

## LETTERS TO THE EDITOR

### ULTRASONIC VELOCITY STUDIES OF HYDROGEN BONDS

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#### Introduction

A HYDROGEN bond involves the formation of a bridge by a hydrogen atom, between two electronegative atoms, through a covalent and an ionic bond. The strength of such a bond increases with an increase in electronegativity of the two-bonded atoms. It is not, however, always necessary that the two-bonded atoms should be electronegative in nature. A strong group of electronegative atoms attached to a carbon atom (e.g., chloroform) can also induce the latter to form a H-bond of type  $\text{CH} \dots \text{X}$  with an adjacent electronegative atom 'X' (e.g., that of acetone). Ewell<sup>1</sup> had pointed out that in such bonds, the number and position of electronegative atoms (chlorine) with respect to the carbon atom in acceptor play a dominant role in deciding the H-bond forming capability of acceptor and donor. The present work is concerned with the ultrasonic velocity and its relationship to the

number of activating chlorine atoms, in these mixtures<sup>1</sup> involving H-bonds of type  $\text{CH} \dots \text{O}$  as detailed in Table I. Incidentally, these are also the systems (with the exception of chloroform-acetone) which have not been studied so far and comprise the following components.

#### Experimental

All the chemicals used were of AR grade. Velocity was measured by using a single crystal interferometer. The velocity could be measured correct to  $\pm 0.018\%$  in the case of sharp maxima.

#### Results and Discussion

The ultrasonic velocity at  $30^\circ \text{C}$  was plotted against concentration of the donor for all the ten mixtures. All the curves were found to show a negative deviation from linearity. In the case of dichloroethane-ethyl methyl ketone and trichloroethane-ethyl butyrate mixtures, where the difference in velocity between two components was small ( $3 \text{ ms}^{-1}$  and  $25 \text{ ms}^{-1}$ ), the curves exhibited minima. A similar behaviour of negative deviation in velocity was observed by others<sup>2-4</sup> in mixtures of chloroform-acetone, chloroform-ether and a minima in chloroform-acetic acid, all involving bonds of type  $\text{CH} \dots \text{X}$ .

*Influence of chlorine atoms:* The velocity is strongly dependent upon the intermolecular forces<sup>5</sup>. But the contribution to negative deviation in velocity is due not only to the presence of these

TABLE I  
Maximum deviation of velocity at  $30^\circ \text{C}$

Sl. No.	Mixture	Number of chlorine atoms in acceptor	MDV in $\text{ms}^{-1}$
1.	Methylenechloride-Propionaldehyde	2	26.7
2.	Chloroform-Acetone	3	49
3.	Chloroform-Propionaldehyde	3	46
4.	Chloroform-Ethyl methyl ketone	3	30
5.	1,2-Dichloroethane-Ethyl methyl ketone	2	16.2
6.	1,1,2-Trichloroethane-Dioxane	3	18.3
7.	1,1,2-Trichloroethane-Ethylbutyrate	3	18
8.	1,1,2,2-Tetrachloroethane-Cyclohexanone	4	28.8
9.	1,1,2,2-Tetrachloroethane-Mesityl oxide	4	20.5
10.	Pentachloroethane-Cyclohexanone	5	46

interactions but also to other factors like non-ideality in free length<sup>6</sup>. If this contribution is assumed not to vary appreciably for mixtures, with acceptor belonging to the same chloroparaffin series, the maximum deviation in velocity from linearity would increase with an increase in the number of activating chlorine atoms. Table I depicts these values. It can be seen that 'MDV' increases with an increase in the number of chlorine atoms. The following order is followed :

1. in chloromethanes : chloroform > methylene-chloride, and
2. in chloroethanes : pentachloroethane > tetrachloroethane > trichloroethane > dichloroethane.

The same order, for H-bond forming capability of acceptor, was arrived at, by Ewell<sup>1</sup> for these mixtures. The curve between MDV and the number of chlorine atoms, when extrapolated, gave a value of 'MDV' equal to 15 ms<sup>-1</sup>. This could be taken as the contribution coming from factors other than intermolecular forces (due to H-bonding and dipole association).

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## STUDIES ON METAL CHELATES OF SILVER(I), COPPER(I) AND THALLIUM(I) WITH 5-IODO-8-HYDROXY QUINOLINO-4-(*p*-TOLYL) SULPHONAMIDE AND 5,7-DI-IODO-8-HYDROXY QUINOLINO-4-(*p*-TOLYL) SULPHONAMIDE AS POSSIBLE ANTIBACTERIALS

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METAL chelates Ag(I), Cu(I) and Tl(I) with the ligands 5-iodo-8-hydroxy quinolino-4-(*p*-tolyl) sulphonamide (IHQTS) and 5,7-Di-iodo-8-hydroxy quinolino-4-(*p*-tolyl) sulphonamide (DIHQTS) were prepared and characterised by the elemental analyses, infrared spectral study and magnetic susceptibility measure-

ments. These were screened for their antibacterial activity against gram positive *S. aureus* and gram negative *E. coli*. It was found that the metal chelates were more potent than the parent compounds.

### Introduction

Quinoline and *p*-toluene sulphonamide have long been associated with medicine<sup>1, 2</sup>. They were used as drugs for the diseases like cancer<sup>3</sup>, tuberculosis<sup>4</sup>, diabetes<sup>5</sup>, malaria<sup>6</sup>, leprosy<sup>7</sup> and convulsant<sup>8</sup>. They were also found to be active against certain types of bacteria. It has also been found that some drugs have increased activity when administered as metal complexes, more so as metal chelates<sup>9, 10</sup>. In the present study we have synthesized the ligands IHQTS and DIHQTS and their metal chelates. The metal chelates of Fe(III), Co(II), Ni(II), Cu(II) and Zn(II) with DIHQTS have already been reported as antibacterials<sup>11</sup>.

### Experimental

The chemicals employed were of AnalaR grade. The ligand-metal ratio was determined by conductometric titration and Job's method of continuous variation which showed 1 : 1 complexation. This was also confirmed by elemental analyses.

### Preparation of the ligands

The ligands were prepared in two steps :

In the first step 5-iodo-8-hydroxy quinoline was allowed to react with chlorosulphonic acid below 0° C and the product thus obtained was found to be 5-iodo-8-hydroxy quinoline-4-sulfonyl chloride. In the second step an alcoholic solution of the sulfonyl chloride was allowed to react with an alcoholic solution of *p*-toluidine when the required product was formed. DIHQTS was also prepared likewise by taking 5,7-di-iodo-8-hydroxy quinoline as the starting material.

### Isolation of the chelates

Reagent solutions were prepared in warm distilled water and were then treated with an appropriate amount of metal salt solutions in distilled water. The pH was maintained between 8-9 by borate buffer. The resulting precipitates of the chelates were filtered, washed well with warm distilled water and dried at 120° C.

The melting points of the chelates were determined by open capillary tubes and were found to be more than 300° C.

### Magnetic properties

Magnetic properties of the chelates were determined by Guoy's method. The metal chelates of Ag (I) gave the moment values of 1.85 and 1.86 B.M. with the ligands IHQTS and DIHQTS respectively, showing tetrahedral structure with sp<sup>3</sup> hybridization. The metal chelates of Cu(I) gave the moment values of 2.12 and 2.30 B.M. with the ligands IHQTS and