SYNTHESIS OF NEW BROMINE ACETYLENE DITHIOCARBAMATES DERIVATIVES AND THEIR GROWTH-STIMULATING ACTIVITY.

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Abstract
The proposed article relates to organic chemical synthesis and the study of new bromo-acetylene dithiocarbamates, the chemical properties of 1-isothiocyanate and 1-thiolacetylene esters of bromo-substituted benzoic acid, which are crystalline substances that are readily soluble in many organic solvents and insoluble in water. The structure of the bromine derivatives of acetylene dithiocarbamates was established by elemental analysis, IR and PMR spectroscopy. A probable mechanism of the interaction of 1-thiopropargyl ethers with 1-isothiocyanato-propargyl ethers is presented. With an increase in the nucleophilicity of the -SH groups, the rates of addition and the yields of the final products increase, with a decrease in basicity and an increase in steric factors of the radicals, the rates of yield of the reaction products decrease slightly.

Comparative tests show that the test derivative of the drug 1 - [(ortho-bromobenzoate-propynyl) -1-hydroxyphosphonic acid] has a higher growth-promoting activity.

Key Words: derivatives, acetylene, carbanions, dithiocarbamates, esters, isothiocyanate, thiolacetylene, propargyl ethers, analysis, spectroscopy, mechanism, growth-stimulating activity.

INTRODUCTION
In recent years, work has been carried out to find new, more effective low-toxic drugs among sulfur compounds, since the presence of a sulfur atom in the molecules of organic compounds increases pharmacological, physiological, biological activity, while reducing toxicity, and also displays antiinflammatory, antimicrobial, antifungal, anti-tuberculosis and other properties [1-6].

SIGNIFICANCE OF THE SYSTEM
The paper mainly focuses on how the chemistry of bromine acetylene dithiocarbamates. The study of literature survey is presented in section III, Proposed methodology and discussion is explained in section IV, section V covers the experimental results of the study, and section VI discusses the future study and Conclusion.

LITERATURE SURVEY
It is known that acetylene, diacetylene derivatives have various types of biological activity. So, acetylene, diacetylene, thiacetylene, thiocyanatoacetylene esters containing aromatic and heteroatom substituents possess pesticidal, herbicidal, fungicidal, insecticidal, growth-promoting, antitumor, anticholinergic and many other activities. [7-12]. The literature [13-19] describes the synthesis of various acetylene sulfides, sulfoxides with an end triple bond. However, information on the synthesis of 1-thiopropargyl containing benzoates and their derivatives of the type has been little studied in the literature. These little-known compounds essentially represent a new kind of compounds whose properties are hardly studied.

PROPOSED METHODOLOGY AND DISCUSSION
In this regard, we obtained 1-isothiocyanato- and 1-thiolacetylene esters of bromo-substituted benzoates. For the synthesis of this kind of isothiocyanates, thiol by reaction with thiocyanate, hydrosulfide of alkali metal, we used bromo-substituted benzoates obtained from 1-bromoacetylene esters according to the scheme:

\[
\begin{align*}
\text{XCOOCH}_2\text{C}=\text{C}=\text{C}=\text{S} & \xrightarrow{\text{Py, HCl}} \text{XCOOCH}_2\text{C}=\text{C}=\text{C}=\text{H} + \text{Cu}_2\text{Cl}_2 \\
\text{XCOOCH}_2\text{C}=\text{C}=\text{C}=\text{Cu} & \xrightarrow{\text{Br}_2, 2\text{CuBr}} \text{XCOOCH}_2\text{C}=\text{C}=\text{C}=\text{Br}
\end{align*}
\]

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The IV reaction was carried out in anhydrous ethyl alcohol at a temperature of 76-80 °C in an atmosphere of dry nitrogen with a yield of 79-86%.

The reaction V of the product was carried out by reacting 1-bromopropargyl ether of orthobromobenzoic acid with sodium thiocyanate at a temperature of 52-54 °C for two hours with stirring in the presence of organic solvents (acetone, ethanol).

It was found that in a dilute sodium hydrosulfide solution, the reaction mixture is weak and the yield of the target products is negligible. When using a saturated solution, the reaction proceeds selectively, easily, smoothly and the yield of the target product is much larger, the products of which have a weak characteristic odor of 1-thiols. Derivatives of 1-isothiocyanate and 1-thiolacetylene esters of bromosubstituted benzoates are crystalline substances that are readily soluble in many organic solvents and insoluble in water.

Physico-chemical parameters of the derivatives of brominated 1-thiol and 1-isothiocyanate acetylene esters of benzoates (IV and V) are shown in table 1.

Purification of 1-isothiocyanate and 1-thiolacetylene esters, bromine-substituted benzoates was carried out using preparative thin-layer chromatography on Al₂O₃ in a benzene-hexane system (24:1). To prove the structure of 1-isothiocyanate and 1-thiolacetylene esters of bromo-substituted benzoates, the method of IR and PMR spectroscopy was used (table 2.)

The following absorption bands are present in the IR spectrum:

- \(-\text{C\text{=}C\text{-}}\) (2222-2230 cm\(^{-1}\));
- \(-\text{SH}\) (2544 cm\(^{-1}\));
- \(-\text{C\text{=}O}\) (1728 cm\(^{-1}\));
- \(-\text{Br\text{=}Br}\) (770-735 cm\(^{-1}\));
- \(-\text{C\text{=}C\text{=}N\text{=}C\text{=}S}\) (2032 cm\(^{-1}\)).

### Table 1. Physicochemical parameters of preparations IV and V

| № | Structural formula | Yield, % | M. T., °C | Rf | Bruttoformula | Elemental analysis, % |
|---|------------------|----------|-----------|----|---------------|---------------------|
| IV | \[\text{X} \quad \text{COOCH}_2\text{C\text{=}C\text{-SH}}\] | 83.7 | 60-61 | 0.64 | \text{C\text{=}SBrO}_2 | N: 11.78; S: 11.79 |
| V | \[\text{X} \quad \text{COOCH}_2\text{C\text{=}C\text{=}N\text{=}C\text{=}S}\] | 80.4 | 119-120 | 0.71 | \text{C\text{=}SBrNBr}_2 | N: 10.83; S: 10.77 |

### Table 2. IR and PMR spectra

| № | R- | IR spectra, cm\(^{-1}\) | PMR spectra - \(\delta\), m.d. |
|---|----|-----------------------|-----------------------------|
| IV | Br | 2544 2222 - - 1728 770-735 2.13 4.65 6.2-7.4 |
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| V | Br | - | 2230 | 2032 | 2145 | 1730 | 770-742 | - | 4.63 | 6.1-7.5 |
|---|---|---|------|------|------|------|--------|---|------|--------|

The following absorption bands are present in the IR spectrum:

\[ \text{C} = \text{C}^- \quad (2222-2230 \text{ cm}^{-1}); \quad \text{C} = \text{N}^= \text{S}^- \quad (2032 \text{ cm}^{-1}); \quad \text{S} \quad (770-735 \text{ cm}^{-1}); \]

In the 1-thiolacetylene ester PMR spectra, signals that are in the range of 6.2-7.4 and 6.1-7.5 m.d. belong to the protons of the o-bromo-substituted benzene ring, signals from protons of \(-\text{O-CH}_2\)- and \(-\text{SH}\) are at 4.65 and 2.13 m.d. respectively.

In addition, the chemical properties of 1-isothiocyanate and 1-thiolacetylene esters of bromo-substituted benzoic acid have been studied.

It was established that group \(-\text{N}^=\text{C}^=\text{S}\) and \(-\text{SH}\) easily react according to the Am mechanism in the presence of dimethylformamide and triethylamine at a temperature of 78-85 °C for 5 hours with the formation of 1-(o-bromo-benzoate-propynyl)-1-(o-bromo-benzoate-propynyl) - dithiocarbamate. Chemical reaction of 1-isothiocyanate-propargyl esters of substituted benzoic acids with 1-thiol of propargyl esters of orthobromobenzoic acid was carried out as follows:

\[
\begin{align*}
\text{Br} & \quad \text{O} \quad \text{CH}_2 \quad \text{C} = \text{C}^- \quad \text{N}^= \text{S}^- \quad \text{O} \quad \text{C} \\
\text{DMFA} & \quad \text{Et}_3\text{N} \\
\text{Br} & \quad \text{O} \quad \text{CH}_2 \quad \text{C} = \text{C}^- \quad \text{N}^= \text{C}^- \text{S}^- \quad \text{C}^- \quad \text{CH}_2 \quad \text{O} \quad \text{C} \\
\end{align*}
\]

The high density, selectivity and easy mobility of the electron cloud of group \(-\text{C} = \text{C}^- \quad \text{N}^= \text{S}^-\) determine its high reactivity. Yields of products amounted to 85%. As expected, products with good Am reaction yields were obtained.

The physicochemical characteristics of the derivatives of bis-propynilnedithiocarbamates are apparently due to the high density and easy mobility of the electron cloud of the super-conjugated \(-\text{C} = \text{C}^- \quad \text{N}^= \text{C}^- \text{S}^-\) group, which leads to an increase in the positive charge on the carbon atom of the isothiocyanate group, facilitating the attack of this atom by a nucleophilic agent, and also regarding the question is whether this occurs due to an increase in the positive charge on the carbon atom or due to the stabilization of the transition state. However, in our cases, the \(-\text{SH}\) thiol group, having a free pair, attacks the electrophilic center in the 1-isothiocyanate molecule of propargyl ethers with the formation of intermediate product (B), which then regroups into the final reaction product. Based on our assumptions and published data, the probable mechanism for the interaction of 1-thiolpropargyl ethers with 1-isothiocyanate propargyl ethers can be represented by the scheme:

\[
\begin{align*}
\text{Br} & \quad \text{O} \quad \text{CH}_2 \quad \text{C} = \text{C}^- \quad \text{N}^= \text{S}^- \quad \text{O} \quad \text{C} \\
\text{Br} & \quad \text{O} \quad \text{CH}_2 \quad \text{C} = \text{C}^- \quad \text{N}^= \text{C}^- \text{S}^- \quad \text{C}^- \quad \text{CH}_2 \quad \text{O} \quad \text{C} \\
\end{align*}
\]
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The structure was established by IR spectroscopy and elemental analysis. Some characteristics and spectral data of the derivative of bis-(propynylbenzoates) substituted dithiocarbamates (V) are shown in table 4.

| No | IR spectra, cm⁻¹ | PMR spectra - δ, m.d. |
|----|-----------------|------------------------|
|    | Structural formula | Calculated for C₈H₆Br₂O₆, %: | Found, %: |
|    |                  | N                  | S       | N       | S       |
| V  | 1126 2220 1730 770-735 1112 1008 | C 37,63; H 1,76; Br 50,09. | C H Br 37,74; 1,88; 50,26. |

With an increase in the nucleophilicity of -SH groups (in the presence of Et₃N or Py), the addition rates and yields of the final products increase; with a decrease in basicity and an increase in steric factors of the radicals, final product yields decrease slightly.

The structure of the first synthesized derivative of bis-[(propynyl-benzoate) -substituted dithiocarbamate] (V) was established by IR spectroscopy and confirmed by elemental analysis.

In the IR spectra of the derivative of bis-[(propynyl-benzoates) dithiocarbamates], the absorption band of the stretching vibrations of the -SH groups (1126 cm⁻¹) is characteristic; -O-CH₂- groups (1720 cm⁻¹); and -C≡C- groups (2200 cm⁻¹). 

EXPERIMENTAL PART

Synthesis of propargyl ether 0-bromobenzoylarnate

2,15 g (0,01 mol) of orthobromobenzoic acid and 10 ml of absolute propinol are placed in a flask. Then 1,58 g of tetrachlorosilicon is added, the reaction mixture is heated to boiling for 30 minutes.

Propargyl ether of orthobromobenzoic acid is obtained with a yield of 2,17 g (91 % of theory); Mp = 74-75 °C

Found, %: C 50,21; 2,87; H Br 33,30. Calculated for C₈H₆Br₂O₆, %: C 50,23; H 2,92.

Synthesis of 1-bromopropargyl ether of orthobromobenzene (a)

1-copper of orthobromobenzoic acid propargyl ether was placed in a two-necked flask equipped with a stirrer and 100 ml of dry ethyl ether was added dropwise. 1,6 g (0,01 mol) of liquid bromine was added dropwise with vigorous stirring. Then the reaction mixture was still stirred for 2 hours at room temperature. After this time, the contents of the flask were filtered off and the filtrate was evaporated. 1-bromo propargyl ether of orthobromobenzoic acid is a crystalline substance of light cream color.

The product yield is 2,84 g (89,4 % of theory). Mp = 54-55°C. 

Found, %: C 37,74; H 1,88; Br 50,26.

1-bromo PE ortho-bromobenzoate (b)

2,15 g (0,01 mol) of orthobromobenzoate propargyl ether in 50 ml of diacine and a freshly prepared solution of sodium hypobromite (8 g of sodium hydroxide, 40 ml of water, 75 g of crushed ice, 2,5 g of bromine) were stirred for 9 hours. Orthobromobenzoate 1-bromopropargyl ether was synthesized at 20-25 °C according to the known method [20] with a melting point of 54-55 °C. The yield is 2,94 g (89,4 % of theory). 

Found, %: C 37,63; H 1,76; Br 50,09. Calculated for C₁ₒH₁₂Br₂O₂, %: C 37,74; H 1,88; Br 50,26.

1-isothiocyanate of propargyl ether of orthobromobenzoate

3,2 g (0,01 mol) of 1-bromo-propargyl ether of orthobromobenzoate with 108 ml of absolute acetone is placed in a three-necked flask with a capacity of half a liter, equipped with a mechanical stirrer, reflux condenser and dropping funnel; alcohol solution of sodium thiocyanate 10,55 g (0,13 mol) and 100 ml of absolute ethanol are added dropwise gradually with stirring. The reaction mixture is heated to a temperature of 52-54 °C in a water bath for 2 hours with stirring.

Then the contents of the flask are transferred to a separatory funnel, diluted with 100 ml of water and extracted twice with

| Table 3. Physico-chemical parameters of the dithiocarbamate derivative (V) |
|-----------------|-----------------|-----------------|-----------------|
| No | Structural formula | Yield, % | MT, °C | Rf | Mw |
| V  | [1-[(ortho-bromobenzoate-propynyl)-1-[(ortho-bromobenzoate-propynyl)] -dithiocarbamate. | 84,5 | 177;178 | 0,71 | 5,54;92. |
ether. The extracts were combined, dried over MgSO₄ and the ether was evaporated. The product recrystallized from methanol has a mp. = 117-118 °C. The obtained target (V) product after TLC on Al₂O₃ has a melting point of 119-120 °C. The yield of 1-isothiocyanate is 80.4 % and 10.6 % of the isomer.

IR spectra ν, sm⁻¹: 2032 [C≡C=O-2N=C=S ].

Found, %: C 80.4; H 10.6

Calculated for C₇H₁₂Br₂S: C 30.8; H 4.85; Br 25.0; S 24.3

1-thiopropargyl ether of ortho-bromobenzoate

3.18 g (0.01 mol) of 1-bromopropargyl ether of ortho-bromobenzoate with 55 ml of absolute ethanol and 0.56 g (0.01 mol) of freshly prepared NaSH are mixed with vigorous stirring in a nitrogen atmosphere at 30-35 °C in a four-necked flask with a capacity of 300 ml equipped with a stirrer, thermometer, gas pipe and a reflux condenser with a calcium chloride pipe. To obtain high yields, the reaction mixture is kept at 70 °C for three hours. The mixture was cooled, acidified with 5% HCl and extracted with sulfuric ether and dried.

The yield of 1-thiol PE ortho-bromobenzoate is 2.25 g (80.7%).

Mp. = 40-41 °C.

Found, %: C 44.4; H 4.5; Br 26.8

Calculated for C₇H₁₂Br₂S: C 13.0; H 2.9; Br 25.0; S 24.3

Table 5. The effect of the preparation AGM-96 on the germination of seeds and the growth of seedlings of cotton variety “S-6524”

| Experiences A drug | Concentration, % | Germination, % | Cotton Root growth | Stem growth |
|--------------------|------------------|----------------|-------------------|-------------|
| Control - water    | without          | 80.0           | 100.0             | 100.0       |
| [1- (ortho-bromobenzoate-propynyl) - 11- (ortho-bromobenzoate-propynyl)] - dithiocarbamate. | 0.1 | 86.8 | 112.0 | 109.0 |
|                    | 0.01             | 84.3           | 111.0             | 111.3       |
|                    | 0.001            | 87.4           | 128.7             | 116.4       |
|                    | 0.0001           | 81.0           | 116.5             | 109.0       |
|                    | 0.00001          | 80.0           | 120.7             | 113.4       |
| «Rosthin» (famous) | 0.75-1.0         | 80.0           | 104.1             | 102.4       |

Table 6. The effect of the drug AGM-96 on the germination of seeds and the growth of seedlings of cucumbers varieties “Uzbekistan-740”

| Experiences A drug | Concentration, % | Germination, % | Cucumbers Root growth | Stem growth |
|--------------------|------------------|----------------|-----------------------|-------------|
| Control - water    | without          | 100.0          | 100.0                 | 100.0       |
| [1- (ortho-bromobenzoate-propynyl) - 11- (ortho-bromobenzoate-propynyl)] - dithiocarbamate. | 0.1 | 100.0 | 105.5 | 107.4 |
|                    | 0.01             | 100.0          | 108.3                 | 111.6       |
|                    | 0.001            | 100.0          | 116.7                 | 110.6       |
Comparative tests also show that the test drug AGM-96, i.e. derivative 1 - [(ortho-bromobenzoate-propynyl) -1]-[(ortho-bromobenzoate-propynyl)] - dithiocarbamate, showed higher growth-promoting activity at a lower concentration (from 7,5 to 75000 times) than currently used in many agriculture industries of Uzbekistan, the drug "Rostlin". The drug AGM-96 on cotton culture showed biological activity at a concentration of 0,0001 % (diluted 75,000 times), stimulated root growth of 120,7 %, and stem growth of 113,4 % higher than the control and the well-known drug Rostlin (concentration 0,75-1,0 %).

The results of determining the growth-promoting activity of compound 1 - [(ortho-bromobenzoate-propynyl) -1]-[(ortho-bromobenzoate-propynyl)] - dithiocarbamate are presented in tables 5,6,7.

### Table 7. The effect of the drug AGM-96 on seed germination and growth of seedlings of tomato varieties "Temp".

| Experience | A drug | Control - water | [1- (ortho-bromobenzoate-propynyl) -1- (ortho-bromobenzoate-propynyl)] - dithiocarbamate. |
|------------|--------|-----------------|-------------------------------------------------------------------------------------|
| Concentration, % | Germination, % | Rootgrowth | Stem growth |
| without | 50,0 | 100,0 | 100,0 |
| 0,1 | 50,0 | 106,3 | 116,6 |
| 0,01 | 56,4 | 115,3 | 121,7 |
| 0,001 | 57,3 | 139,6 | 125,4 |
| 0,0001 | 49,8 | 114,5 | 107,7 |
| 0,00001 | 53,3 | 119,3 | 106,4 |
| [Rostlin] (famous) | 0,75-1,0 | 52,1 | 107,4 |

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