



ISSN: 2350-0328

**International Journal of Advanced Research in Science,  
Engineering and Technology**

Vol. 6, Issue 6, June 2019

# **N, N<sup>1</sup> –Hexamethylene Bis - [(Hexanoilo) - Carbamat]: Synthesis, Structure, Properties and its Applications.**

**Makhsufov Abdukhamid G., Valeeva Nailya G., Holboev Yusubzhon Kh.**

D.Sc., Professor, Department of NGCICT, Tashkent chemical-technological institute, Uzbekistan

Ph.D., associate professor, Department of General Chemistry, Tashkent State Technical University named after Islam Karimov, Uzbekistan

Ph.D., Associate Professor, Head of the Department of Medical Chemistry, Andijan State Medical Institute, Uzbekistan

**ABSTRACT:** The proposed article relates to organic chemical synthesis and the study of N, N<sup>1</sup> – hexamethylene bis - [(hexanoyl) -carbammates], its chemical properties and reactions of dichlorination, dinitrosylation, dibenylation. The structures of the synthesized compounds were established as, well as a growth promoter of industrial plants. The results of the biological activity of N,N<sup>1</sup>- hexamethylene bis<sup>1</sup>- {bis<sup>2</sup>- [2,2<sup>1</sup>- (phenylazo) -1,11- (naphtol-glycerol-2,21-dioxy-β-ola) - } are presented. The relationship between structure and activity is established. A stimulating effect on the germination of seeds was noted depending on the concentration. The ways of their practical application are outlined.

**KEY WORDS:** Carbamate, Naphtol, Hexamethylene, Dinitrosylation, Metallation, Alkylation, Halogenations, Field test.

## **I. INTRODUCTION**

In recent years, efforts are being made to find new, most effective drugs. There were acquired directions of fine organic synthesis of substances, among which a significant role is given to the derivatives of carbamate and bis-carbamate, derived from isocyanates, as well as «OH» - containing radicals.

## **II. SIGNIFICANCE OF THE SYSTEM**

The paper mainly focuses on how the chemistry derivatives of carbamate and bis-carbamate compounds. 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.

## **III. LITERATURE SURVEY**

Recently, numerous studies in the field of carbammates and bis-carbammates derivatives, currently underway, have been stimulated not only by theoretical, but also by practical needs. From this point of view, derivatives of carbammates and bis-carbammates are of undoubted interest as substances with different technical, biological and pharmacological activity. They are successfully used in almost all sectors of the national economy, in particular, in technology as rubber vulcanization accelerators, as thermal stabilizers of polymers, additives to lubricating oils, and are used as starting products for the production of polymers, as corrosion inhibitors [1-8].

In agriculture, they have been used as fungicides, pesticides, defoliants, herbicides, insecticides, nematocides, bactericides, biostimulants, and much more. The use of this class of compounds in medicine is of particular interest as antiviral, anti-diabetic, anticancer, anti-inflammatory and other drugs [9-21].

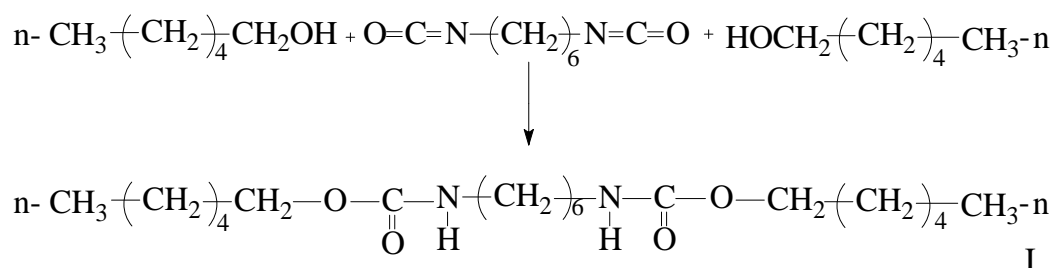
## **IV. PROPOSED METHODOLOGY AND DISCUSSION**

The object of the study was the derivatives of N, N<sup>1</sup> – hexamethylene bis - [(hexanoyl) -carbammates]. The course of the reaction and the individuality of the compounds are monitored by TLC on aluminum oxide with (II) degree of activity

with the appearance of spots by iodine vapor. IR spectra recorded on a VR-20 spectrometer in KBr tablets. Their physical and chemical properties, biostimulating activity were studied.

We have presented previously conducted research in the field of the synthesis of new derivatives of N, N<sup>1</sup> – hexamethylene bis - [(hexanoyl) -carbamates] and carried out a study of their chemical properties in the reaction centers.

So, by the interaction of n-hexanol with diisocyanate, N,N<sup>1</sup>-hexamethylene bis-[(hexanoyl)–carbamate derivatives were obtained according to the following scheme:



The reaction of hexamethylene diisocyanate with n-Hexanol was carried out at a molar ratio of reagents of 1: 2 at room temperature of 26-34 °C for 3-3,5 hours. As a result of the reaction, N,N<sup>1</sup>-hexamethylene-bis [(n-hexanoyl) -carbamate] (I) is formed, which is a snow-white high-melting powder, which is difficultly soluble in water and other non-polar

light available solvents, which confirms the presence of two (  $\begin{array}{c} \text{-N-C-O-} \\ \text{H O} \end{array}$  ) -carbamate, and also hexamethylene hydrocarbons.

Physico-chemical parameters of the obtained N, N<sup>1</sup> – hexamethylene bis - [(n-hexanoyl) -carbamate] (I) are listed in Table 1.

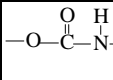
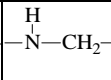
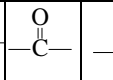
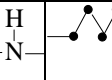
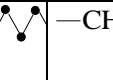
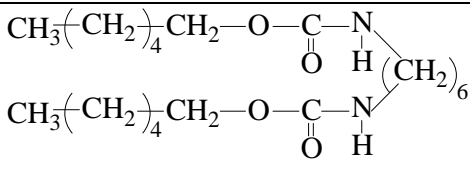
Table 1. Physico-chemical parameters of the drug (I).

Structural formula	Yield, %	MT, °C	R <sub>f</sub>	Brutto formula	Elemental analysis, %						M <sub>M</sub>
					Calculated			Found			
					C	H	N	C	H	N	
$  \begin{array}{c}  \text{CH}_3(\text{CH}_2)_4\text{CH}_2\text{-O}-\underset{\text{O}}{\underset{\parallel}{\text{C}}}-\text{N} \\  \text{H} \quad \diagdown \\  \quad \quad \quad \text{H} \quad \quad \quad \text{(CH}_2\text{)}_6 \\  \text{CH}_3(\text{CH}_2)_4\text{CH}_2\text{-O}-\underset{\text{O}}{\underset{\parallel}{\text{C}}}-\text{N} \\  \text{H} \quad \diagup \\  \quad \quad \quad \text{H} \quad \quad \quad \text{(CH}_2\text{)}_6  \end{array}  $	88,77	260-261	0,78	C <sub>20</sub> H <sub>40</sub> N <sub>2</sub> O <sub>4</sub>	64,51	10,75	7,52	64,39	10,58	7,31	372

As can be seen from table 1, the yield of N, N<sup>1</sup>-hexamethylene bis - [(n-hexanoyl) -carbamate] is quite high. The high yield of the resulting bis - [(n-hexanoyl) -carbamate derivative] is apparently due to the high density and easy mobility of the electron cloud of the conjugated (  $\text{-N}=\text{C}=\text{O}$  ) group, which leads to an increase in the positive charge on the carbon atom of the isocyanate group, having an attack of this nucleophilic agent and the absence of steric hindrances.

The structure of the synthesized compound (I) was established by the methods of IR and PMR spectroscopy and elemental analysis data (table 2).

Table 2. IR and PMR spectral data of compounds (I)

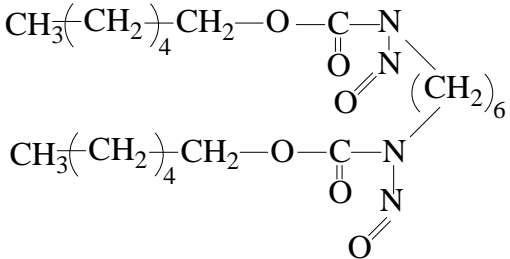
Compound I	IR-spectra, $\nu$ , $\text{cm}^{-1}$					PMR spectrum, $\delta$ , m.g.		
						-CH <sub>3</sub>	-N-CH <sub>2</sub>	-CH <sub>2</sub>
$\text{CH}_3(\text{CH}_2)_4\text{CH}_2\text{O}-\text{C}(=\text{O})\text{N}(\text{H})(\text{CH}_2)_6$ 	1594	1430-1376	1694	3291	752-718	2,18	3,05	1,42-1,40

To identify the reactivity of the N-H reaction centers of the N, N<sup>1</sup>-hexamethylene-bis - [(n-hexanoyl) -carbamate], we carried out the reactions of N, N<sup>1</sup>-dinitrozoation, metallation, alkylation, and halogenation.

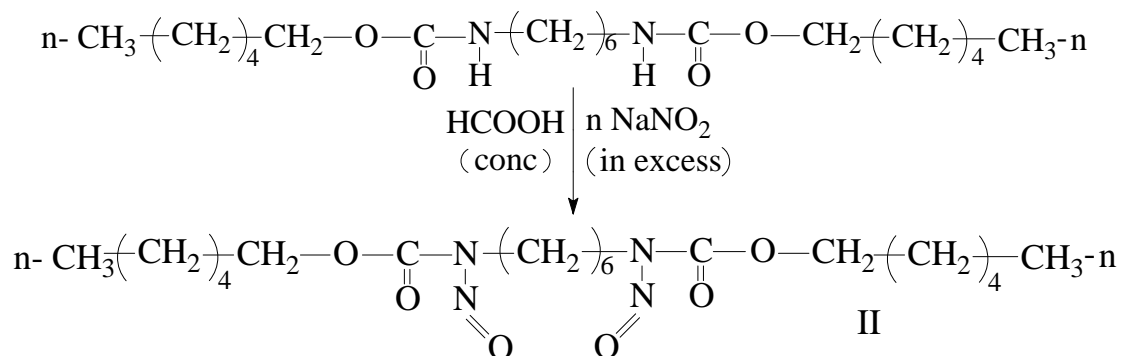
#### A. Getting N,N<sup>1</sup>-dinitroso substituted - N,N<sup>1</sup>-hexamethylene bis -[(N-hexanoyl) -carbamate](II).

As a result of the reaction of N, N<sup>1</sup>-dinitro of the bis - [(n-hexanoyl) -carbamate derivative] with sodium nitrite (in excess) in formic acid, the corresponding N, N<sup>1</sup>-dinitroso substituted bis- [(n-hexanoyl) -carbamate] were obtained in a yield of 84,6 % (Table 3).

Table 3. Physico-chemical parameters of the compounds (II).

Structural formula	Yield, %	MT, °C	Brutto formula	Elemental analysis, %						M <sub>r</sub>
				Calculated			Found			
				C	H	N	C	H	N	
$\text{CH}_3(\text{CH}_2)_4\text{CH}_2\text{O}-\text{C}(=\text{O})\text{N}(\text{H})(\text{CH}_2)_6$ 	83,6	305 (>decom)	C <sub>20</sub> H <sub>38</sub> N <sub>4</sub> O <sub>6</sub>	55,81	8,83	13,02	55,63	8,71	12,86	430

N, N<sup>1</sup>- dinitrozoation proceeds by the mechanism of electrophilic substitution (SE).



The attacking agent is nitrosonium ion  $\text{NO}^{\oplus}$ . Since nitrous acid, which is the most common agent, does not exist in its free form, sodium nitrite and strong acid ( $\text{HCOOH}$ ) are used to carry out the process. The nitrous acid produced in this

process, by adding a proton, generates an ion  $\text{NO}^{\oplus}$ :

$\text{N, N}^1$ -dinitrosation is carried out with cooling ( $0-5\text{ }^{\circ}\text{C}$ ) of the reaction mixture. Increasing the temperature is undesirable because it reduces the yield of the target product, and sometimes affects the direction of the reaction.

Identification of  $\text{N, N}^1$ -dinitroso compounds is carried out in absorption bands of the  $\text{N}$ -nitroso group. A very strong absorption band in the region of  $1527-1440\text{ cm}^{-1}$  for groups is quite characteristic.

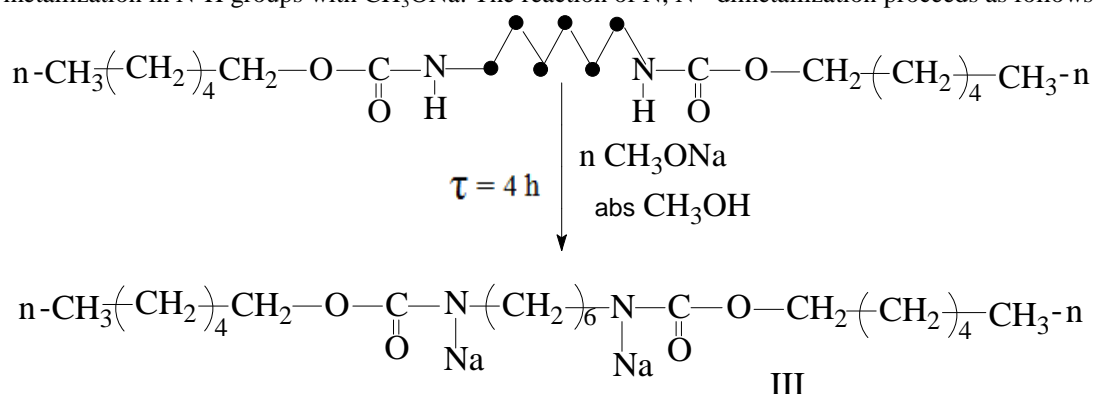
The structure of the synthesized compound (II) was established by the method of IR and PMR spectroscopy and data of elemental analysis (table 4).

Table 4. IR and PMR spectral data of compounds (II).

Compound II	IR-spectra, $\nu, \text{cm}^{-1}$					PMR spectrum, $\delta, \text{m.g.}$		
	$\begin{array}{c} \text{---N---C---} \\ \diagdown \quad \diagup \\ \text{O} \quad \text{O} \end{array}$	$\begin{array}{c} \text{---O---} \\ \diagdown \quad \diagup \\ \text{---C---} \end{array}$	$\text{---}(\text{CH}_2)_6\text{---}$	$\text{---CH}_2\text{---}$	$\text{---CH}_3$	$\text{---CH}_3$	$\text{---CH}_2\text{---}$	$\text{---N---CH}_2\text{---}$
$\text{n-CH}_3(\text{CH}_2)_4\text{CH}_2\text{---O---C---N} \begin{array}{l} \diagup \quad \diagdown \\ \text{O} \quad \text{N} \\ \diagdown \quad \diagup \\ \text{O} \quad \text{N} \end{array} \text{---}(\text{CH}_2)_6\text{---}$ $\text{n-CH}_3(\text{CH}_2)_4\text{CH}_2\text{---O---C---N} \begin{array}{l} \diagdown \quad \diagup \\ \text{O} \quad \text{N} \\ \diagup \quad \diagdown \\ \text{O} \quad \text{N} \end{array} \text{---}(\text{CH}_2)_6\text{---}$	1505-1430	1717	766-724	2933-2858	754-718	2,18	1,42-1,40	3,04

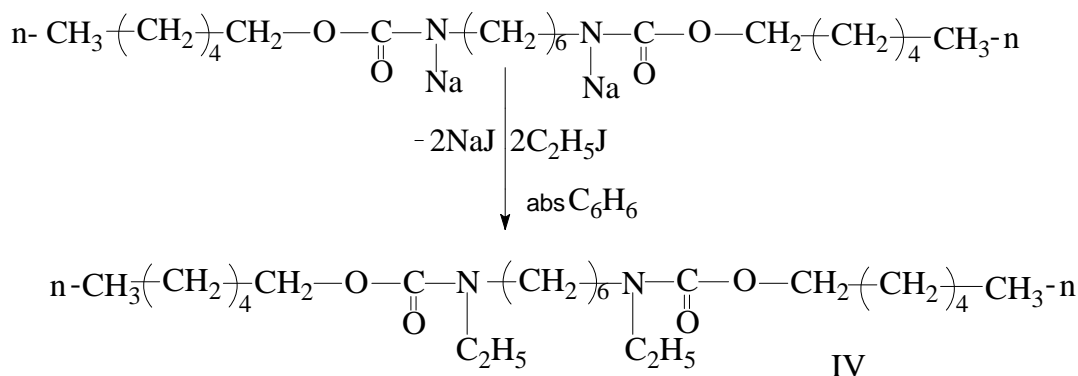
### B. Preparation of $\text{N, N}^1$ -disodium substituted of $\text{N, N}^1$ -hexamethylene bis - [(n-hexanoyl) carbamate].

One of the methods of metalation, which can be carried out with the use of  $\text{N}$  - metalation, is the substitution of hydrogen atoms by sodium in the  $\text{N} - \text{H}$  group. The  $\text{N, N}^1$ -hexamethylene bis - [(n-hexanoyl) carbamate] is subjected to targeted metallization in  $\text{N-H}$  groups with  $\text{CH}_3\text{ONa}$ . The reaction of  $\text{N, N}^1$ -dimetallization proceeds as follows:



### C. Preparation of $\text{N, N}^1$ -diethyl-substituted $\text{N, N}^1$ -hexamethylene bis - [(n-hexanoyl) -carbamate] (IV).

$\text{N, N}^1$ -ethylation of  $\text{N-H}$  in carbamates with alkyl halides is of undoubted interest to determine the reactivity of  $\text{N-H}$  containing compounds. We carried out alkylation reactions by reacting  $\text{N, N}^1$ -disodium of  $\text{N, N}^1$ -hexamethylene-bis - [(n-hexanoyl) -carbamate derivatives] with ethyl iodide in absolutely dry benzol at room temperature  $27-30\text{ }^{\circ}\text{C}$  with stirring for  $3,0-3,5$  hours according to the scheme:



The course of the alkylation reaction exclusively on the nitrogen atom N, N<sup>1</sup>- is explained, apparently, by the relatively easy dissociation of sodium in this atom due to the presence of carbonic groups in the neighboring. The yield of the product (IV) is 94,0 %, Mp. = 151-152 °C.

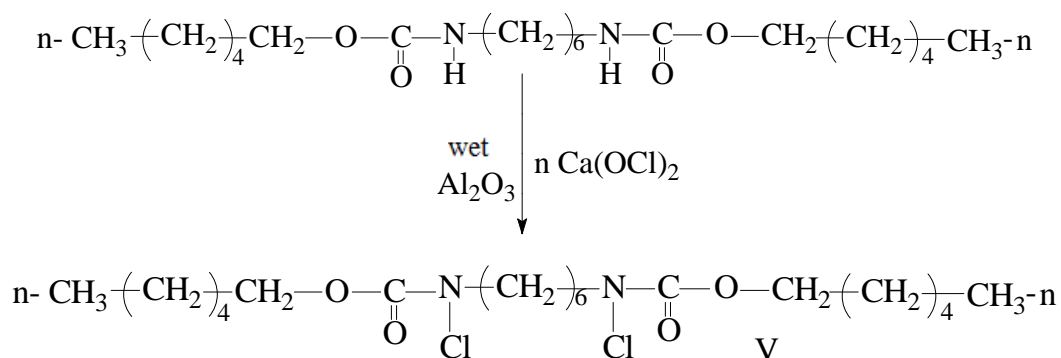
Physico-chemical parameters of the obtained product (IV) are given in table 5.

Table 5. Physical and chemical parameters of compounds (IV)

Structural formula	Yield, %	MT, °C	R <sub>f</sub>	Brutto formula	Elemental analysis, %		M <sub>M</sub>
					Calculated	Found	
					N	N	
$  \begin{array}{c}  \text{CH}_3\text{-(CH}_2\text{)}_4\text{CH}_2\text{-O-C(=O)-N(CH}_2\text{)}_6\text{-N(CH}_2\text{)}_6\text{-C(=O)-O-CH}_2\text{-(CH}_2\text{)}_4\text{CH}_3 \\  \begin{array}{c} \text{C}_2\text{H}_5 \\   \\ \text{O} \\   \\ \text{C}_2\text{H}_5 \end{array}  \end{array}  $	94,0	151-152	0,63	C <sub>24</sub> H <sub>48</sub> N <sub>2</sub> O <sub>4</sub>	6,54	6,42	428

#### D. Getting of N, N<sup>1</sup>-dichloro substituted N, N<sup>1</sup>-hexamethylene bis - [(n-hexanoyl) -carbamate] (V)

An efficient, affordable, cheap, environmentally friendly method for the implementation of N, N<sup>1</sup>-dichlorination of a bis-carbamate derivative with calcium hypochlorite on wet Al<sub>2</sub>O<sub>3</sub> has been developed. The chemical reaction scheme is as follows:



These reactions are of interest to many specialists chemists, pharmacologists, biologists, biochemists, bioorganicists, microbiologists, and many others, because of the presence of a vital, highly reactive center (NH group) in the bis-carbamate derivative necessary for carrying out nucleophilic and electrophilic substitution reactions. The yield of the product (V) and physico-chemical parameters are shown in table 6.

Table 6 Physico-chemical parameters of the compounds (V).

Structural formula	Yield, %	MT, °C	R <sub>f</sub>	Brutto formula	Elemental analysis, %				M <sub>m</sub>
					Calculated		Found		
					N	Cl	N	Cl	
$  \begin{array}{c}  \text{Cl} \\    \\  \text{n-CH}_3(\text{CH}_2)_4\text{CH}_2\text{-O-C-N} \\     \quad \diagup \\  \text{O} \quad \quad (\text{CH}_2)_6 \\    \\  \text{Cl}  \end{array}  $	93,7	103-104	0,72	C <sub>20</sub> H <sub>38</sub> Cl <sub>2</sub> N <sub>2</sub> O <sub>4</sub>	6,34	16,09	6,19	15,94	441

To prove the structure of the newly synthesized N, N<sup>1</sup>-dichloro-substituted N, N<sup>1</sup>-hexamethylene bis - [(n-hexanoyl) -carbamate], IR spectra were taken, elemental analysis and qualitative reactions with AgNO<sub>3</sub> were carried out. Thus, methods for producing N, N<sup>1</sup>-hexamethylene-bis - [(n-hexanoyl) -carbamate] were developed and its chemical properties were studied by the N-H reaction centers: the reactions of dinitrozoation, metallation, alkylation and chlorination.

## V. EXPERIMENTAL RESULTS

### A. Synthesis of N, N<sup>1</sup>-hexamethylene bis - [(n-hexanoyl) -carbamate] (I).

8 ml of triethylamine, 40 ml of DMF are added to 9,2 ml (0,2 mol) of ethanol, while stirring the mixture 16,8 ml (0,1 mol) of hexamethylene diisocyanate dissolved in 40 ml of DMF are added dropwise at room temperature. The reaction mixture is stirred for 3 hours at a temperature of 38-41 °C. After the time the contents of the flask is transferred into a glass, water is added. The precipitate is washed with TLC. After drying, a colorless powder is obtained, the yield of the product (I) is 25,7 g (98,9 % of the theoretical); Mp = 253-254 °C.

Found, %: C 55,24; H 9,17; N 10,56

Calculated for C<sub>12</sub>H<sub>24</sub>N<sub>2</sub>O<sub>4</sub>, %: C 55,38; H 9,23; N 10,77

### B. Synthesis of N, N<sup>1</sup>-dinitroso-N, N<sup>1</sup>-hexamethylene-bis-[(n-hexanoyl) -carbamate] (II).

0,7 g of sodium nitrite is added in portions in excess within 3,5-4 hours to 2,6 ml (0,01 mol) (I) dissolved in 77 ml of formic acid, while constantly stirring at a temperature of 0-5 °C. After the termination is poured into a glass, water is added, the precipitated precipitate is filtered off, washed with benzene and dried, TLC is on Silifol plates, the yield of product (II) is 84,6%; Mp = 305 °C (decomposition).

Found, %: C 55,63; H 8,71; N 12,86

Calculated for C<sub>20</sub>H<sub>38</sub>N<sub>4</sub>O<sub>6</sub>, %: C 55,81; H 8,83; N 13,02

### C. Synthesis of N, N<sup>1</sup>-disodium-N, N<sup>1</sup>-hexamethylene – bis-[(n-hexastano) -carbamate] (III).

2,61 g (0,01 mol) (I) are added in CH<sub>3</sub>ONa (out of 0,031 g / mol and 80 ml absolute. CH<sub>3</sub>OH). The mixture is stirred for 2 hours at a temperature of 20 °C and 2 hours at 40 °C. The precipitate is filtered off, washed with absol. CH<sub>3</sub>OH and get (III), yield – 2,74 g – 89,5 % (from theoretical); Mp = 305 °C (decomposition).

**D. Synthesis of N, N<sup>1</sup>-diethyloyl - N, N<sup>1</sup>-hexamethylene – bis - [(n-hexanoyl) -carbamate] (IV).**

2,74 g (III) is placed in 15 ml of DMF, 2,0 g of ethyl iodide is added dropwise with stirring, the mixture is stirred for 10 hours while heating in a boiling water bath, then cooled and washed with 50% alcohol solution. The precipitate is separated, recrystallized from 50 % alcohol, dried and obtained (IV) with a yield of 94 % (from theoretical); Mp = 151-152 °C.

Found, %: C 67,13; H 11,09; N 6,42

Calculated for C<sub>24</sub>H<sub>48</sub>N<sub>2</sub>O<sub>4</sub>, %: C 67,29; H 11,21; N 6,54

**E. Synthesis of N, N<sup>1</sup>-dichloro-N, N<sup>1</sup>-hexamethylene-bis - [(n-hexanoyl) -carbamate] (V).**

2,60 ml (0,01 mol) (I), 50 ml of CCl<sub>4</sub>, 19 g of wet alumina are placed and 4,2 g of calcium hypochlorite are added dropwise at 40 °C for 1 hour. The reaction mass is set at 20,5 hours, filtered, washed with ether, alcohol, dried and receive (V). With a yield of 93,7 % (from theoretical); Mp = 103-104 °C.

Found, %: C 54,29; H 8,48; N 6,19; Cl 15,94

Calculated for C<sub>20</sub>H<sub>38</sub>Cl<sub>2</sub>N<sub>2</sub>O<sub>4</sub>, %: C 54,42; H 8,62; N 6,34; Cl 16,09

**F. Field tests on the growth-promoting activity**

To identify the growth-promoting activity of the compounds N, N<sup>1</sup>-hexamethylene-bis - [(n-hexanoyl) -carbamate] with the conditional name (AGM-XM-16), tests were carried out in the laboratory of the Institute of Chemistry of Plant Substances of the Academy of Sciences of the Republic of Uzbekistan in laboratory conditions; vegetable and cotton seeds served as biotests.

The experiments used cucumbers of the variety “Uzbekistan-740”, tomatoes of the variety “Temp” and medium-fiber cotton of the variety “S-6524”. The preparations were dissolved in DMF and used by the method of presowing seed locking for 18-20 hours. Were used concentration – 0,1; 0,01; 0,001; 0,0001; and 0,00001 %%. The repetition of experiments was 4-fold. Accountings were carried out by measuring the length of the stem and root in 10 day old seedlings of cotton.

It was noted that all drugs have a tendency to stimulate the growth of the root system of young seedlings, both vegetable crops and cotton. [17-21]

Primary screening was carried out according to the method of Yu.V. Rakitin. This method allows you to quickly determine the degree of physiological activity of new chemical compounds, which is detected by stimulation or germination of plant seeds, as well as by changing the length of the roots and the length of the stem part.

The preparations were tested by the method of locking seeds in solutions of different concentrations with following germination in Petri dishes. Control seeds were soaked in distilled water.

Each series of experiments was accompanied by control. In the control variants, only pure solvent is added to the nutrient medium.

The result of the experiments is recorded after 3,5,7 and 10 days after inoculation (Tables 7-9).

Table 7. The effect of the drug AGM-HM-16 on the germination of seeds and the growth of cotton seedlings of variety "S-6524"

A drug	Experiences	Concentration, %	Germination, %	Cotton	
				Root growth,%	Stem growth, %
Control - water		6/0	80,0	100,0	100,0
N, N <sup>1</sup> -hexamethylene-bis - [(n-hexanoyl) - carbamate]		0,1	88,4	112,5	108,7
		0,01	86,5	117,3	114,5
		0,001	90,4	142,3	121,6
		0,0001	86,7	119,4	114,6
		0,00001	84,4	129,8	120,3
«Roslyn» (famous)		0,75-1,0	80,0	102,3	101,4



Comparative tests also show that the test drug AGM-XM-16, that is, the derivative of N, N<sup>1</sup>-hexamethylene-bis - [(n-hexanoyl) -carbamate] has from 7,5 to 75,000 times lower concentration of our drug, showed a higher growth-promoting activity than the ROSLIN drug currently used in many branches of agriculture in Uzbekistan

The preparation AGM-XM-16 on a cotton crop showed biological activity at a concentration of 0,00001 % (at a dilution of 75,000 times). Stimulated root growth of 129,8 %, and stem growth of 120,3 % above the control and the well-known drug ROSLIN (concentration 0,75-1,0 %).

The preparation AGM-XM-16 on tomatoes, similarly to previous cultures, showed a very high biological activity, 151,6 % at a concentration of 0,001 (even at a dilution of 750 times). The AGM-XM-16 preparation on a cucumber culture also showed biological activity at a concentration of 0,0001 % (i.e., at a dilution of 7500 times). It contributed to the growth of the root of 143,6 %, slightly lower - the growth of the stem of 122,3 % above the control and the well-known drug "ROSLIN" (concentration 0,75-1,0 %).

Table 8. The effect of the drug AGM-HM-16 on the germination of seeds and the growth of seedlings of tomato varieties "Temp"

A drug	Experiences	Concentration, %	Germination, %	Tomato	
				Root growth,%	Stem growth, %
Control - water	6/o		50,0	100,0	100,0
N, N <sup>1</sup> -hexamethylene-bis - [(n-hexanoyl) - carbamate]	0,1		53,4	106,6	117,4
	0,01		60,6	118,3	133,4
	0,001		57,5	151,6	127,8
	0,0001		54,4	133,2	123,2
	0,00001		53,2	122,6	109,7
«Roslyn» (famous)		0,75-1,0	52,1	101,4	100,8

Table 9. The effect of the drug AGM-HM-16 on seed germination and growth of seedlings of cucumber varieties "Uzbekistan-740"

A drug	Experiences	Concentration, %	Germination, %	Cucumber	
				Root growth,%	Stem growth, %
Control - water	6/o		100,0	100,0	100,0
N, N <sup>1</sup> -hexamethylene-bis - [(n-hexanoyl) - carbamate]	0,1		100,0	109,6	114,2
	0,01		100,0	118,5	114,6
	0,001		100,0	129,6	116,7
	0,0001		100,0	143,6	122,3
	0,00001		100,0	119,7	108,7
«Roslyn» (famous)		0,75-1,0	100,0	102,6	101,3

## VI. CONCLUSION AND FUTURE WORK

Thus, the low toxic (LD ≈ 5170 mg / kg) AGM-XM-16 preparation showed high stimulating properties on the seeds of tomato, cucumbers and cotton at 0,0001 and 0,00001 % of concentration. Further in-depth study in the field conditions. Similarly, it is interesting to further study in the field of sunflower, soybeans, corn, etc.

## REFERENCES

- [1] Makhsumov A.G., Atakhodzhaeva M.A. Synthesis and antimicrobial activity of bromine-PE pyrazolyl-M-methylcarbamate // Chemical Pharmaceutical Journal, Moscow, №4, 1988, P. 431-433.
- [2] Melnikov N.N., Baskanov Yu.A. Synthesis and physiological activity on plants of isopropyl ethers of some arylcarbamic acids // J. General Chemistry, № 24, 1954, p. 376-379.
- [3] Sutoris V., Sunak J., Cipinova H. Preparation of ethinyl esters and carbamates and the study of their pesticidal action // Chem.J.Vesti, 23, № 11, 1969, P.47-48.





ISSN: 2350-0328

## International Journal of Advanced Research in Science, Engineering and Technology

Vol. 6, Issue 6, June 2019

- [4] Makhsumov A.G., Sulaimonov B.I., Burkhonov I.B., Bekchanov D.Sh. Synthesis of waste-free technologies for producing bromo-substituted aryl-bis-carbamates and their chemical properties // Inter. SCIENCE magazine. Education. Equipment. Kyrgyzstan, 2009, №1 (2), p.45-47.
- [5] MOSZYNSKI Wieslaw. The pesticidal activity of arylesters of N-aryl carbamic acid // Organa. Ponaik. Ingot. Organ., 1980, P.53-58.
- [6] Barkan Ya.G. Organic chemistry // Moscow, "Higher School", 1973, P.471.
- [7] Karmanova L.P., Kuchin A.V., Koroleva A.A. Chemistry, technology of bioregulators // 17th Mendeleev Congress on General and Applied Chemistry, Kazan, Russian Federation, 2003, P.243.
- [8] Makhsumov A.G., Zakirov U.B., Atakhodzhaeva M.A. Study of the pharmacological properties of propargil carbamate derivatives // J. Physiol. active substances, Kiev, Ukraine, Vol. 13, 1981, P.50-52.
- [9] Makhsumov A.G., Atakhodzhaeva M.A., Talipova M.A., Djuraev A.D. Synthesis and study of PVA pyrazolyl N-methyl carbamates // Chemical-Pharmaceutical Journal. Moscow, № 4, 1988, p. 431-433.
- [10] Makhsumov A.G., Atakhodzhaeva M.A., Talipova M.A., Djuraev A.D. Synthesis and study of PVA activity of propargil carbamate derivatives // J. Chemistry and Pharmacy, Tashkent, 1996, № 6, P.11-12.
- [11] Patent 105160/04 of Russia. Derivatives of carbamate and fungicide of agriculture // OzAKT MACATI, FUKHMOTQ SUMITIRO. VGR<sup>7</sup> C 07 C 27/20; F 01 N 47/12; declared an August 3, 2000; Published on November 20, 2003.
- [12] Patent 7074782 United States / Carbamate in case of caspase and their application // Beblington David, Knegetel Ronald, Mortimore Michael // IPS<sup>7</sup>, from 07 D 213/8; it is declared on August 21, 2003; Published on; July 11, 2006.
- [13] Khatamova M.S., Makhsumov A.G. Modern achievements in the synthesis of bis (alkyl) -carbamate derivatives and their properties // Chemical Journal of Kazakhstan, Special issue - Almaty, 2007, P. 120-124.
- [14] Makhsumov A.G., Samadov S.ZH., Nazirov Z.Sh. The production technology of the bis derivative - [(ortho-aminoacetylphenoxy) - carbamate] and its properties // Chemical Journal of Kazakhstan, Almaty, № 2, 2008, P.163-170.
- [15] Siddikova Kh.H., Makhsumov A.G., Isaev A.N. "Scientific Vestnik", And. State University, 2017, № 4, P. 22-25.
- [16] Makhsumov A.G., Nabiev U.A., Valeeva N.G. Development of synthesis, properties of derivative 1-aminoanthraquinone and its bio-simulating activity // Monthly International Scientific Journal "Austria-science" 2018, I part, # 16, P.65- 70
- [17] Makhsumov A.G., Ismatov D.N., Valeeva N.G. Synthesis, properties and biological activity N,N<sup>1</sup>hexamethylene bis-[(1-naphthoxy)-carbamate]. International journal of Engineering sciences and research technology, 2018, 7(8), P. 194-200.
- [18] Makhsumov A.G., Absalyamova Q.M., Ismailov B.M., Mashayev E.E. Synthesis and properties of the derivative-N,N<sup>1</sup>-hexamethylene bis-[(ortho-aminoacetylphenoxy)] - carbamate and its application // "UNIVERSIM: CHEMISTRY AND BIOLOGY, Москва, 2019, № 3, P. 65-71.
- [19] Makhsumov A.G. Synthesis, properties and biological activity of L-borneol carbamate derivative // International Journal of Engineering and Scientific Research, (Indiya). 2019, Vol.7 Issue 1, January, p.1-8.
- [20] Makhsumov A.G., Samadov S.J., Valeeva N.G. Synthesis and properties of the derivative-N,N-tetramethylene bis-(h-ferrocenylphenoxy) - carbamate and its application // International Journal of Engineering and Scientific Research, (Indiya). 2019, Vol.7 Issue 2, Month, p.1-7.
- [21] Makhsumov A.G., Ismatov D.N., Valeeva N.G., Asadova R.D., Ruzmatov B. Modern advances in the synthesis of new derivatives of acetylene dithiocarbamate and their biological activity // International Journal of Engineering and Scientific Research, (Indiya). 2019, Vol.7 Issue 3, March, p.1-9.

### AUTHOR'S BIOGRAPHY

Makhsumov Abdukhamid Gofurovich - Honored Inventor of the Republic of Uzbekistan, Academician, Doctor of Chemical Sciences, Professor.

Abdukhamid Gofurovich Makhsumov (born in 1936) created a scientific school in the direction of "Synthesis, properties and use of biologically active compounds." He published more than 1,800 scientific works, including 310 patents, more than 10 textbooks and teaching aids. He introduced more than 10 drugs in medicine, 115 biostimulators, herbicides in agriculture, animal husbandry, over 50 dyes in the textile, chemical industries, and national economy.