

HALOGENATION OF 3-PHENYL-5-BENZYL-1,6-DIHYDRO-1,2,4-TRIAZIN-6-ONE AND SOME OF ITS CONVERSIONS

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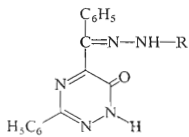
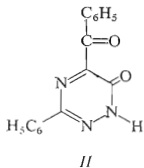
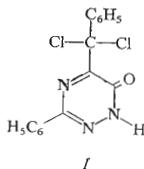
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Halogenation of 3-phenyl-5-benzyl-1,6-dihydro-1,2,4-triazin-6-one with phosphorus pentachloride gave 3-phenyl-5-[(1,1-dichloro-1-phenyl)methyl]-1,6-dihydro-1,2,4-triazin-6-one (*I*) which was converted solvolytically to 3-phenyl-5-benzoyl-1,6-dihydro-1,2,4-triazin-6-one (*II*). Condensation of compound *II* with hydrazine and arylhydrazine gave hydrazones *IIIa–IIIc* which were also prepared by coupling corresponding diazotized amines with 3-phenyl-5-benzyl-1,6-dihydro-1,2,4-triazin-6-one. The structure of compound *I* was also confirmed by $^1\text{H-NMR}$ and IR spectra.

The preparation of 3-aryl-5-aryl-1,6-dihydro-1,2,4-triazin-6-ones has been described in the literature^{1–4} several times. In order to contribute to the knowledge of their structure the reactivity of 3-phenyl-5-benzyl-1,6-dihydro-1,2,4-triazin-6-one¹ as a model substance has been investigated. On halogenation with phosphorus pentachloride (the compound did not react with thionyl chloride) the product of electrophilic substitution on the methylene group of the benzyl residue in the position 5 of the triazine was obtained, *i.e.* 3-phenyl-5-[(1,1-dichloro-1-phenyl)methyl]-1,6-dihydro-1,2,4-triazin-6-one (*I*). This structure is also supported by the analysis of $^1\text{H-NMR}$ and IR spectra. The originally assumed structure of 6-chlorotriazine can be excluded on the basis of $^1\text{H-NMR}$ spectra; the determination of chloride also disagrees with this structure. The $^1\text{H-NMR}$ spectrum consists of signals of aromatic protons (7.2–8.3 ppm) and a broad singlet at 13.97 ppm. The ratio of the intensity of the signals of aromatic protons and the intensity of this signal is 10 : 1. In the IR spectrum a distinct band appears which can be assigned to the carbonyl group. Its position is the same as in the case of unhalogenated triazine, so that the dichloro derivative of triazine can also be excluded, in which one chlorine atom is in the position 6 and the second in the position 5. The proposed structure is also confirmed by the presence of an absorption band at 1668 cm^{-1} in the IR spectrum, which can be considered an amide-I band.

The structure of compound *I* was confirmed by its solvolysis to 3-phenyl-5-benzoyl-1,6-dihydro-1,2,4-triazin-6-one (*II*) which was converted to corresponding

hydrazones *IIIa–IIIc* by condensation reactions with hydrazine or some of its derivatives. Compounds *IIIb–IIIc* were prepared by coupling corresponding diazotized amines with the active methylene group of 3-phenyl-5-benzyl-1,6-dihydro-1,2,4-triazin-6-one¹.



IIIa, R = H

IIIb, R = C₆H₅

IIIc, R = C₆H₄NO₂-(4)

IIIc, R = C₆H₃(NO₂)₂-(2,4)

The reactions described demonstrate the reactivity of the methylene group in the 3-phenyl-5-benzyl-1,6-dihydro-1,2,4-triazin-6-one¹ studied, and hence also its structure. It may be assumed that the conclusions given may be also applied to triazines^{2,3} which were prepared by the same synthetic procedure and which represent an extended scale of substances of the same type.

EXPERIMENTAL

The IR spectra were measured on a Zeiss UR 20 instrument. The ¹H-NMR spectra were recorded on a Varian T-60 spectrometer, 60 MHz. The melting points were determined on a Boetius block. Samples for analysis were dried at 120–140°C for 4–6 hours.

3-Phenyl-5-[(1,1-dichloro-1-phenyl)methyl]-1,6-dihydro-1,2,4-triazin-6-one (*I*)

A mixture of 4.0 g (15.1 mmol) of 3-phenyl-5-benzyl-1,6-dihydro-1,2,4-triazin-6-one¹, 7 g (33.6 mmol) of PCl₅ and 110 ml of xylene was refluxed for 30 min. After 24 h standing at room temperature the separated compound was suction-dried and washed with three 50 ml portions of ethanol. Yield 3.2 g (64%), m.p. 210–220°C. After double crystallization from toluene a yellow powder was obtained with m.p. 229–232°C (decomp.).

For C₁₆H₁₁Cl₂N₃O (332.2) calculated: 57.85% C, 3.34% H, 21.34% Cl, 12.65% N; found: 58.11% C, 3.43% H, 21.09% Cl, 12.71% N.

3-Phenyl-5-benzoyl-1,6-dihydro-1,2,4-triazin-6-one (*II*)

A suspension of 7.8 g (23.4 mmol) of compound *I* in 1200 ml of ethanol and 400 ml of water was refluxed for 10 h. The solution formed was concentrated to about 150 ml and the separated substances filtered off under suction and washed twice with 20 ml of ethanol. Yield, 5.2 g (80%), m.p. 205–210°C. After double crystallization from toluene a yellow product was obtained of m.p.

213–215°C, poorly soluble in hot water and ethanol, and well soluble in hot toluene, similarly to compound *I*. For $C_{16}H_{11}N_3O_2$ (277.3) calculated: 69.30% C, 4.00% H, 15.16% N; found: 69.58% C, 4.22% H, 15.12% N.

Hydrazone of 3-phenyl-5-benzoyl-1,6-dihydro-1,2,4-triazin-6-one (*IIIa*)

Hydrazine hydrate (80%; 0.664 g, 13.2 mmol) was added to a stirred solution of compound *II* (0.554 g; 1.9 mmol) in 100 ml of ethanol and 100 ml of water at 60°C. The separated compound was filtered off under suction and washed with ethanol, yield 0.400 g (68%). After double crystallization from aqueous ethanol (1 : 1) a yellow substance was obtained, m.p. 216–219°C, well soluble in benzene and ethanol, poorly soluble in cold or hot water. For $C_{16}H_{13}N_5O$ (291.3) calculated: 65.97% C, 4.50% H, 24.04% N; found: 66.20% C, 4.66% H, 24.25% N.

Phenylhydrazone of 3-Phenyl-5-benzoyl-1,6-dihydro-1,2,4-triazin-6-one (*IIIb*)

A) Phenylhydrazine (0.216 g, 2.0 ml, 2.0 mmol) was added in portions to a stirred suspension of 0.554 g (1.9 mmol) of compound *II* in 100 ml of ethanol and 100 ml of water. The separated compound was suction-dried and washed with ethanol, yield 0.510 g (69%). After double crystallization from ethanol the m.p. was 236–238°C. The substance is insoluble in hot water, and soluble in hot ethanol and benzene. For $C_{22}H_{17}N_5O$ (367.4) calculated: 71.92% C, 4.66% H, 19.06% N; found: 71.74% C, 4.83% H, 18.84% N.

B) A solution of benzenediazonium chloride (prepared from 1.7 ml aniline, 1.28 g $NaNO_2$ and 2 ml conc. HCl) was added under stirring at –5°C to a solution of 3-phenyl-5-benzoyl-1,6-dihydro-1,2,4-triazin-6-one¹ (5 g; 18.9 mmol) in 55 ml of pyridine and the mixture was allowed to stand in a mixture of ice and salt for 1.5 h. The precipitate formed was filtered off under suction, washed with cold ethanol and dried. Yield 3.5 g (50%). After double crystallization from ethanol the product melted at 236–238°C. Mixture m.p. with a product prepared as under *A* was undepressed. The IR spectra also were identical (cm^{-1}): 748, 765, 784, 808, 822, 848, 854, 892, 915, 930, 985, 1004, 1028, 1072, 1133, 1169, 1195, 1256, 1312, 1355, 1389, 1432, 1515, 1518, 1531, 1601, 1658.

4-Nitrophenylhydrazone of 3-Phenyl-5-benzoyl-1,6-dihydro-1,2,4-triazin-6-one (*IIIc*)

A) A suspension of 0.306 g (2.0 mmol) of 4-nitrophenylhydrazine in 10 ml of 20% aqueous acetic acid was poured at 60°C under stirring into a solution of 0.554 (1.9 mmol) of compound *II* in 100 ml of ethanol and 100 ml of water and the stirring was continued at room temperature for 5 h. The precipitated substance was filtered off under suction and washed with cold ethanol. Yield 0.560 g (68%). After double crystallization from ethanol the orange powder had m.p. 247–250°C. The compound is insoluble in hot water and well soluble in hot ethanol and benzene. For $C_{22}H_{16}N_6O_3$ (412.4) calculated: 64.07% C, 3.91% H, 20.38% N; found: 64.06% C, 3.94% H, 20.30% N.

B) A solution of 4-nitrobenzenediazonium sulfate (2.1 g; 15.1 mmol), prepared from 2.1 g of 4-nitroaniline, 1.05 g $NaNO_2$ and 2 ml conc. H_2SO_4 , was added at –5°C to a stirred solution of 3-phenyl-5-benzoyl-1,6-dihydro-1,2,4-triazin-6-one¹ (4 g; 15.1 mmol) in 40 ml of pyridine, and the mixture was allowed to stand at room temperature for 3 days. The precipitated substance was filtered off and washed with cold ethanol. Yield 1.7 g (27%). After double crystallization from ethanol, m.p. 247–250°C. Mixture m.p. with a substance prepared as under *A* was undepressed. The IR spectra were identical (cm^{-1}): 421, 458, 496, 526, 588, 612, 625, 643, 662, 694, 707, 752, 769, 848, 878, 1108, 1142, 1216, 1245, 1340, 1408, 1495, 1545, 1580, 1600, 1668.

2,4-Dinitrophenylhydrazone of 3-Phenyl-5-benzoyl-1,6-dihydro-1,2,4-triazin-6-one (III_d)

A) A suspension of 0.396 g (2.0 mmol) of 2,4-dinitrophenylhydrazine in 10 ml of 50% aqueous acetic acid was poured at 60°C into a stirred solution of 0.554 g (1.9 mmol) of compound *II* in 100 ml of ethanol and 100 ml of water. The precipitated substance was suction-dried and washed with ethanol. Yield 0.500 g (54%). After double crystallization from ethanol the red substance had m.p. 276–278°C and it was well soluble in hot ethanol, while in hot water and in benzene it was insoluble. For C₂₂H₁₅N₇O₅ (457.4) calculated: 57.77% C, 3.30% H, 21.44% N; found: 57.60% C, 3.39% H, 21.32% N.

B) 3-Phenyl-5-benzyl-1,6-dihydro-1,2,4-triazin-6-one¹ (4.31 g; 16.3 mmol) was added at –5°C to a stirred solution of 2,4-dinitrobenzenediazonium sulfate (prepared according to ref.⁵ from 3 g of 2,4-dinitroaniline, 1.14 g of NaNO₂ and 8.9 ml of H₂SO₄) and the mixture was poured into 100 ml of water and stirred for another 1.5 h. The precipitated substance was filtered off under suction, washed with ethanol and dried. Yield 2.10 g (28%). After double crystallization from ethanol, m.p. 276–278°C. On admixture of the substance prepared under *A* it melted undepressed. The IR spectra were identical (cm⁻¹). 427, 465, 487, 531, 576, 635, 698, 708, 744, 759, 767, 782, 828, 839, 916, 995, 1005, 1034, 1061, 1111, 1140, 1221, 1335, 1429, 1504, 1540, 1600, 1618, 1668.

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