STUDIES ON PYRAN, ITS ANALOGS, AND RELATED COMPOUNDS

XL. REACTION OF CHROMONECARBOXYLIC ACIDS WITH GUANIDINE

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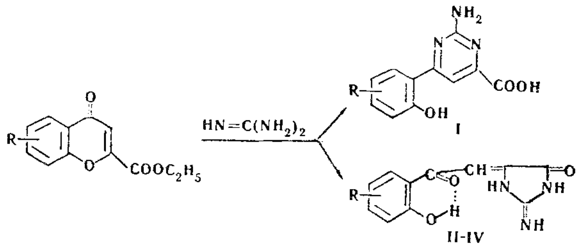
The action of guanidine on esters of chromone-2-carboxylic acids leads to the opening of the pyrone ring and to the formation of hydantoin derivatives – 2-imino-5-(2-hydroxybenzoylmethylene)tetrahydroimidazol-4-ones – in addition to other reaction products.

Information exists on the reaction of guanidine with chromones, leading by the opening of the pyrone ring to substituted aminopyrimidines [1]. Consequently, in this reaction the pyrone ring of chromones behaves like the corresponding β-dicarbonyl compound. We may mention that the formation of a pyrimidine ring by the condensation of guanidine with β-dicarbonyl compounds is widely known. There is no information in the literature on the reaction of esters of chromone-2-carboxylic acids with guanidine.

We have found that guanidine carbonate in boiling ethanol forms with ethyl chromone-2-carboxylate a certain amount (13%) of a hydantoin derivative – 2-imino-5-(2-hydroxybenzoylmethylene)tetrahydroimidazol-4-one (II) – in addition to the normal reaction product – 2-amino-4-(2-hydroxyphenyl)pyrimidine-6-carboxylic acid (I).



I, II R=H; III R=4-CH$_3$O; IV R=5-NO$_2$

The bulk of the starting material undergoes more pronounced (evidently hydrolytic) degradation. The separation of the phenolic substance (II) from the acid I was carried out by dissolving the I in aqueous bicarbonate.

The imidazole derivative II is a high-melting yellow-orange crystalline substance very sparingly soluble in the usual organic solvents but soluble in aqueous alkalis and dilute hydrochloric acid, giving a color reaction for a phenolic hydroxyl with alcoholic ferric chloride.

Compounds III and IV, substituted in the benzene ring, were obtained similarly (the problem of isolating the compounds of type I not arising). We did not study in detail the structures of substances II-IV as potential tautomeric systems, but by analogy with 3-(2-hydroxybenzoylmethylene)piperazin-2-one [2,3] it may be assumed that their molecules contain an aminovinyl ketone fragment. The existence of effective conjugation in the molecule of II is reflected in the UV spectrum. The IR spectra are in harmony with the

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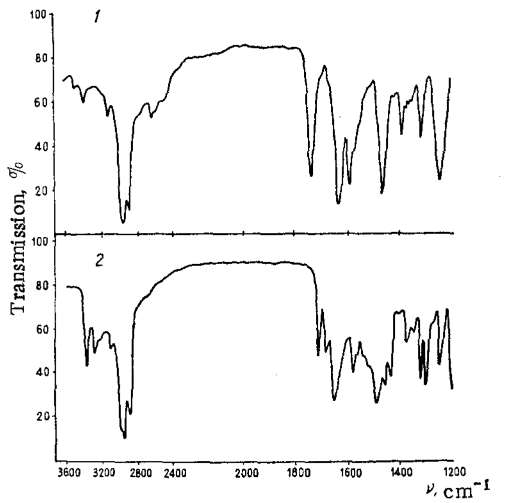

Fig. 1. IR spectra (in paraffin oil): 1) 2-amino-4-(2-hydroxyphenyl)pyrimidine-6-carboxylic acid (I); 2) 2-amino-5-(2-hydroxybenzoylmethylene)tetrahydroimidazol-4-one (II).

given structure for II-IV. In the IR spectrum of II (Fig. 1, curve 2), the bands at 3340 and 3250 cm^{-1} are obviously due to the vibrations of bound NH groups. The very weak diffuse band at 2500-2800 cm^{-1} is due to a chelate hydrogen bond between the phenolic hydroxyl and the keto group. The bands at 1716, 1683, 1652, and 1582 cm^{-1} may be assigned to the vibrations of the following groups, respectively: $C=O$ of a lactam, $C=N$, $C=O$ of a ketone, and a benzene ring.

EXPERIMENTAL

A mixture of 2.18 g (0.01 mole) of ethyl chromone-2-carboxylate and 1.8 g (0.01 mole) of guanidine carbonate in 150 ml of absolute ethanol was boiled for 2 h 30 min. The alcohol was distilled off in vacuum, the residue was dissolved in 10% NaOH, the solution was filtered, and the filtrate was acidified with conc HCl. The orange precipitate that deposited was filtered off and treated with 5% $NaHCO_3$ solution (solution A), compound II being obtained as a residue with a yield of 0.3 g (13%), mp 259°C (decomp., from dimethylformamide). UV spectrum (ethanol, c $1 \cdot 10^{-5}$ - $1 \cdot 10^{-4}$ M), λ_{max}, nm (log ε): 296-300 (5.11), 360-370 (5.05), with a "tail" at 440 (log ε 3.0). Found %: C 56.8; H 3.9; N 18.0. $C_{11}H_9N_3O_3$. Calculated %: C 57.1; H 3.9; N 18.2. With an ethanolic solution of $FeCl_3$, the substance gives a red-brown coloration, and it dissolves in dilute hydrochloric acid from which it is precipitated by sodium bicarbonate. The bicarbonate solution A was acidified with 80% acetic acid, and the precipitate was filtered off and washed with water to give I, yield 1.03 g (44.6%), mp 261°C (decomp., from acetic acid). IR spectrum (Fig. 1, curve 1), cm^{-1}: 3350-3450 (bound NH_2 and OH groups), 2400-2600 (OH of a carboxyl), 1735 (very strong band, $C=O$ of a carboxyl), 1632 and 1589 (very strong bands, probably the vibrations of the bonds of the pyrimidine and benzene rings). UV spectrum (ethanol, c 10^{-5}-10^{-4} M), λ_{max}, nm (log ε): 260 (inflection, 5.15), 350 (5.10). Found %: C 56.9; H 3.9; N 18.2. $C_{11}H_9N_3O_3$. Calculated %: C 57.1; H 3.9; N 18.2.

The following substances were similarly obtained: III, mp 280°C (decomp., from dimethylformamide). Found %: C 55.2; H 4.2. $C_{12}H_{11}N_3O_4$. Calculated %: C 55.2; H 4.2; IV, yield 72.5%, mp 312°C (by reprecipitation from K_2CO_3 solution). Found %: C 47.6; H 3.1; N 20.3. $C_{11}H_8N_4O_5$. Calculated %: C 47.8; H 2.9; N 20.3.

LITERATURE CITED

1. C. Musante and S. Fatutta, Farmaco (Pavia), Ed. Sci., 9, 328 (1954).
2. V. A. Zagorevskii and D. A. Zykov, ZhOKh, 30, 3579 (1960).
3. V. A. Zagorevskii, D. A. Zykov, and É. K. Orlova, ZhOKh, 34, 539 (1964).