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**SYNTHESIS OF COMPOUNDS
OF THE 1,2,4-AMINOTRIAZINES SERIES**

СИНТЕЗ СОЕДИНЕНИЙ РЯДА 1,2,4-АМИНОТРИАЗИНОВ

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Abstract. The streamlined synthesis of compounds with wide spectrum of essential properties is prospective lines of development of chemistry of nitrogen containing heterocyclic compounds. Triazines hold a specific place among the great variety of nitrogen containing heterocyclic compounds. Derivatives of unsymmetrical triazines demonstrate a large range of bioactive action, they were offered in the quality of herbicides, plant growth regulators, insecticides, antifungal, acaricide, pharmaceutical and veterinary preparations, stabilizer-antioxygen of polymers and also as corrosion inhibitor. Compounds of 1,2,4-triazinones series are widely reported in the publications, but unsymmetrical triazines particularly their acyl and amino derivatives haven't been studied detailed. Especially there are not many articles about route for the synthesis of acyl and amino

derivatives. Known methods of synthesis based on the hardly accessible materials. For this reason developing of new methods of unsymmetrical triazines synthesis on the base of available petrochemical raw materials and investigation of their properties and fields of their application are promising direction. The reactions of aminoguanidine and hydrazine hydrate with carboxylic acids derivative, that led to 1,2,4-triazines with the amino group in the different position were studied. 3-Amino-1,2,5,6-tetrahydro-1,2,4-triazin-6-one obtained by interaction of chloroacetylchloride and unsubstituted aminoguanidine. 4-amino-1,4,5,6-tetrahydro-1,2,4-triazin-5-one forms in the reaction of monochloroacetic acid with hydrazine hydrate. 4-Amino-1,2,5,6-tetrahydro-1,2,4-triazin-5,6-dione was synthesized from diethyl oxalate, hydrazine hydrate and formic acid. On the base of synthesized amino-triazines and isobutyryl chloride corresponding amides were obtained. Physico-chemical constants of obtained compounds are shown. It is determined that data of elemental analysis of obtained compounds correspond to theoretically calculated values in range of standard deviation.

Аннотация. Перспективным направлением развития химии азотсодержащих гетероциклических соединений является направленный синтез веществ, обладающих широким спектром практически ценных свойств. Среди многообразия азотсодержащих гетероциклических соединений особое место занимают триазины. Производные несимметричных триазинов проявляют довольно насыщенный спектр биологически активного действия, они предложены в качестве гербицидов и регуляторов роста растений, инсектицидов и фунгицидов, акарицидов, лекарственных и ветеринарных веществ, стабилизаторов-антиоксидантов полимеров, а

также ингибиторов коррозии. В литературе широко освещены соединения ряда 1,2,4-триазинов, однако несимметричные аминотриазины, в частности, их ацил- и аминопроизводные изучены недостаточно подробно. Особенно мало публикаций о методах их синтеза. Известные способы получения соединений этого ряда основаны на использовании труднодоступного сырья. Поэтому перспективным направлением является разработка методов получения несимметричных аминотриазин на основе доступного нефтехимического сырья, а также исследование некоторых свойств и возможных областей их применения. В работе приводятся результаты исследования реакций аминогуанидина и гидразингидрата с производными карбоновых кислот, приводящие к 1,2,4-триазинам с аминогруппой в разных положениях. Установлены условия (мольное соотношение реагентов, растворитель, температура) максимального выхода целевых продуктов. При взаимодействии хлорацетилхлорида и незамещенного аминогуанидина образуется 3-амино-1,2,5,6-тетрагидро-1,2,4-триазин-6-он. В реакции монохлоруксусной кислоты с гидразингидратом образуется 4-амино-1,4,5,6-тетрагидро-1,2,4-триазин-5-он. 4-Амино-1,4,5,6-тетрагидро-1,2,4-триазин-5,6-дион получен из диэтилоксалата, гидразингидрата и муравьиной кислоты. На основе синтезированных аминотриазин и хлорангидрида изомаляной кислоты получены соответствующие амиды. Приведены физико-химические константы полученных соединений. Установлено, что данные элементного анализа синтезированных соединений соответствуют теоретически рассчитанным значениям в пределах обычных отклонений.

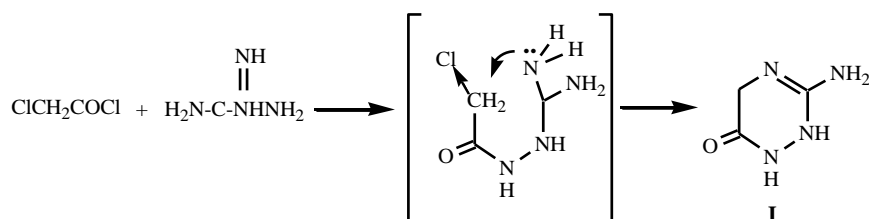
Key words: 3-Amino-1,2,5,6-tetrahydro-1,2,4-triazin-6-on, 4-amino-1,4,5,6-tetrahydro-1,2,4-triazin-5-on, 4-Amino-1,2,5,6-tetrahydro-1,2,4-triazin-5,6-dion, 3-isobutylamido-1,2,5,6-tetrahydro-1,2,4-triazin-6-on, 4-isobutylamido-1,2,5,6-tetrahydro-1,2,4-triazin-5,6-dion, 4-isobutylamido-1,2,5,6-tetrahydro-1,2,4-triazin-5-on.

Ключевые слова: 3-амино-1,2,5,6-тетрагидро-1,2,4-триазин-6-он, 4-амино-1,4,5,6-тетрагидро-1,2,4-триазин-5-он, 4-амино-1,4,5,6-тетрагидро-1,2,4-триазин-5,6-дион, 3-изобутиламидо-1,2,5,6-тетрагидро-1,2,4-триазин-6-он, 4-изобутиламидо-1,4,5,6-тетрагидро-1,2,4-триазин-5-он, 4-изобутиламидо-1,4,5,6-тетрагидро-1,2,4-триазин-5,6-дион.

Derivatives of unsymmetrical triazines are a prospective class of heterocyclic compounds. Their aminoderivatives are not great studied but they are attractive in relation to searching for new plant growth regulators, herbicides, antifungal, acaricide, pharmaceutical and veterinary preparations [1-5].

In this work the results of an investigation of new methods of synthesis and of the chemical-physical properties of 1,2,4-triazine's derivatives with aminogroups in 3-, and 4- positions are shown.

3-Amino-1,2,5,6-tetrahydro-1,2,4-triazin-6-on (I) was obtained from chloroacetylchloride and unsubstituted aminoguanidine.



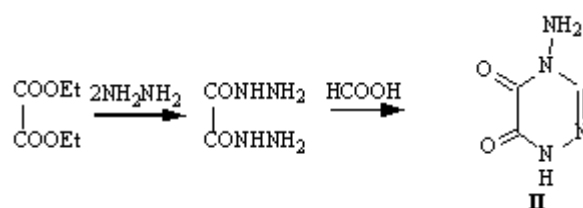
Chloroacetylation proceed on the more basic N¹ atom, produced 1-chloroacetylaminoguanidine cyclizes into triazine as a result of nucleophilic

attack of the nitrogen atom of the amino group of the methylene carbon atom in the molecule of the intermediate compound which we couldn't isolate.

The reaction proceeds with the highest yield in the glacial acetic acid in the presence of sodium acetate as a cyclizing agent, in case of the equimolar ratio of initial reagents and room temperature.

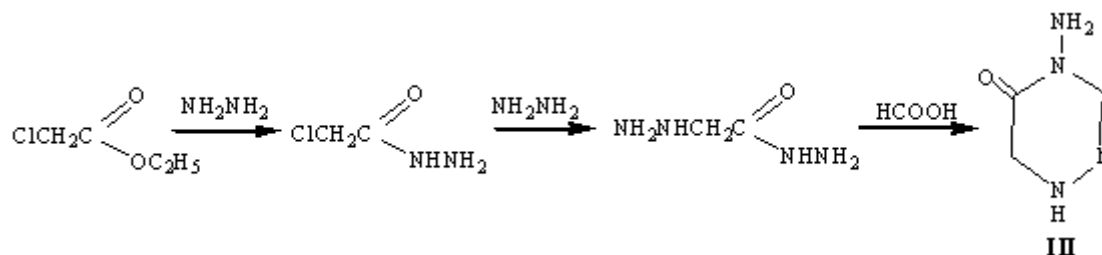
When using substituted aminoguanidines (guanilhydrazones of aldehydes and ketones) substituted 2-hydrazinoimidazolin-4-ones was obtained instead of the expected aminoderivatives of 1,2,4-triazain [6].

4-Amino-1,2,5,6-tetrahydro-1,2,4-triazain-5,6-dion (II) was derived from diethyl oxalate, hydrazine hydrate and formic acid. Synthesis was carried out in two stages.



In the first stage oxalic dihydrazide with 75% yield was obtained. In the second stage 4-amino-1,2,5,6-tetrahydro-1,2,4-triazain-5,6-dion was obtained by boiling of 10% excess of oxalic dihydrazide with formic acid in the dimethylformamide during 3 hours with maximum yield.

4-amino-1,2,5,6-tetrahydro-1,2,4-triazain-5-on (III) was obtained on a base of ethyl monochloroacetate. In the first stage monochloroacetic acid hydrazide was synthesized. In the second stage hydrazino acetic acid hydrazide was synthesized. The desired product (III) was prepared by boiling hydrazino acetic acid hydrazide with two and half of excess of formic acid until solid residue.



In the IR spectra strong absorption lines of triazine's ring at 1500-1700, 600-800 cm^{-1} are observed. In the mass-spectrums of synthesized triazines, intensive molecular peaks, which coincide with the calculated weight o molecular mass, present and give evidence that the supposed structure corresponds to the real structure [7].

Corresponding amides (IV-VI) were obtained by interaction of aminotriazines (I-III) with isobutyryl chloride. Synthesis was carried out in glacial acetic acid with using 5% excess of isobutyryl chloride at room temperature.

Experimental part

The ^1H NMR-spectra were recorded on the Bruker DPX-400 spectrometer in CDCl_3 , The IR-spectra – on Specord 75-IR spectrometer in paraffinic oil, the mass spectra – on KRATOS-80 mass-spectrometer.

Hydrazino acetic acid hydrazide. A mixture of 0,2 moles of hydrazine hydrate and 0,1mole of monochloroacetic acid hydrazide in 10 ml of ethanol was exposed for 3 hours at 80°C. The reaction mixture was treated with hexane, evaporated and was treated with 6n solution of hydrochloric acid.

3-Amino-1,2,5,6-tetrahydro-1,2,4-triazin-6-on (I). 5,6g (0,05mole) of chloroacetylchloride was put in drop by drop into the mixture of 6,7g (0,05mole) aminoguanidine bicarbonate, 4,1 g (0,05mole) of sodium acetate and 10ml of glacial acetic acid. At this time, the reaction mixture

warmed up to 70°C. The mixture was cooled to room temperature and was added to the 23% soda solution. The precipitated solid was filtrated and washed in water and acetone and air-dried. Yield 75%, mp 105-106°C. IR, ν , cm^{-1} : 3240(NH), 1520 (CO), 1680(triazine ring). $^1\text{HNMR}$, δ , 8.97 (3H, $\text{NH}_{\text{triazin}2}$, NH_{amine}), 8.45 (1H, $\text{NH}_{\text{triazin}1}$). Found, %: C 31.37; H 5.30; N 49.12. $\text{C}_3\text{H}_6\text{N}_4\text{O}$. Requires, %: C 31.57; H 5.26; N 49,12. M 114.13.

4-Amino-1,2,5,6-tetrahydro-1,2,4-triazin-5,6-dion (II). 2 ml (0,045 mole) of 95% formic acid was added drop by drop to the solution of 5,9 g (0,05 mole) oxalic dihydrazide in 10 ml of DMFA and was heated for 3 hours with refluxing, 20 ml cold water was added. The precipitate was filtrate and recrystallized from water and air-dried. Yield 47%, mp 224-225°C. IR, ν , cm^{-1} : 3300(NH), 1460 (CO), 1530(triazine ring). $^1\text{HNMR}$, δ , 12.84 (1H, $\text{NH}_{\text{triazin}1}$), 6.00 (2H, NH_{amin}). Found, %: C 28.15; H 3.11; N 43.18. $\text{C}_3\text{H}_4\text{N}_4\text{O}_2$. Requires, %: C 28.13; H 3.14; N 43,74. M 128.09.

4-Amino-1,2,5,6-tetrahydro-1,2,4-triazin-5-on (III). Solution of 5,3 g (0,05mole) hydrazino acetic acid hydrazide in 2 ml (0,045 mole) of 85% formic acid was boiled until formic acid removing, then 14,4 (0.08 mole) water was added and dried. Solid residue was washed by acetone and air-dried. Yield 93%, mp 149-151°C. IR, ν , cm^{-1} : 3400(NH), 1460 (CO), 1630(triazine ring). $^1\text{HNMR}$, δ , 6.47 (3H, $\text{NH}_{\text{triazin}2}$, NH_{amine}), 9.90 (1H, CH_{arom}). Found, %: C 31.57; H 5.31; N 49.12. $\text{C}_3\text{H}_6\text{N}_4\text{O}$. Requires, %: C 31.57; H 5.26; N 49.10. M 114.11.

Isobutylamido-1,2,5,6-tetrahydro-1,2,4-triazin (IV, V, VI). 0,05 moles of chloroanhydride of isobutyric acid was added drop by drop to the 0,05 moles of triazin (I, II or III) in 10 ml of glacial acetic acid. The obtained precipitate was filtered and washed in water.

3-Isobutylamido-1,2,5,6-tetrahydro-1,2,4-triazin-6-on (IV). Yield 80%, mp 113-115°C. IR, ν , cm^{-1} : 3420(NH), 1660 (CO), 1620(triazine

ring). $^1\text{HNMR}$, δ , 8.96 (2H, $\text{NH}_{\text{triazin2}}$), 2.80 (3H, Me), 2.78 (3H, Me). Found, %: C 45.62; H 6.57; N 30.39. $\text{C}_7\text{H}_{12}\text{N}_4\text{O}_2$ Requires, %: C 45.64; H 6.56; N 30,41. M 184.20.

4-Isobutylamido-1,2,5,6-tetrahydro-1,2,4-triazin-5,6-dion (V). Yield 78%, mp 242-244°C. IR, ν , cm^{-1} : 3440(NH), 1610 (CO), 1650(triazine ring). $^1\text{HNMR}$, δ , 9.9 (H, CH), 12.89 (H, $\text{NH}_{\text{triazin}}$), 2.84 (3H, Me), 2.86 (3H, Me). Found, % : C 42.45; H 5.06; N 28.22. $\text{C}_7\text{H}_{10}\text{N}_4\text{O}_3$ Requires, %: C 42.43; H 5.08; N 28.27. M 198.128.

4-Isobutylamido-1,2,5,6-tetrahydro-1,2,4-triazin-5-on (III). Yield 81%, mp 214-216°C. IR, ν , cm^{-1} : 3420(NH), 1650 (CO), 1630(triazine ring). $^1\text{HNMR}$, δ , 9.9 (H, CH), 12.40 (H, $\text{NH}_{\text{triazin}}$), 2.88 (3H, Me), 2.88 (3H, Me). Found, % C 45.65; H 6.52; N 30.38. : $\text{C}_7\text{H}_{12}\text{N}_4\text{O}_2$ Requires, %: C 45.64; H 6.56; N 30,41. M 184.20.

Conclusion

As the result the data of elemental analysis corresponds to the calculated data in the range of standard deviation. Obtained compounds were delivered for testing in the quality of corrosion inhibitor.

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