2-(1-PHTHALAZINYL)PHTHALAZ-1-ONE, A HYDROLYSIS PRODUCT OF 1-CHLOROPHTHALAZINE*

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The hydrolysis of 1-chlorophthalazine (I; \( R = \text{Cl} \)) with very dilute hydrochloric acid proceeds anomalously: the "normal" hydrolysis product, phthalaz-1-one (I; \( R = \text{OH} \)) is a minor product, the major product is a compound for which the 2-(1-phthalazinyl)-phthalaz-1-one structure (II) has been suggested;\(^1\) analogous structures have been proposed for the compounds formed in the spontaneous decomposition of 4-halogenopyridines\(^2\) and of 1,4-dichloropyridazines.\(^3\) Christensen and

![Chemical structures](image)

his co-workers\(^4,5\) have reported the formation (in a different manner) of analogous compounds in the quinazoline series. 2-(1-Phthalazinyl)phthalaz-1-one has now been synthesized and shown to be identical with hydrolysis product.

Phthaldehydic acid condenses readily with 1-phthalazinylhydrazine (I; \( R = \text{NH}_2\text{NH} \))\(^6\) to give the hydrazone (III; \( R = \text{H} \)). Thermal cyclodehydration of the hydrazone by pyrolysis or in high boiling inert solvents was unsuccessful, as were attempts at cyclization in polar solvents under acidic conditions; a reaction in n-pentanol containing hydrochloric acid gave the n-pentyl ester (III; \( R = \text{C}_5\text{H}_{11} \)). However, treatment of the hydrazone with pure thionyl chloride at room temperature gave the required product in good yield.

The stereochemistry of the phthalazinylhydrazone (III; \( R = \text{H} \)) has not been investigated but the ease of cyclodehydration with thionyl chloride would suggest a cis structure (with the secondary amino and the carboxyl groups in juxtaposition). Acid catalysed cyclization of phthaldehydic acid hydrazones normally proceeds

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without difficulty\(^7\) and its failure in the present case may be associated with steric hindrance due to the phthalazine ring. To test the influence of such a steric factor we have investigated the cyclodehydration of the \(\alpha\)- and \(\beta\)-naphthylhydrazones of phthaldehydic acid. The latter cyclizes so readily that reaction of \(\beta\)-naphthylhydrazine and phthaldehydic acid gave directly 2-(\(\beta\)-naphthyl)phthalazin-1-one; but all attempts to cyclo dehydrate the \(\alpha\)-isomer were unsuccessful. An examination of molecular models reveals significantly greater steric crowding around the reacting centres of the molecule in the \(\alpha\) as compared to the \(\beta\)-isomer.

**Experimental**

**Phthaldehydic Acid Phthalazinylhydrazone**

The hydrazone was prepared in the normal manner from phthaldehydic acid and 1-phthalazinylhydrazine. It was recrystallized from aqueous carbitol, m.p. 208° (Found: C, 65.6; H, 4.3; N, 18.9. \(\text{C}_{13}\text{H}_{12}\text{N}_{2}\text{O}_{2}\) requires C, 65.7; H, 4.1; N, 19.1%).

Attempted cyclodehydration by refluxing the hydrazone in \(n\)-pentanol/hydrochloric acid gave only the \(n\)-pentyl ester, m.p. 142° from alcohol (Found: C, 69.6; H, 6.1; N, 15.5. \(\text{C}_{21}\text{H}_{12}\text{N}_{2}\text{O}_{2}\) requires C, 69.6; H, 6.2; N, 15.3%).

**2-(1-Phthalazinyl)phthalazin-1-one**

Phthaldehydic acid phthalazinylhydrazone (1 g) was added to cold pure thionyl chloride (10 ml). The solid dissolved with vigorous effervescence to give a clear solution which was allowed to stand at room temperature for 1 hr. Excess thionyl chloride was removed under reduced pressure and the solid residue was dissolved in water. Neutralization with solid sodium bicarbonate deposited a pale yellow solid which was washed with cold dilute sodium hydroxide and hot alcohol and recrystallized from dilute acetic acid, m.p. 279-280°. It was identical with 2-(1-phthalazinyl)phthalazin-1-one from the hydrolysis of 1-chlorophthalazine.\(^1\)

**Phthaldehydic Acid \(\alpha\)-Naphthylhydrazone**

The hydrazone was prepared in the normal manner; m.p. 152° from ethanol (Found: C, 74.6; H, 5.0; N, 9.9. \(\text{C}_{14}\text{H}_{12}\text{N}_{2}\text{O}_{2}\) requires C, 74.5; H, 4.9; N, 9.7%). All attempted cyclodehydrations to the phthalazine were unsuccessful.

**1-(\(\beta\)-Naphthyl)phthalazin-1-one**

Phthaldehydic acid (1.6 g) and \(\beta\)-naphthylhydrazine (1.5 g) were dissolved in alcohol (20 ml) and heated under reflux for 3 hr. The white product deposited on cooling the solution was recrystallized from ethanol, m.p. 168° (Found: C, 79.7; H, 4.6; N, 10.3. \(\text{C}_{16}\text{H}_{12}\text{N}_{4}\text{O}\) requires C, 79.4; H, 4.5; N, 10.3%). The intermediate hydrazone was never isolated.