

Dissociation Constants of Cyanohydrins of Some Tetrahydropyran-4-ones

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The dissociation constants of cyanohydrins of some substituted tetrahydropyran-4-ones have been determined at 30° in 80% dioxan-water (v/v). The results substantiate the steric environment of the carbonyl group in these ketones.

In continuation of our previous work¹⁻³ we have presently determined the dissociation constants of the cyanohydrins of some substituted tetrahydropyran-4-ones, at 30° in 80% dioxan-water (v/v). The equilibrium constant (K_D) of the reaction (1) has been utilised to study the steric environment of the carbonyl group in cyclic ketones⁴⁻⁷.



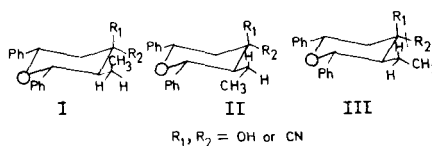
cis-2,6-Diphenyltetrahydropyran-4-one, *trans*-2,6-diphenyltetrahydropyran-4-one, 3-methyl-2,6-diphenyltetrahydropyran-4-one, 3-ethyl-2,6-diphenyltetrahydropyran-4-one and 3,5-dimethyl-2,6-diaryl-tetrahydropyran-4-one were prepared as described earlier¹, and purified by recrystallisation to constant melting points.

Commercial dioxan was purified by the known procedure. The reagents used were AR grade chemicals. The dissociation constants were measured at 30° in 80% dioxan-water (v/v) following the procedure described by Baliah and Chandrasekaran⁷.

Table 1—Dissociation Constants of Cyanohydrins of Tetrahydropyran-4-ones

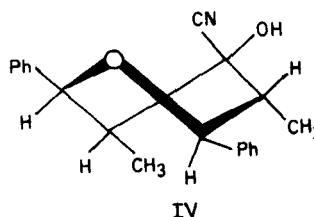
No. Cyanohydrin of tetrahydropyran-4-ones	$K_D \times 10^3$ (mol dm ⁻³)
1 <i>cis</i> -2,6-Diphenyl-	6.78
2 <i>trans</i> -2,6-Diphenyl-	62.6
3 3-Methyl-2,6-diphenyl-	7.92
4 3-Ethyl-2,6-diphenyl-	34.6
5 3,5-Dimethyl-2,6-diphenyl-	19.2
6 2,6-Di- <i>p</i> -chlorophenyl-3,5-dimethyl-	16.2
7 2,6-Di- <i>p</i> -methoxyphenyl-3,5-dimethyl-	14.5
8 3,5-Dimethyl-2,6-di- <i>m</i> -nitrophenyl-	15.6
9 3,5-Dimethyl-2,6-di- <i>p</i> -tolyl-	23.2

The dissociation constants of cyanohydrins of 3-alkyl and 3,5-dialkyl-2,6-diphenyltetrahydropyran-4-ones are higher than that of *cis*-2,6-diphenyltetrahydropyran-4-one (Table 1). In all these ketones the bond angle strain will be constant. The observed difference in K_D should then be mainly due to differences in torsional interactions involving OH and CN groups, resulting in high K_D values. The K_D value for 3-ethyl-2,6-diphenyltetrahydropyran-4-one is more striking showing that the OH and CN groups in the cyanohydrin of this compound experience larger interactions with the methyl group of the ethyl substituent. In this the alkyl group can have various conformations I to III.



Only the conformation I and III are energetically favourable since the methyl group is away from the phenyl group. But the interaction with OH or CN group is large, hence a higher K_D value.

The higher K_D values of all the 3,5-dimethyl substituted tetrahydropyran-4-ones are indicative of the non-chair conformation (IV) of these cyanohydrins.



The effect of the heteroatom on the dissociation of heterocyclic ketone cyanohydrin is of interest due to two reasons. The change of hetero atom may lead to some change in the conformation. There is also electronic effect of the hetero atom on the reaction centre. A comparison of the dissociation constants of cyanohydrins⁷ of *cis*-2,6-diphenyltetrahydropyran-4-one ($K_D = 6.78 \times 10^{-3} \text{ mol dm}^{-3}$), 2,6-diphenylpiperidin-4-one ($K_D = 7.14 \times 10^{-3} \text{ mol dm}^{-3}$) and *cis*-2,6-diphenyltetrahydrothiopyran-4-one ($K_D = 11.9 \times 10^{-3} \text{ mol dm}^{-3}$) indicates that the results are in the order that would be expected on the basis of electronegativity of the heteroatoms. Of these, the

oxygen heterocycle dissociates least in conformity with the highest electron withdrawing power of oxygen. (Cyanohydrin dissociation is disfavoured⁸ by electron withdrawing substituents as evidenced by the reaction constant of -1.4).

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