex is in a 1:1 stoichiometric ratio. X-ray diffraction analysis showed that ACV exists in a semi-crystalline state in a complex form with beta-CD. DSC studies have proven the existence of a new complex. When studying the solubility of solid ACV complexes, it turned out that it is more soluble than the simple drug acyclovir [1].

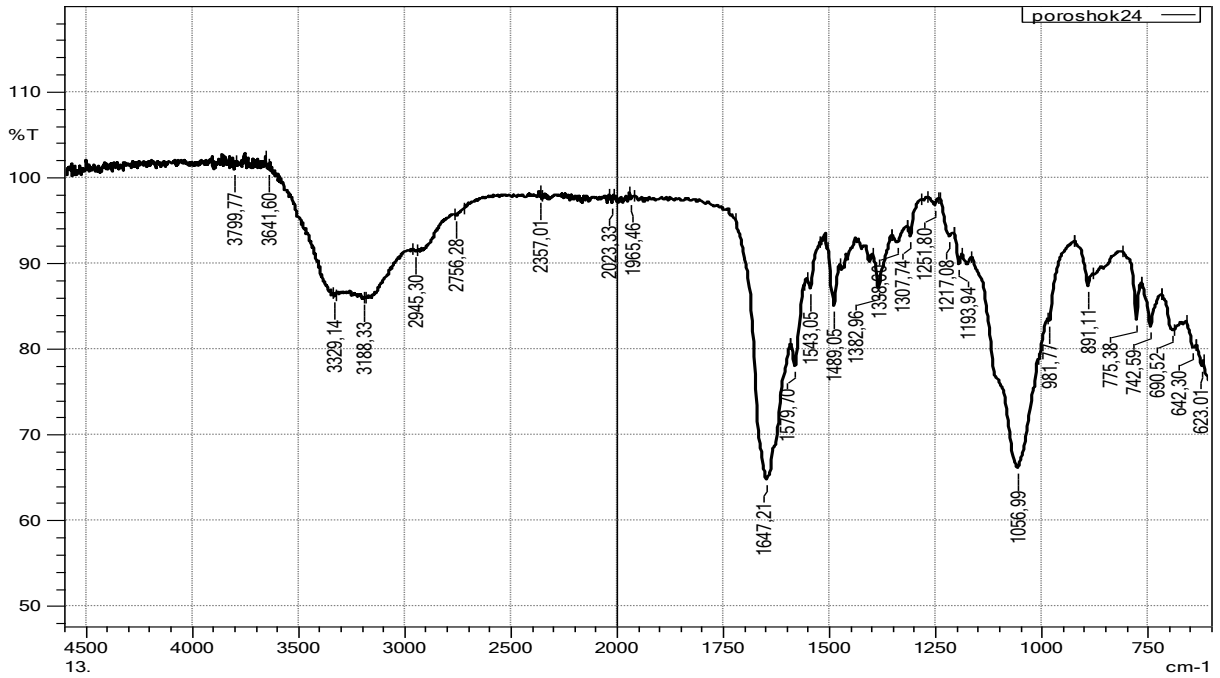
Methods for obtaining complex combinations of acyclovir with various metals have also been studied. It has been proved by spectroscopic methods that it is a complex compound with cobalt in a ratio of 2:1. This compound has also been used in pharmaceutical applications and to determine the concentration of drugs [2]. Complex combinations of the drug valaciclovir with a copper ion in a ratio of 1:1 to 1:10 were obtained, and activity against various microbial strains was studied in pharmaceutical studies [3]. A mixed-ligand aquacomplex of metallic copper with acyclovir was synthesized in the presence of nitric acid. The structure of the resulting complex compound was confirmed by X-ray diffraction crystallography [4]. The compounds [M(ACV)2(H2O)4]Cl2 2ACV (M = Ni II or Co II), [Zn(ACV)Cl2(H2O)]3 and the polymer complex [Cd(ACV)Cl2] H2O were synthesized. The structure of the obtained compounds was determined by optical methods [5]. Complexes of acyclovir containing phenyl

groups with platinum have also been studied and their biological activity has been proven. The level of toxicity and cellular effects of this compound were analyzed [6]. Germanium complexes containing citrate ions, arginine, and acyclovir have also been synthesized [7]. The composition of these germanium complexes was determined by high performance liquid chromatography [8].

Experimental part: To study the complex formation of Cu(II) with acyclovir, 0.001 M CuSO4, pH=6 and 0.002 M acyclovir; 0.004 M; 0.006 M; A solution of 0.008 molar ethanol at 20°C was used.

A number of ligand solutions were exposed to 0.001 M CuSO4 solutions one by one on a magnetic stirrer.

Air coloring of the metal sulfate solution turned green under the influence of acyclovir solutions. The compound was filtered, washed with ethanol, recrystallized and dried in a desiccator.



Picture. IR spectral analysis of the complex compound [Cu(L)2] Analysis of results

Physicochemical analysis, composition, and structure of the synthesized [Cu(L)2] complex were studied using an IR spectrum instrument (IK-Fourier, SHIMADZU, Japan).

According to the results of the analysis, the absorption frequencies due to the stretching vibrations of the OH group were observed in the spectral region 3329.14 cm-1, the stretching vibrations of the NH group 3188.33 cm-1 and >C=O-group. in the 1647.21 cm-1 region, the corresponding stretching vibrations were also observed, characteristic of the -NH2 scissors bond at 1579.70 cm-1 and vibration frequencies characteristic of the Su-N bond at 623.01 cm-1.

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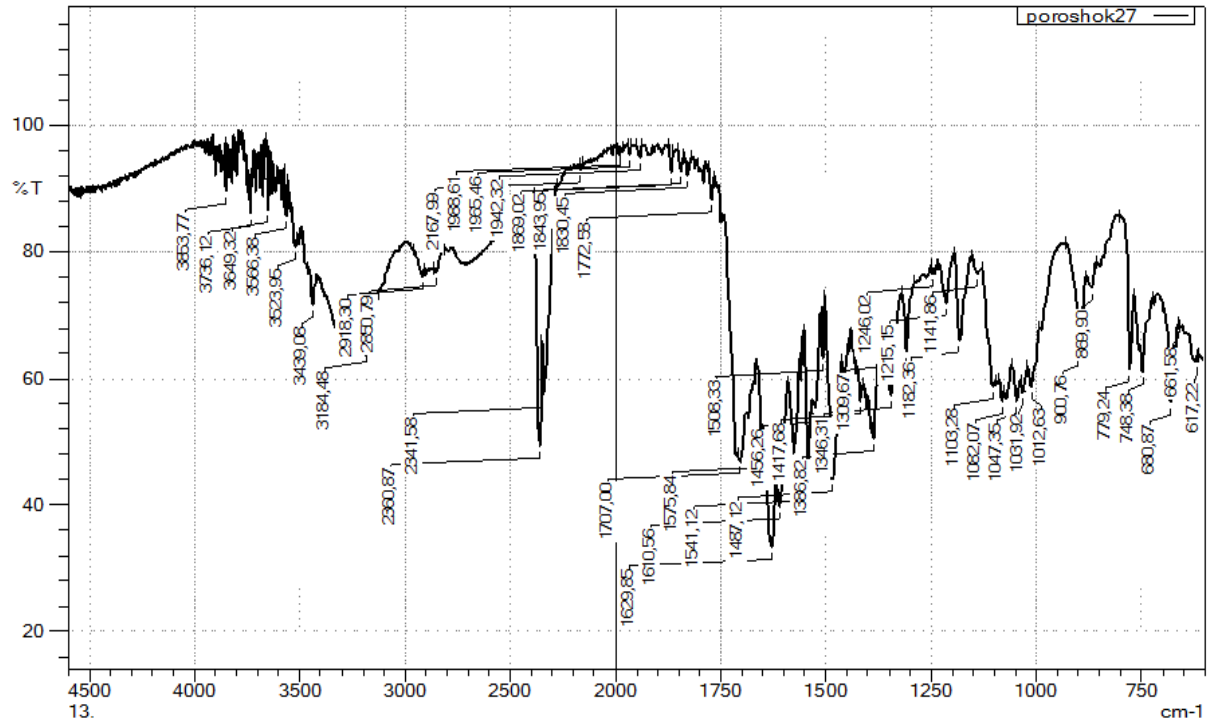


Picture 2. IR spectral analysis of the ligand

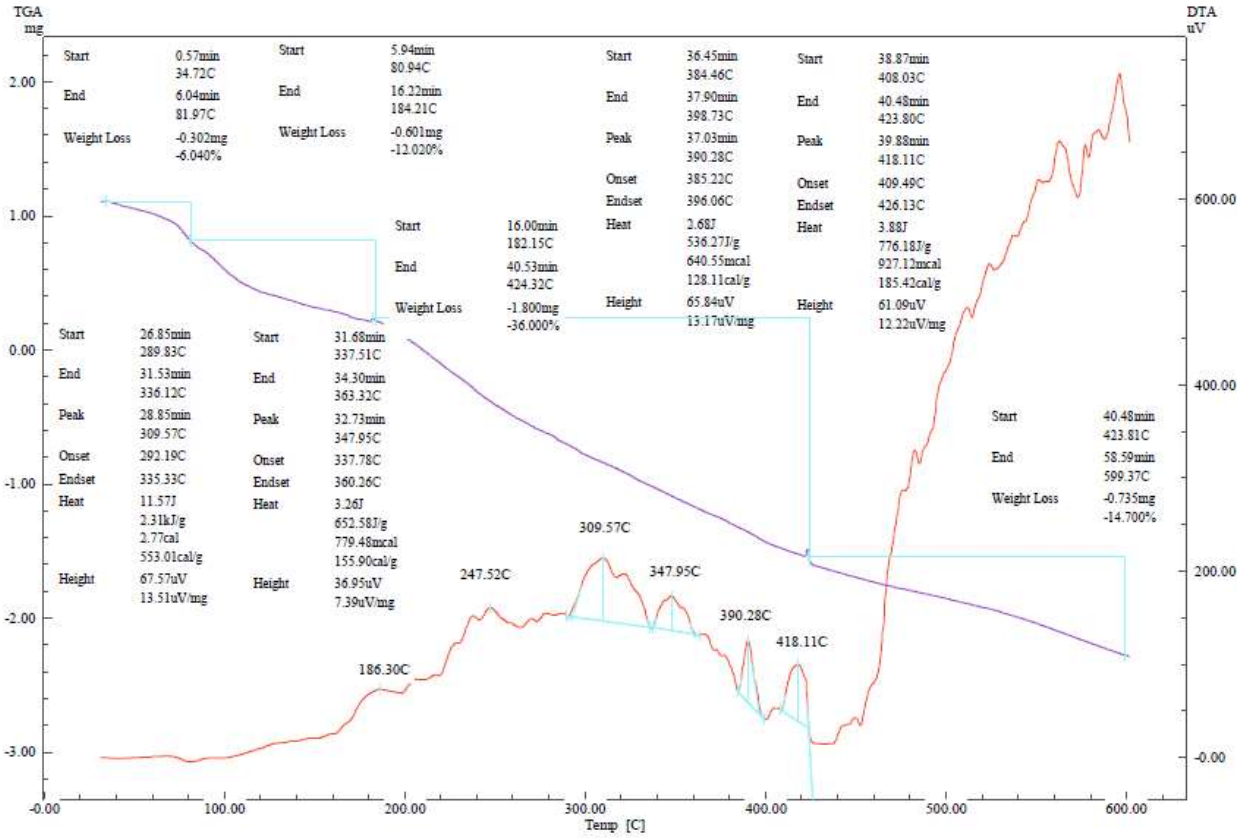
According to the results of the analysis, the absorption frequencies due to the stretching vibrations of the OH group were observed in the spectral region 3439.08 cm-1, the stretching vibrations of the NH group 3184.48 cm-1 and >C=O-group. in the region of 1629.85 cm-1, the corresponding stretching vibration, 1575.84 cm-1

Vibration frequencies characteristic of the -NH2 bond were observed.

The thermal stability of the synthesized substances was analyzed by differential thermal and thermogravimetric methods on a DTG-60 instrument from the Japanese company SHIMADZU. Investigated on a derivatograph at a speed of 10 deg/min, sensitivity of galvanometers T-900, TG-200, DTA-1/10, DTG-1/10, by automatic recording of the derivative.

Vibrational frequencies in IR spectra, cm-1		Connections
Ligand	$[Cu(L)_2]$	
3439,08	3329,14	OH
3184,48	3188,33	NH
1629,85	1647,21	>C=O
1575,84	1579,70	NH_2
-	623,01	Cu-N

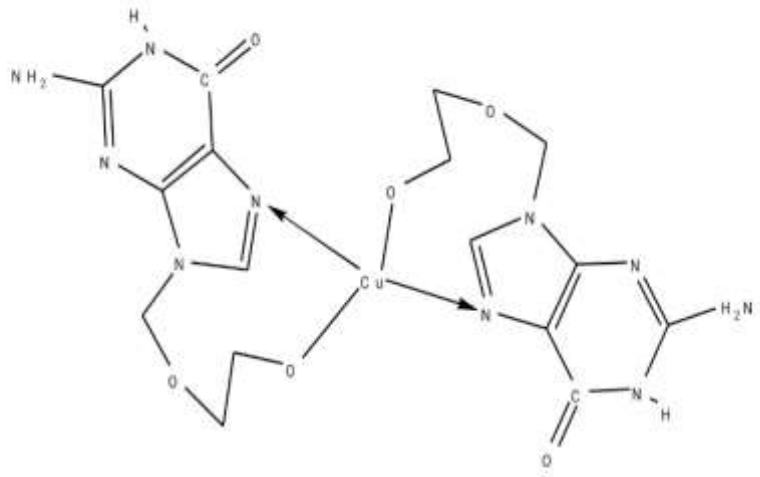
Table 1. IR spectral analysis of the ligand (acyclovir) and the complex compound



Thermal analysis of the complex compound [Cu(L)2]. The complex was studied at temperatures up to 600°C.

Figure 3. Thermogravimetric (TGA) and differential thermal derivatogram (DTA) of the complex compound [Cu(L)2].

The obtained analyzes show that the complex compound synthesized on the basis of Su2+ and acyclovir thermally decomposes in 4 stages. The first thermal decomposition starts at 34.72°C and takes 6.04 minutes to reach 81.92°C, ending with a weight loss of 6.040% due to outgassing of the compound. The second thermal decomposition took 16.22 minutes from 81.92°C to 184.21°C. This resulted in a weight loss of 12.020% due to the decomposition of water vapor in the mixture. The third thermal decomposition lasted from 184.21°C to 424.32°C for 16 minutes and resulted in a weight loss of 32% due to the decomposition of additives in the mixture. The fourth thermal decomposition took 40.48 minutes from 424.32°C to 599.37°C resulting in a weight loss of 14.70%. This ended with the liquefaction of the complex. Also in the DTA analysis 186.30; -247.50; -309; -57,347; At temperatures of 55, -390.27 and 418.11°C, four exothermic effects were observed - spatial transition temperatures.



Picture 4. Structure of the complex compound [Cu(L)2].

Summary In conclusion, we can say that a complex combination of Cu(II) with acyclovir has been obtained. Its IR-spectral and thermal analyzes were carried out, and the formulation of a new complex obtained as a result of research was proposed.

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