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Synthesis, Spectroscopic and Acoustical Properties of Metal Complexes

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This research includes preparation of complexes for Ni ion chloride (II) Cr ion chloride(III) and aqueous iron chloride (III) with Schiff bases ligand (N, N) di methyl of the amino Benzaldehyde. The prepared complexes were characterized by IR, UV and visible spectra. The acoustical properties were also studied by technique of ultrasonic waves velocity at 40 KHz frequency. This include the ultrasonic waves velocity, absorption coefficient of ultrasonic waves, relaxation time, relaxation amplitude, specific acoustic impedance compressibility, and bulk modules. The Results showed that all properties decrease with increase in the ultrasonic waves velocity except the specific acoustic impedance and bulk modules which is directly proportional to the velocity and all the results were compared with those for similar compounds.

Introduction

Ultrasonic technique is very effective, powerful and reliable tool to investigate the properties of solution From the physical parameters characterizing the ultrasound propagation in tissues, important information about anatomical functions of the biological tissues or the foreign bodies and tumors can be evidenced. So, the study of the propagation is very important for biology, biophysics and medicine. On the other hand, the domain of the ultrasounds bond vast fields of knowledge from physics, biology, chemistry or bioengineering which contribute to the understanding of the complex, phenomena of ultrasound interaction with living system. Strictly speaking Schiff bases are compounds having a formula RR'C=NR" where R is an aryl group, R' is a hydrogen atom and R" is either an alkyl or aryl group. However, usually compounds where R" is an alkyl or aryl group and R' is an alkyl or aromatic group are also counted as Schiff bases class is very versatile as compounds which can have a variety of different substituents and they can be unbridged or N, N bridged. Most commonly Schiff bases have NO or N_2O_2 -donor atoms but the oxygen atoms can be replaced by Sulphur, Nitrogen or Selenium atoms. In this study, attention was paid to the most common Schiff bases, especially to salen and salophen.

Calculation Measurements and

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The Ultrasonic velocity (V) was measured using the pulse ultrasonic technique. The metal vibrator was coated with oil and kept in contact with the wall of the glass tank that contains the test sample. The receiver quartz crystal was mounted on a digital vernier of slow motion. The receiver crystal could be displaced in parallel to the sender through 10 Cm. The sender and receiver pulses were displaced on two traces of cathode ray oscillograph. Theoretical values such as absorption coefficient α of ultrasonic waves, relaxation time τ, relaxation amplitude D, compressibility β 'specific acoustic impedance Z and bulk modulus K for the polymer solutions have been calculated using the following equationS.

$$\alpha = \frac{-\ln A / A_0}{X} \qquad \text{----------1}$$

Where A and A_0 are ultrasonic wave amplitude and initial wave amplitude, respectively and X is the crystal moving distance. The relaxation time τ had been calculated as :

$$\tau = \frac{4\eta}{3\rho V^3} \qquad \text{----------2}$$

where η is the viscosity of solution, ρ the density, V velocity of ultrasonic waves
The relaxation amplitude *D* is calculated by the following equation
Ultrasonic:

$$D = \alpha / f^2 \qquad \text{----------(3)}$$

where f is the frequency of ultrasonic waves

The specific acoustic impedance *Z* is given by :

$$Z = \rho V \qquad \text{----------(4)}$$

The compressibility β and the bulk modulus K are computed from equations (5) and (6) , respectively .

$$\beta = (\rho V^2)^{-1} \qquad \text{----------(5)}$$

$$K = \beta^{-1} = \rho V^2 \qquad \text{----------(6)}$$

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Experimental method

Synthesis of Schiff Base Ligand

The method of preparation was as follows:

The *4*-amino antipyrine (5 g, 0.014 mol) dissolved with 4-dimethylamino benzaldehyde (3.6 g, 0.024 mol) in ethanol (40 ml). Five drops of glacial acetic acid added to the solution and the mixture was refluxed for (1.5hr). The Schiff base compound was isolated after the volume of the mixture was reduced to half using rotary evaporation and the obtained product was collected by filtration, washed several times with ethanol and recrystilized from absolute ethanol the melting point of the yellow crystals found to be (219 °C). The yield was (99.99 %).

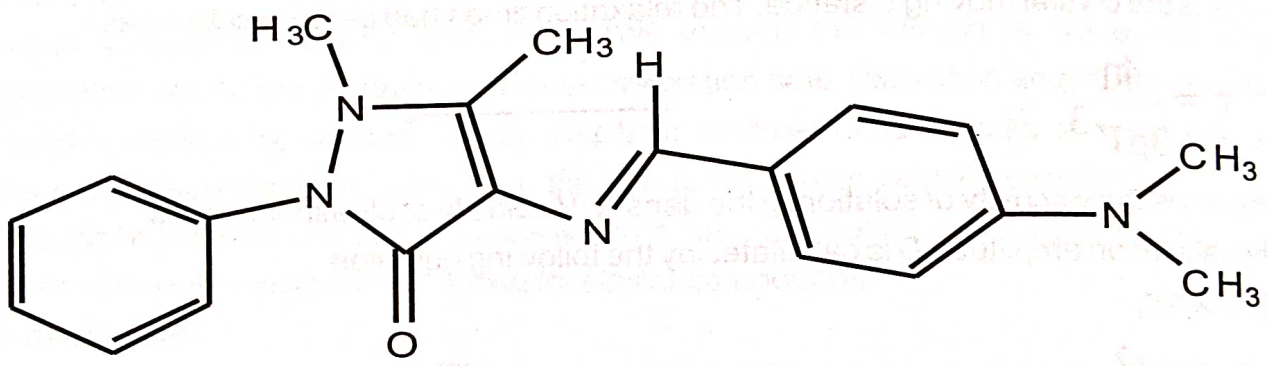

Fig: 1 Structural formula of the ligand (free material)

Preparation of Schiff Base Complexes:

The prepared Schiff base (3.34 gm, 0.01mol) in 30 ml ethanol have been mixed with metal salts [1.29 g $NiCl_2$ (0.01 mol), $CrCl_3.6H_2O$(2.66 g), $FeCl_3$ (0.8 g)] respectively in the same amount and refluxed for two hours. The resulted complexes were collected by filtration and then washed several times with ethanol, dried and stored. All the prepared compounds have been characterized using infrared (IR) and ultraviolet and visible (UV-Vis) spectra.

Result & Conclusions

1. Ease of preparation of this type of ligand accompanied by some of the difficulties in purifying prepared compounds
2. Characterized metal complexes shows not affected by the circumstances of the light, humidity, and air, which refers to the perceived stability, in addition to its relatively high degrees of melting, which gives further evidence of the extent of stability.

3. The process of absorption and attenuation of ultrasonic energy are very dependent on both the length of the chain (free material and prepared complexes under study) and the velocity of these waves with respect to its acoustical properties,

4.The values of the relaxation time using the molecular value measured for each of the density and viscosity show the decrease in the relaxation time and compressibility with increasing velocity to get the cross linking between the molecular compounds.

5. Acoustic impedance form linearly and the reason goes back to the increase the number molecular due to increase velocity.

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