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# Preparation organic-metallic compounds from Schiff bases and study some mechanical properties

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# Preparation organic-metallic compounds from Schiff bases and study so mechanical properties

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**Key Words:** Schiff bases, organic-metallic compounds, ultrasonic method, mechanical properties

**Abstract**

The research includes preparation ligand (DMAB) and its Complexes with Cu (II) as symbol (M1), Fe (III) as symbol (M2) and Cr (III) as symbol (M3). The identity of prepared compounds has been characterized by spectral methods, infrared ray (IR) and measures melting point (m.p.). Also the research included study of the Mechanical properties by ultrasonic waves velocity technique at 40 KHz frequency, absorption coefficient of ultrasonic waves, relaxation time, relaxation amplitude, specific acoustic impedance compressibility, and bulk modules has been measured and all the results showed that all properties decrease with increase ultrasonic waves velocity except the specific acoustic impedance and bulk modules which was increase with increase velocity and all the results compared with similar compound.

## Introduction

Co-ordination compounds exhibit different characteristic properties which depend on the metal ion to which they are bound. The nature of the metal as well as the type of ligand etc. these metal complexes have found extensive application in various fields of human interest (R. NAIR *et. al.* 2006). 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.82 The Schiff base class is very versatile as compounds 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 complexes. (RAJEEV JOHARI *et. al.* 2009) Studied the antibacterial activities of the Schiff base derived from the salicylaldehyde and histidine and its Ni(II), Zn(II), Fe(II) and Cu(II) and four metal complexes were synthesized complexes on some pathogenic bacteria .The Mechanical properties had been reported by (Al-Bermany 2009) The present work aims to synthesis sample from Schiff bases complex through of correction Schiff bases compounds and Study Some of Mechanical Properties.

## Experimental

### Preparation of Samples

Syntheses of Schiff base (DMAB) an ethanolic solution (20 ml) of (1-phenyl-2, 3-dimethyl-4-aminopyrazol-5-one) (4-aminoantipyrine) (2.03 g, 0.010 mol) were added to an ethanolic solution of benzaldehyde (1.06 g, 0.010 mol). On stirring, a yellow-colored solid (I) separated, which was filtered and re-crystallized from ethanol (Raman *et. al.* 2008) Syntheses of complexes Cu(II) as symbol (M1) , Fe (III) as symbol (M2) and Cr (III) as symbol (M3) , a solution of metal chloride in ethanol (1.0 m mol) was refluxed with an ethanolic solution of the Schiff base (2.0 m mol) for ca. 2 hrs. Then the solution was reduced to one-third of its volume on a water bath. The precipitated solid complex was filtered and washed thoroughly with ethanol and dried under vacuum, the materials used in the preparation was the same degree of purity (99.99%).

**Preparation of Solutions**

The compounds solutions were prepared by soluble the compounds in absolute ethanol with concentration ($1*10^{-3}$ molar), the solubility is made by adding a known weight of the compound to affixed volume of ethanol and then agitating with magnetic stirrer for about (5 min) , Until a clear solutions were obtained .

**Ultrasonic measurements**

The Ultrasonic velocity (V) was measured using the pulse ultrasonic technique of sender- receiver type SV-DH-7A, SVX-7 with (0-50 kHz) variable frequency at frequency (40 KHz), the metal vibrator was coated with oil and kept in contact with the wall of the glass tank containing the test sample the receiver quartz crystal was mounted on a digital vernier of slow motion. The receiver crystal could be displaced parallel to the sender through (10 cm). The sender and receiver pulses were displaced on two traces of cathode ray oscillograph.

**Theoretical calculation for mechanical properties**

The absorption coefficient (α) was calculated from Lambert – Beer law (Zong and Dong 2011):

$$A/A_0 = e^{(-\alpha x)} \ldots\ldots (1)$$

The ultrasonic wave velocity was calculated using the following equation (Abdul-Kareem *et. al.* 2011):

$$v = x / t \ldots\ldots (2)$$

Where ($A_0$) is the initially amplitude of the ultrasonic waves, (A) is the wave amplitude after absorption and (x) is the thickness of the sample. Attenuation is generally proportional to the square of sound frequency so the relaxation amplitude (D) was calculated from the following equation (Josef and Herbert 1990):

$$D = \alpha / f^2 \ldots\ldots\ldots (3)$$

Bulk modulus (B) of a composite is the substance's resistance to uniform compression, it was calculated by Laplace equation where (ρ) is the density (Al-Bermany E. 2004):

$$B = \rho v^2 \ldots\ldots (4)$$

Compressibility (β) was calculated by the following equation (Hassina *et. al.*2009):

$$\beta = (\rho v^2)\text{-}1 \ldots\ldots\ldots (5)$$

The acoustic impedance of a medium (Z) was calculated by equation (Jarth 2008):

$$Z = \rho v \ldots\ldots\ldots (6)$$

The relaxation time (τ) was calculated from the equation (Herbert 1985):

$$\tau = 4 \eta_s / 3\rho v^2 \ldots\ldots\ldots (7)$$

**Results and Discussion**

The samples had been characterization with compounds by mediated spectroscopic infrared technique, when comparing the IR spectra of this complex with ligand spectra observed changes are clear, new packages were not already present in the spectrum of ligand while suffered other packages from the obvious changes in shape, intensity and location, table (1) illustrates melting point and the changes on package sites of infrared spectrum for each of the ligand (DMAB) and complexes, the reason for this is to get the consistency between the metal ions and free material.

Figure (1) shows the ultrasonic velocity increasing in the DMAB, M1 and M2 this because structural relaxation occurs in associated liquids, a liquid when at rest has a lattice structure similar to that possessed by solid when waves are propagated through it, which made the particles due to the situation stable duration is shorter, then due to the structural relaxation happening between the molecules of the compound will be responsible for the decreasing in the absorption of ultrasonic as shown in figure (2) as well as a process of cross linking, which leads to random distribution of particles of the compound and the solvent and this is confirmed by the increase in the values of the ultrasonic velocity, in M3 the ultrasonic velocity decreasing with distance inside the solution , this because there are more attenuation of complex molecules to ultrasound waves (Al-Bermany 2010) so reducing the velocity because of increasing network formation between complex chains against the ultrasonic velocity waves.

Figure (3) shows the relaxation time decreasing with increasing distance to get the cross linking between the molecular compound that restricts the movement of these molecular in their positions, leading to the decrease in the values of the relaxation time of any decrease in the time required to re-molecule raised to its original status, as the relaxation time is less in the compound (DMAB) The reason is when the passage of ultrasound in the solution lead to break bonds for complexes (M1, M2 and M3) and as a result of broken bonds for the purpose of stability and re-entry into their original positions require a period of relaxation is greater than its predecessor in the molecules of the compound(DMAB) (Subhi *et. al.*1990).

Figure (4) shows the relationship between the relaxation amplitude and distance, as seen from the Figure that the relaxation amplitude decreasing with increasing velocity and the reason is due to the small distance traveled by the molecule in the process of arousal, because of the determination of the inertia of the large molecular is small (E.Foled *et. al.*1988)and we show that the molecular at velocities few took the character of cross linking after a break bonds and increase the size of the molecular and then increased moment of inertia, which leads in turn to increase the relaxation amplitude and in particular a complex chromium as it takes high values for the relaxation amplitude at low velocities and due to the presence of water molecules associated with the bonds of hydrogen, which are themselves the bonds are weak as quickly broken when the pass of ultrasonic to the solution of the complex referred to, and This action is reversed when increasing velocity, as well as the relaxation amplitude is directly proportional with the

absorption coefficient as shown in relation (3), and when the frequency constant (40) KHZ for all models is therefore expected to increase the relaxation amplitude of the molecules of the solution when increasing the absorption coefficient.

Figure (5) shows the relationship between the Specific acoustic impedance and the distance, as seen from the figure the specific acoustic impedance increasing with distance and the reason goes back to increase the number of molecular due to increased velocity, which in turn leads to increased density of the medium as the passage of ultrasonic within the solution lead to a compression and rarefaction, there is breaking bonds and formation of free roots in chains (material free and complexes) that are inherently unstable and that must be interdependence again to get the state of stability and thus configure the phenomenon of cross linking in the solution, which lead to increased specific acoustic impedance expressed by the solution as a result of the case of overlapping cross and increase the medium density, thus increasing the specific acoustic impedance.

Figure (6) shows that increases bulk modulus with increasing distance and the reason for this through the relationship (4), the behavior of bulk modulus is the same behavior of ultrasonic velocity, where the note in iron complex of that the bulk modulus record the highest values at velocities large because of the high density of this complex compared complexes other and followed the free material (DMAB) and then complexes chromium, nickel, iron (M1, M2 and M3) respectively.

Figure (7) shows the compressibility with distance are decreasing with increasing distance, and the reason for this is due to the convergence of molecular the solution led to the occupancy of space in the solution, which in turn led to a decrease of compressibility (Pradeep *et. al*. 2009, Al-Bermany 2010), since the compressibility is inversely proportional with velocity as described in equation (5), this lead to decreased compressibility where we note in free material of compressibility value at the highest velocity first because of the lack of overlap between the particles of medium which makes the compression takes a high value on the opposite than in the case of complex (M1,M2 and M3) except that the compressibility decreases quickly because of the complexity of the solution molecules led to the decrease in compressibility.

**Conclusions**

1- 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.
2- 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 is for its mechanical properties.
3- The molecules absorbed the sound waves according to Lambert-Beer Law which is biased on concentration so reducing velocity in complexes comparing with legand.

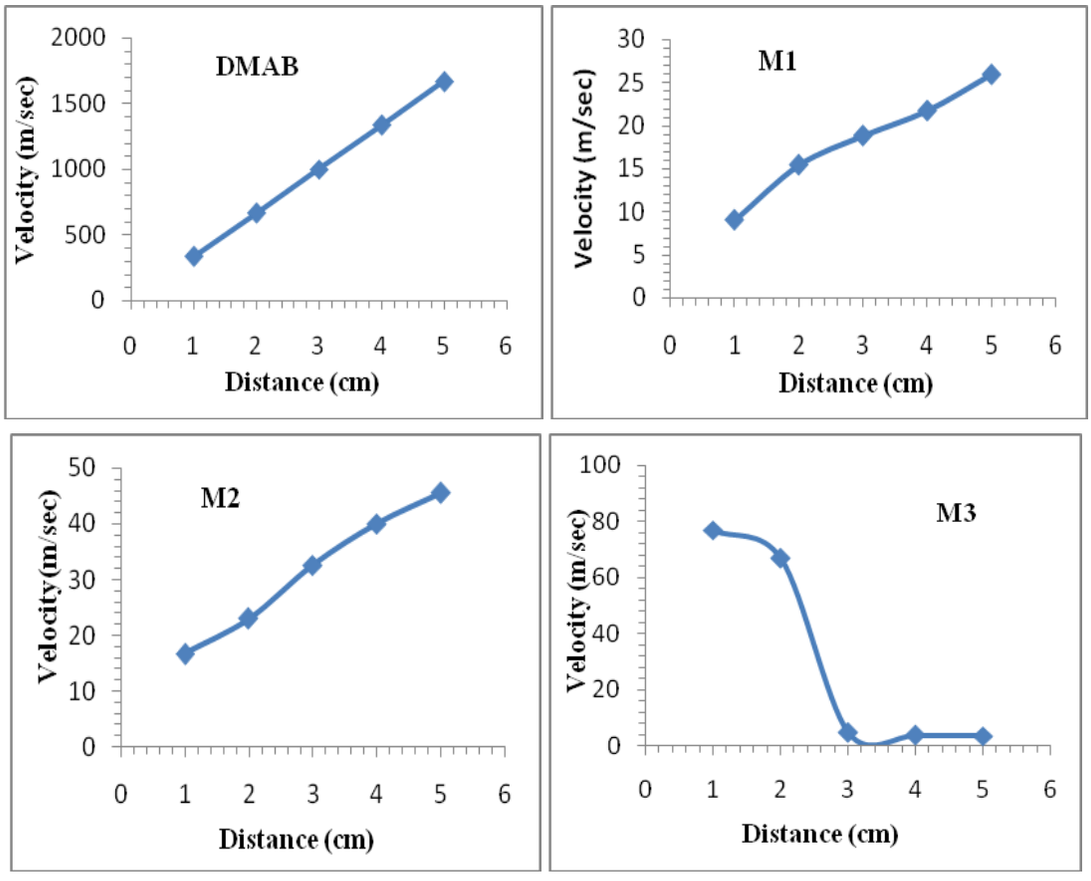
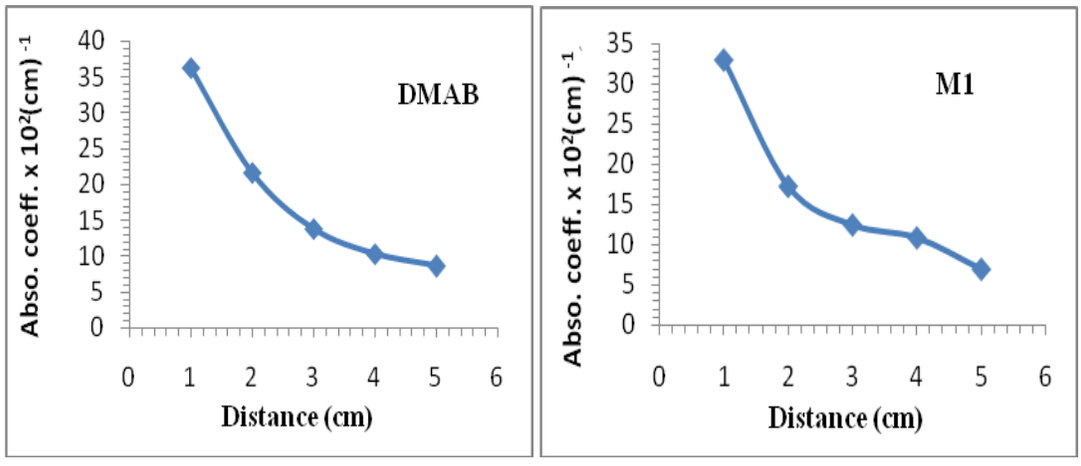



**Figure (1) the velocity due to the distance of the sound waves in solutions.**



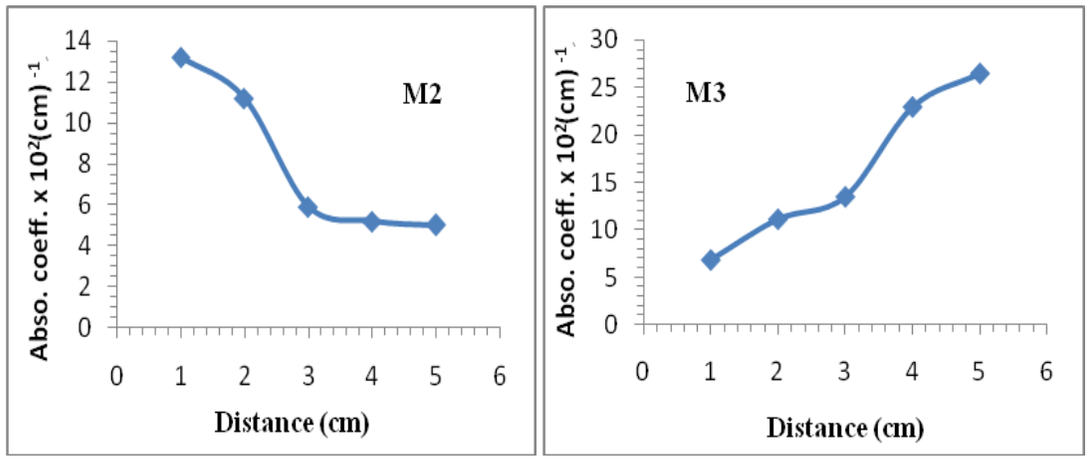



**Figure (2) the absorption coefficient due to the distance of the sound waves in solutions.**

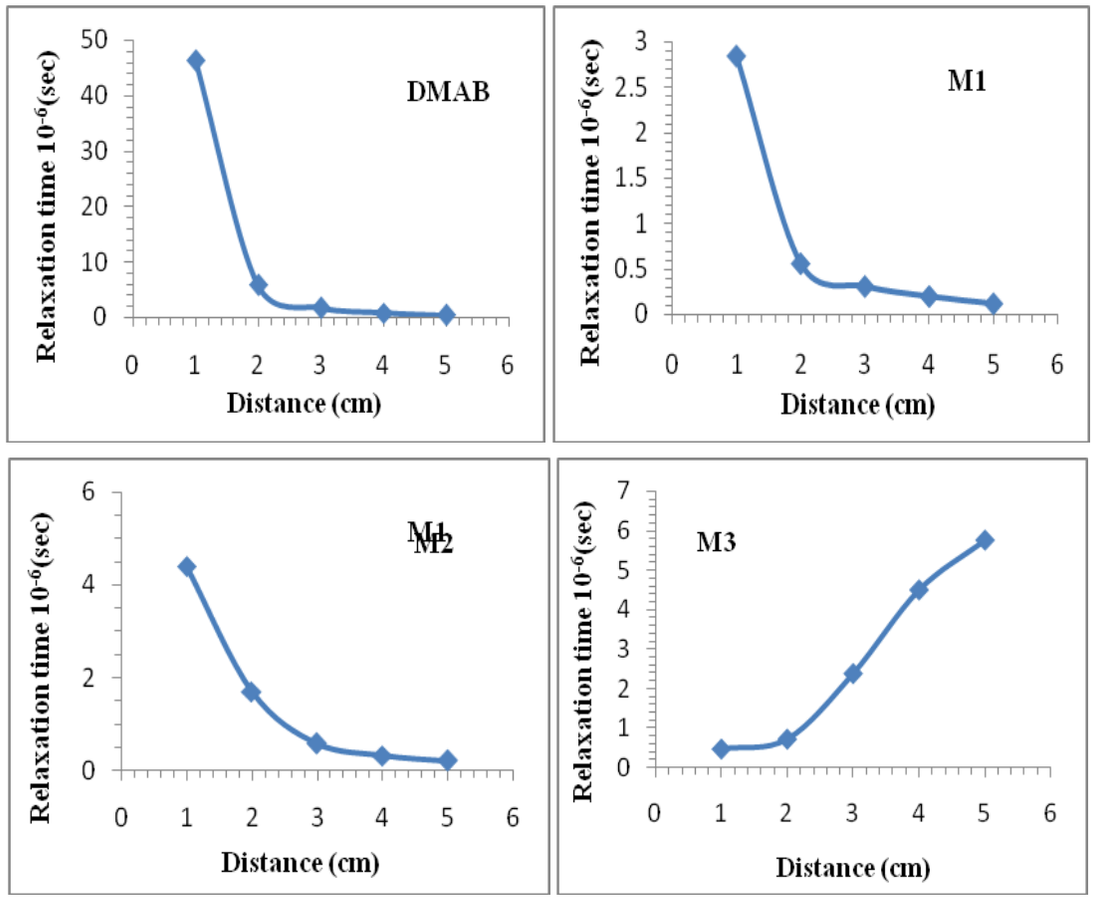
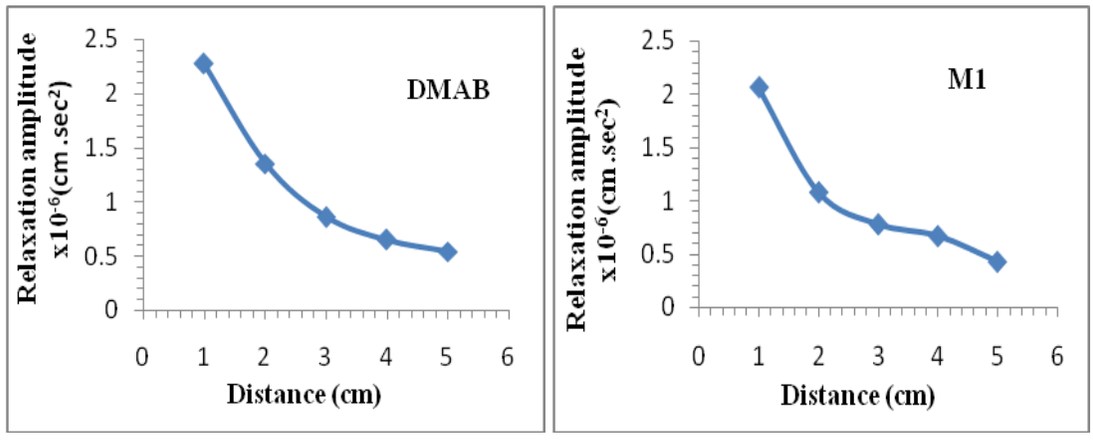



**Figure (3) the relaxation time due to the distance of the sound waves in solutions.**



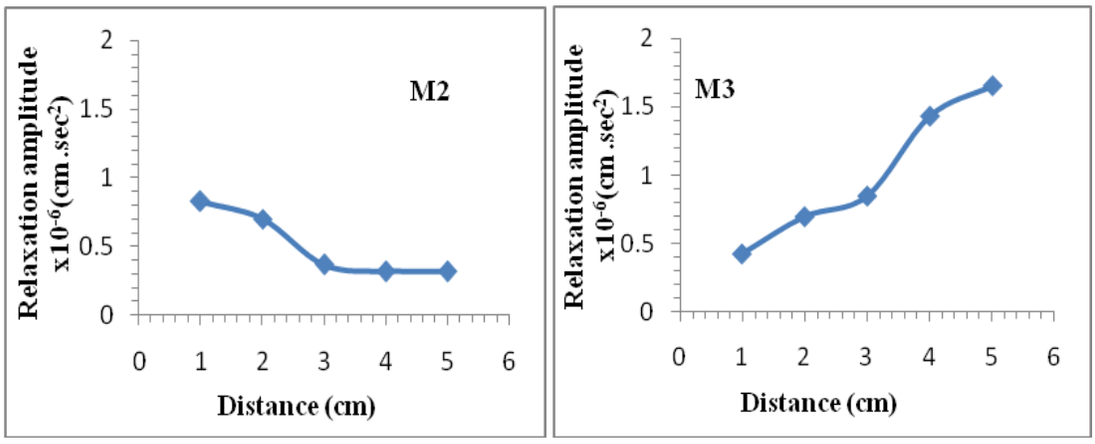



**Figure (4) the relaxation amplitude due to the distance of the sound waves in solutions.**

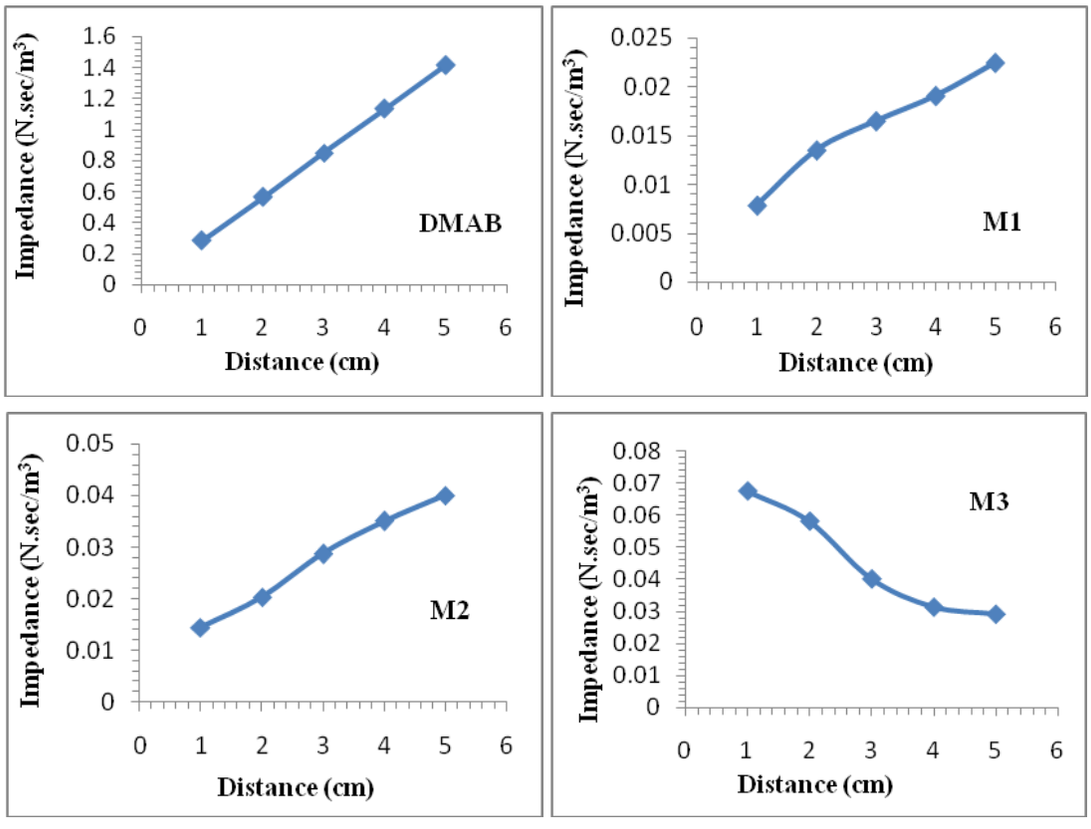
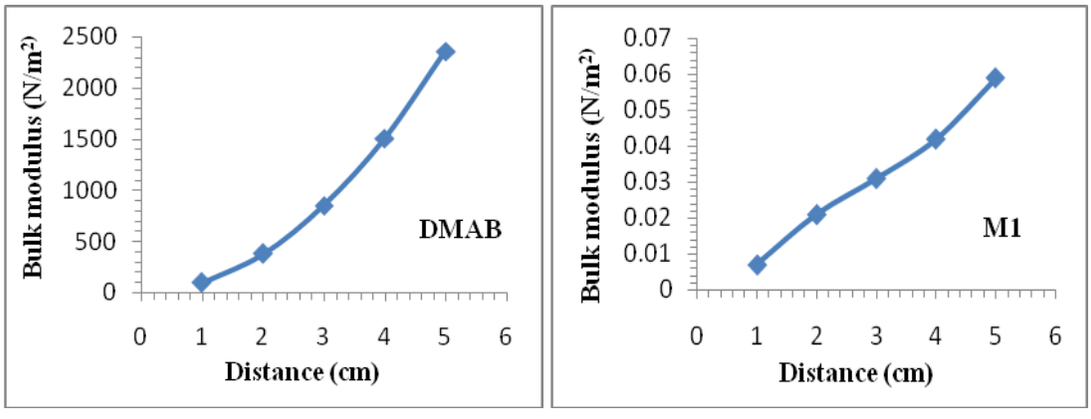



**Figure (5) the Impedance due to the distance of the sound waves in solutions.**



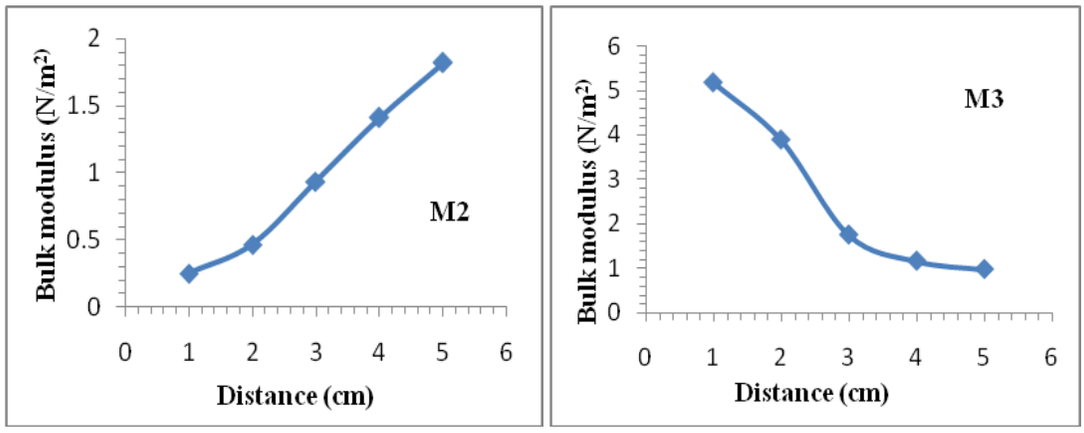



**Figure (6) the Bulk modulus due to the distance of the sound waves in solutions**

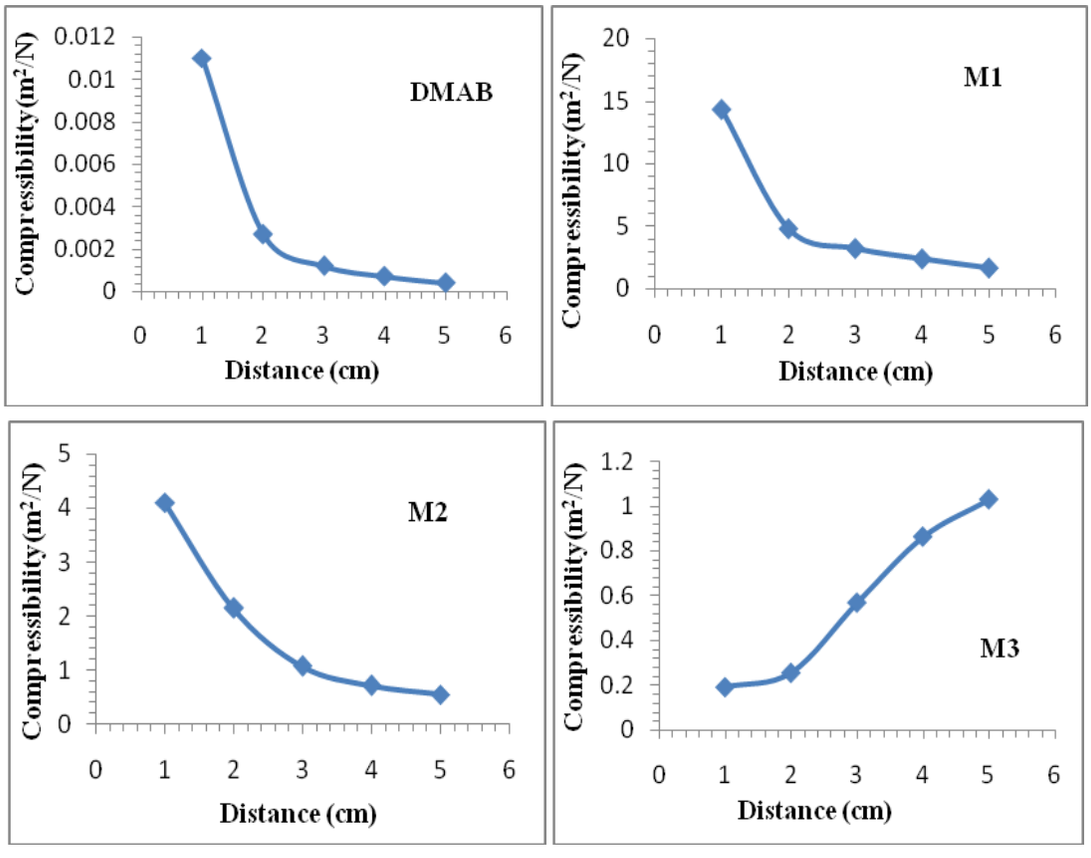



**Figure (7) the compressibility due to the distance of the sound waves in solutions**

**Table (1) melting point the infrared ray spectra of ligand (DMAB) and its complexes in ($cm^{-1}$) units**

| No. | Compound | Symbol | Melting Point (°C) | $\overline{\nu}$ (C=O) | $\overline{\nu}$ (C=N) | $\overline{\nu}$ (M-N) | $\overline{\nu}$ (M-O) |
|---|---|---|---|---|---|---|---|
| 1 | $C_{18}H_{17}N_3O$ | DMAB | 174 | 1651.12 | 1568 .18 | - - | - - |
| 2 | $[CuL_2Cl_2]H_2O$ | M1 | 130 | 1700 | 1650 | 510 | 430 |
| 3 | $[FeL_2Cl_2]Cl$ | M2 | 216 | 1695.49 | 1599.04 | 515 | 440 |
| 4 | $[CrL_2Cl_2]Cl$ | M3 | 198 | 1651.12 | 1564.32 | 500 | 420 |

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