



ORIGINAL RESEARCH PAPER

Life Science

SYNTHESIS AND RESEARCH OF CYANIDE COMPLEXES OF CUPRUM (I) TO ARSENIC LIGANDS

**KEY WORDS:** 1. One Third Arsinine ,2.Arsenic Salt ,3.Cyanide ,4.Copper,5.Thermo-gravimetric Analysis

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ABSTRACT

Synthesis and of cyanide complexes of cuprum (I) to arsenic ligands is represented. We took arsenic iodide absolute alcohol (spirit) as arsenic ligands, which was taken to the admixture with the influence of the solution (in water) of plumbic nitrate by this general formula  $[Ar_3AsR]NO_3$  where  $Ar = -C_6H_5, -C_6H_4CH_3; R = -CH_3, -CH_2CH = CH_2, -C_6NH_2$ , which was added to potassium dicyandiamide (I) water solution and cryptocrystalline substance, which was filtered according to the rules after maturing mother chemical solution and we made an analysis to it. Into the mixed substances we determined arsenic by Evins's method, and cuprum – by the method of iodometry, we determined the coordinated formulas of the synthesized complex admixtures by analyzing electric conductivity of the diluted solutions in dimethyl-formamide solution. The outcomes of the research confirm that mixed (synthesized) admixtures are cationic-anionic complexes. The consistence and structure of synthesized compounds (admixture) were also established with the methods of spectroscopy and X-ray analysis. Transforming of the complexes towards heating is searched by thermo-graphic method. Synthesized (compound) complexes reveal biocide chemical influence towards the studied actinomyces.

**Aim:** The aim of this work is to make a research of the synthesis of tri aril- alkilarsonium dicyanoargentates and determine their physical and chemical features. It is likely that these compounds have high specific biological activeness, as they contain arsenic in their structural units, many different kinds of organic radicals, cyanide groups and cuprum (I).

**INTRODUCTION:** Ethers of arsenic acid with the general formula  $(RO)_3As$  are easily hydrolyzed with water, one third arsines,  $R_3As$  where R – might be of alkyl, alkinel or aril radical, are also easily corroded by air oxide. That's why we made an experiment of the synthesis of the arsenic organic compounds in an environment of dry inert gas (carbon dioxide gas or argon) we used diethyl ether, tetra-hydro furan, benzoline, ethyl alcohol and other solutions for solving, which were carefully cleaned and dried [1].

“White arsenic” was cleaned according to the methodic [2]. We got arsenic acid ethers by intervening high range of atom spirit on it [3]. Symmetrical triarilararsines  $Ar_3As$  were synthesized on arsenic acid ethers by appropriate griniaris reactive effect [4]. We got secondary chlorine arsines by methodic [5], and alkyl magni-bromide effect on it – appropriate asymmetric one third arsines are adopted by general formula  $Ar_2AsR$  [6].

Arsonium iodides are adopted by chemical reaction of methyl iodide or allyl iodide on symmetric, mixed radicals one third arsines [7].

Researches for studying the features and synthesis of copper (I) cyanide complexes were not very frequent [8]. As for the cationic and anionic complexes with the consistence  $[Ar_2AsR][Cu(CN)_2]$  where Ar – aril, R – alkyl or alkenyl change in wide limits, are not found in literature and information about them is very rare. Although, polyphenism of the compounds as a rule, gives us the opportunity to use them in practice [9].

**Experiment:** In the samples of the research we determined the percentage of the arsenic consistence by commonly known Evins's method [13], cuprum by iodometric method [14], carbon dioxide, hydrogen and nitrogen were also determined in some samples by commonly known burning method.

infrared spectrums of arsenic organic ligands and also synthesized four times substituted arsonium dicyan substance (I) coordinative compounds were taken to UR-20 spectro-photometer according to the generally known rule. The samples were mashed in Vaseline:

We were making thermos-gravimetric research on the derivative graph by Paulic-Paulic-Erday system, which gave us the opportunity to simultaneously adopt four thermal curve (graph), which describe current processes related to the heating of the studied samples. Describing and recording of the derivative graphs lasted for two hours in normal atmospheric pressure and moisture. The sensitivity of ДТГ was 1/5, DTG-1/20 and the exactness of the temperature was  $\pm 50^\circ C$ . Comparing standard was heated aluminum oxide. 100 mg of the sample was placed on the

platinum holder which had a shape of a plate, and the speed of the heating was 10°/min.

Electric conductivity of the studied substances were measured in cleaned and fresh dimethyl formamide solution on 250C. For that we used conduct-meter of the “impulse” brand with the exactness of  $\pm 1,5\%$ . We used water thermostat to reach temperature conservation on  $\pm 0,50$  C exactness, electric conductivity of each solution was measured several times until getting equal results.

X-ray observation of the samples was done in the researching laboratory of nonorganic chemistry and electric chemistry on the DPOH-3M diffractometer. Illuminating was done on CuK ray, on the regime of 30 sq, 30 ma, 2/min 720 mhr.

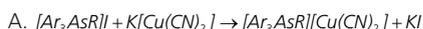
Tri-phenyl methyl arsonium diayan substance (I); synthesis is adopted with 1,06 gr plumbum (II) acetate solution on room temperature and 2,5 gr tri-phenyl methyl arsonium iodide spirit solution (1:1) is added to it. Immediately the solvate of yellow colour is adopted (Pbl2), which is delayed for 2 or 3 hours in the mother (main) solution for getting complete solvate. Solution of 0,50 gr cuprum cyanide and 2,52 gr kalium cyanide compound is prepared. Kalium dicyan solution adopted in such way is added in conditions of constant stirring, as a result of the intercourse of plumbum (II) acetate and tri-phenyl methyl arsonium iodide we adopt filtrate. Cryptocrystalline substance is precipitated, which is filtered after 2 hours and is washed with bidistilled water, then it is dried until the fixed mass is adopted and finally it is analyzed. 1,30 gr of tri-phenyl methyl arsonium dicyan substance(I) is adopted, which contains 53,3% of theory.

Such kinds of experiments were also made in order to adopt the rest of the arsonium dicyan substances.

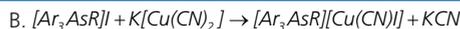
**The results of the experiment and review:** Receiving and adopting applied product is conditioned with the unity of the following sequential chemical reactions.

- I.  $2[Ar_2AsR] + Pb(NO_3)_2 \rightarrow Pbl_2 + 2[Ar_2AsR]NO_3$
- II.  $KCN + CuCN \rightarrow KCu(CN)_2$
- III.  $[Ar_2AsR]NO_3 + K[Cu(CN)_2] \rightarrow KNO_3 + [Ar_2AsR][Cu(CN)_2]$

The tri aril- alkilarsonium iodide usage to get final product by the following chemical reaction given below:

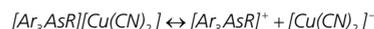


This reaction also produces complex compounds with mixed ligands apart from dicyan-produced substances.

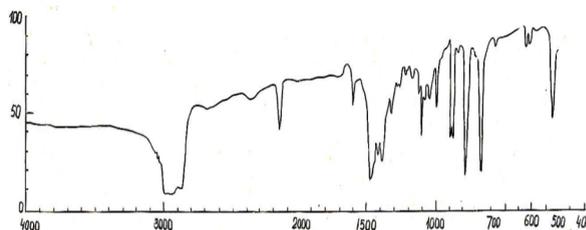


Differentiating A and b reaction products with common methods (such as – precipitation, crystallization etc.) is impossible. In order to get applied product in individual condition the III chemical reaction is more convenient. It should also be mentioned, that we have almost the same results if we use plumbum acetate in order to get soluble arsonium salts which are substituted four times.

Coordinated formulas of synthesized complexes were determined according to the mixed solutions and their molar electrical conductivity data, because arsonium dicyan products (I) are insoluble in water and their electric conductivity had been analyzed in dimethyl formamide solution. The results of the research are given in the schedule #1. As this schedule shows us, molar electric conductivity of the adopted compounds stands from 59 to 71  $\text{ohm}^{-1} \cdot \text{cm}^2 \cdot \text{mol}^{-1}$  which is appropriate to double ionic electrolytes' electric conductivity [10]. On the basis of this fact we can conclude, that synthesized compounds are cationic anionic complexes, which dissociate in dimethyl formamide solution with the following ionic equation:



The consistence and structure of the synthesized compounds, apart from element analysis and molar electric conductivity, it was studied also by the method of spectroscopy. As it is known [8], cyanide complexes are characterized with  $CN^-$  group coordination and according to this, crystal products wide option. On the basis of the X-ray analysis, it was concluded, that arsonium dicyan product (substance) of four times substitute, have trigonal coordination, where it is related to two groups of  $CN^-$  by carbon dioxide atom, anion has the shape of spiral chain, which consists of cuprum atoms and  $CN^-$  groups [11]. Spectrums of synthesized compounds show, that change of the kalium with bigger complex cation of the arsonium in dicyan products does not cause crucial change of the coordination correlation with  $CN^-$  group producers. It means that crystal structures are basically saved. For example, three systems of devouring stripes (bars) can be seen in devouring spectrums of dicyan substances (I) of the arsonium of four substitute [pict. 1] as it happens in case of kalium dicyan substance spectrum. In all synthesized compounds' spectrum can be seen stripes of devouring, which are conditioned by phenyl group vibrations:



PICT. 1. Tri-phenyl Ethyl Arsonium Dicyan Substance (i) Devouring Spectrum In Vaseline Oil

1580, 700, 740, 3000-3080  $\text{cm}^{-1}$ . As-C stripes of devouring of the bindings are marked with close to the 625  $\text{cm}^{-1}$ , which indicates, that within this time the arsenic is in  $SP^3$  hybrid condition [7]. #4 and 5 complexes (schedule 1) in infrared spectrums are devouring stripes in 1700-1720  $\text{cm}^{-1}$  unit, which is commonly equaled to C=O valence vibrations, apart from the devouring stripes of the carbonyl group, devour can be seen in it, which is caused by binding valence vibrations. In 3050-3550  $\text{cm}^{-1}$  unit [12]. Though, the intensiveness of these stripes is radically decreased compared to the appropriate individual acid amides, which affirms the existence of the amidic radicals in cationic complex consistence of the synthesized compounds.

It is crucial to mention the reaction of the studied complexes towards heating. The thermo-gravimetric analysis showed, that their thermolysis flows almost alike.

It should also be mentioned, that in order to reveal the synthesized compounds we made researches on several microorganisms. The results of the research show, that given substances reveal biocide reaction towards the studied actinomycetes.

**CONCLUSION.** It is shown, that di-aril di-alkyl and tri-aril alkyl-arsonium iodides and plumbum (II) acetate intercourse product and with its reaction we adopt arsonium dicyan substances (I) of four times substitute within the process of abundant cyanide equation on cuprum (I) cyanide solutions.

schedule N1

**Cyanide complexes of cuprum (I) to arsenic ligands  $[Ar_3AsR][Cu(CN)_2]$  melting temperature and its molar electric conductivity and the results of the element analysis**

N	Ar	R	T melting, °C	Molar electric conductivity in dimethyl formamide 25° C $\text{ohm}^{-1} \cdot \text{cm}^2 \cdot \text{mol}^{-1}$	result %	found, %		formula	calculated, %	
						As	Cu		As	Cu
1	C <sub>6</sub> H <sub>5</sub>	CH <sub>3</sub>	128-129	528	53,3	16,76	14,0	C <sub>21</sub> H <sub>18</sub> AsCuN <sub>2</sub>	17,18	14,55
2	θ-CH <sub>3</sub> C <sub>6</sub> H <sub>4</sub>	CH <sub>3</sub>	93,94	63,6	56,7	15,24	12,96	C <sub>24</sub> H <sub>24</sub> AsCuN <sub>2</sub>	15,67	13,27
3	C <sub>6</sub> H <sub>5</sub>	CH <sub>2</sub> = CH - CH <sub>2</sub>	72-73	61,8	57,4	15,68	13,28	C <sub>23</sub> H <sub>20</sub> AsCuN <sub>2</sub>	16,22	13,73
4	C <sub>6</sub> H <sub>5</sub>	CH <sub>2</sub> = C $\begin{matrix} // \\ \backslash \\ \text{NH}_2 \end{matrix}$	162-163	68,4	48,0	15,16	13,02	C <sub>22</sub> H <sub>19</sub> AsOCuN <sub>3</sub>	15,64	13,21
5	θ-CH <sub>3</sub> C <sub>6</sub> H <sub>4</sub>	CH <sub>2</sub> = C $\begin{matrix} // \\ \backslash \\ \text{NH}_2 \end{matrix}$	115-116	70,6	48,9	14,02	11,96	C <sub>25</sub> H <sub>25</sub> AsOCuN <sub>3</sub>	14,38	12,18

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