

Synthesis, Characterization and Antibacterial Activity Studies of Mn (II) Complex with Schiff base

تحضير، توصيف، ودراسة النشاط المضاد للبكتيريا لمركب المنغنيز (II) مع قاعدة شيف

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Abstract

In this study, the transition metal chelates of Mn (II), with Schiff base were synthesized and characterized. Elemental analysis data showed that, the isolated chelates are in 1:1 [M: L] ratio. The molar conductance values revealed that the chelates are none electrolyte in nature. The results of magnetic moment measurements demonstrated that, the chelates of Mn (II) have unpaired electrons and. The infrared spectral data displayed the main coordination sites Salicylaldimine towards Mn (II) ions. The electronic spectrum results of the Schiff base ligand and its chlates suggest that the Mn (II) have octahedral structure This study paper summarizes the synthesis via traditional method of the Schiff base and its metal complex. The antibacterial function of the Schiff base's metal complex has also been discussed. Using H1 NMR and elemental analysis, the compound's structure was reported. The obtained Schiff bases have been evaluated against bacteria such as E. coli and S. aureus

Keywords: antibacterial activity, Schiff base, Mn (II).

الملخص

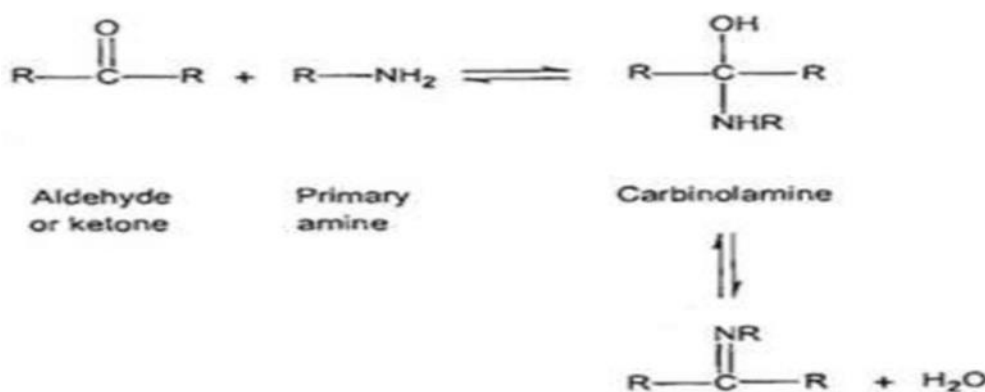
في هذه الدراسة، تم تصنيع وتوصيف مخرّبات المعادن الانتقالية للمنغنيز (II) مع قاعدة شيف. أظهرت بيانات التحليل العنصري أن المخرّبات المعزولة هي بنسبة 1:1 [M:L]. وكشفت قيم الموصلية المولارية أن المخرّبات ليست إلكتروليتيّة بطبيعتها. أظهرت نتائج قياسات العزم المغناطيسي أن مخرّبات المنغنيز (II) تحتوي على إلكترونات غير مقترنة. أظهرت بيانات الطيف تحت الأحمر مواقع التنسيق الرئيسية (ساليسيلالديمين) تجاه أيونات المنغنيز (II). تشير نتائج الطيف الإلكتروني لربطة قاعدة شيف ومخرّباتها إلى أن المنغنيز الثنائي (Mn (II)) له بنية ثماني السطوح. تلخص هذه الدراسة عملية تخليق قاعدة شيف ومعقدتها المعدني بالطريقة التقليدية. كما نوقشت الوظيفة المضادة للبكتيريا لمعقد قاعدة شيف المعدني. باستخدام الرنين النووي المغناطيسي H1 والتحليل العنصري، تم تحديد بنية المركب. قُيِّمت قواعد شيف الناتجة ضد بكتيريا مثل الإشريكية القولونية والمكورات العنقودية الذهبية.

الكلمات المفتاحية: النشاط المضاد للبكتيريا، قاعدة شيف، المنغنيز الثنائي.

Introduction

Schiff bases compounds are contain azomethine group ($-HC=N-$), and were first reported by Hugo Schiff in 1864 [1]. These compounds are also known as anils, imines or azomethines. It is usually formed by condensation of ketone or an aldehyde with primary amine [2]. Schiff bases are the most widely used organic compounds. They have been shown to exhibit abroad range of biological activities, including antifungal, antibacterial, and antimalarial, ant proliferative, anti-inflammatory, antiviral, and antipyretic properties. this study summarizes the synthesis and the biological activities of Schiff bases and their chelates [3] A research paper revealed comparative study between antimicrobial activity of metal complex of ligand and simple ligand by testing it against gram positive bacteria *Staphylococcus Aureus*. Metal complex of Schiff base obtained from salicylaldehyde and 1, 2-phenylenediamine with the bivalent transition metals Zn and Cu was characterized and tested. It was concluded from the experiment that the metal complex of salicylaldehyde ligand shows more activity than salicylaldehyde ligand [8]. A Schiff base formed by 2- Hydroxy-6penta-decylbenzaldehyde and 6-bromo-3- chloro1-benzo-thiophene-2-carboxy-licacidhydrazide was synthesized and tested anti-fungal and anti-bacterial activity against *B. subtilis* and *S. aureus* [9]. [5]. Schiff bases and and their metal chelates play an important role in the development of coordination chemistry resulting an enormous number of

publications, has been studied extensively, and have gained much importance recently due to their chelating ability, antimicrobial, anti-inflammatory activities and anticorrosion [6-9]. Schiff bases used in the fields of industry, medicine, and organic synthesis, analytical inorganic chemistry, they used in optical and electrochemical sensors, transition metal complexes are used in dyes industry for food, leathers, and wood [10,11] tetra dentate Schiff bases ligand with a N₂O₂ donor atom set are well known to coordinate with various metal ions, and this has attracted the interest of many authors. Chelates of Schiff base ligands studied for their oxidative catalysis [12].



Scheme 1 formation reaction of Schiff base

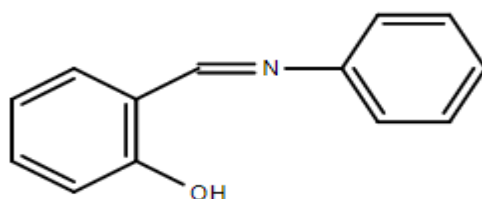
Materials

All the chemicals used in this study were of analytical grade (BDH, Aldrich) including salicylaldehyde, aniline, ethanol, diethyl ether and diethyl formamide.

Synthesis of Schiff base L

The Schiff base was synthesized by adding (1.22ml, 0.01mol salicylaldehyde) dropwise to (0.92ml, 0.01 mol) in 50 ml of absolute ethanol. The reaction mixture was refluxed for three hours. Then the product obtained was allowed to cool at room temperature, filtered and recrystallized from ethanol, and then dried under vacuum to get pale yellow precipitate (yield 80%). The Schiff base formation can be explained as shown in scheme

Scheme 1. Synthesis of Schiff base L/Reaction condition: salicylaldehyde (1.22ml, 0.01mol), aniline (0.92ml, 0.01mol), absolute ethanol (50 ml)



Scheme2 Schiff base L₁

Synthesis of Schiff bases complex with Mn (II):

The Schiff bases L chelate under investigation were synthesized by adding Salicylaldehyde (1.84g ,0.01 mole) in absolute ethanol . The reaction mixtures were heated under reflux for 3 hours. The chelates were filtered and recrystallized from ethanol and finally kept in a desiccator over silica gel.

Antibacterial activity:

The antibacterial performance of the prepared compound was examined by a well diffusion assay method. For quality purpose, Std. strains *S. aureus* ATCC 25923 and *E. coli* ATCC 25922 were used. Nutrient agar medium was prepared and autoclaved for the well diffusion assay. The inoculum of 150 μ l of each bacterium was spread with a swab on the plate of culture media/ nutrient agar.

Wt. of sample in gram= M. wt x Vml/1000

Wt of sample in gram = M.wt x 0.1 x1ml /1000

Results and discussions

The reaction between the salicylaldehyde and aniline yields one product (scheme 1)

Table 1 some physical properties of the Schiff bases L and its chelate with Mn (II):

Compound/chelates	M.Wt	M.P	color	Δ (μ s)	BM
L ₁ (C ₁₃ H ₁₀ ON)	184	60	orange	-	-
L ₃ Mn.Cl ₂	277	300<	Green	11	1.89

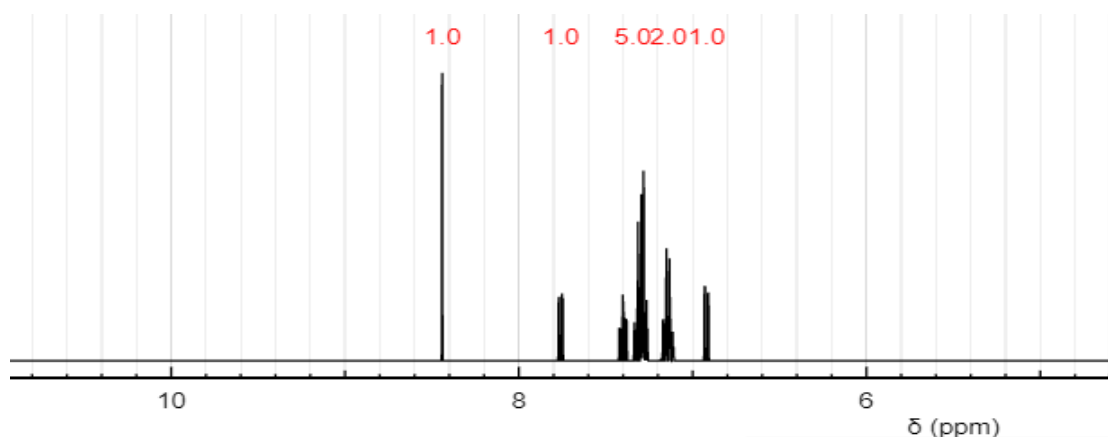


Figure1. H^1 NMR spectrum of Schiff base

Proton nuclear magnetic resonance spectrum of L

The H^1 - NMR spectrum recorded in d_6 -DMSO solvent on a jeol-90 Fourier transform (200 MHz). Shows some singlet signals (Figure3) 8.2 ppm assigned to isomethene proton, 6.9 to 7.9 ppm, assignable to the protons of two phenyl ring with C= and OH, phenyl ring in downfield and phenyl ring bond with =N on

Infrared spectra of Schiff base and its complex:

The IR spectra of the ligands and its chelates with Mn^{2+} , were recorded in the solid state in the rang $400-4000\text{ cm}^{-1}$ using kBr disk on Perkin -Elmer 1430 ratio recording infrared spectrophotometer (Figures 7-10). The IR spectral data are present in Tabl 2. A verification of the structures of metal chelates can be easily achieved by comparing the IR spectrum of the free ligand with those chelates [25].

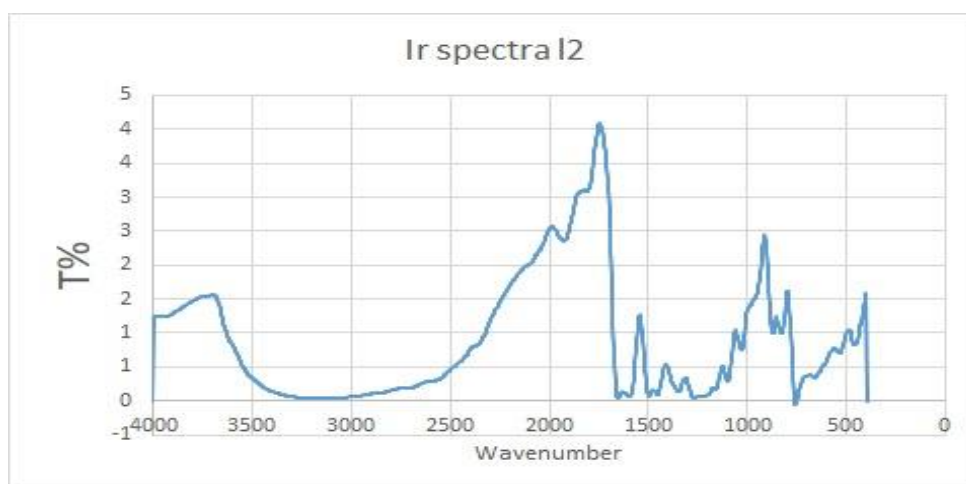


Figure2IR spectrum of Schiff base

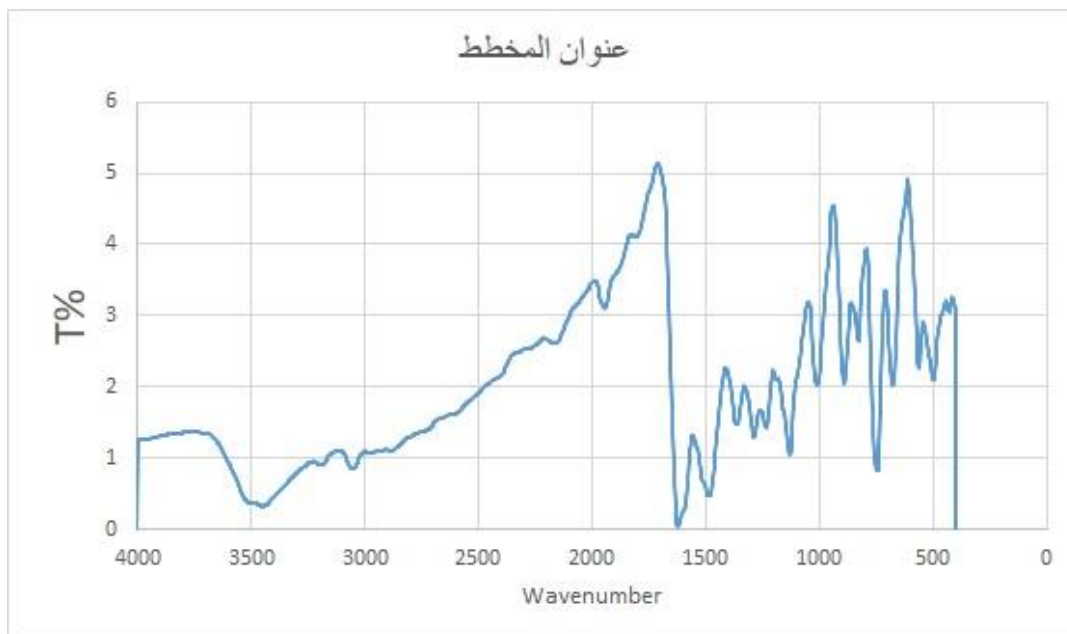


Figure2. IR spectrum of the complex

The IR spectrum of the Schiff base displays five bands. The first is a broad peak at 3000–3500 cm^{-1} assigned to the OH group, and a sharp peak at 1600 cm^{-1} which is assigned to the isometine- $\text{C}=\text{N}$ group and a weak band at 1600 cm^{-1} which indicates the phenyl (phenyl ring), and CH (stretching vibration) groups respectively [26]. Also, one strong band at 1609 cm^{-1} is due to $\text{C}=\text{N}$ and a band at 1507 cm^{-1} is due to bending vibration. The IR spectrum revealed broad bands in the range of 3500 cm^{-1} that are attributed to the stretching vibration of OH of coordinated water molecules during chelate formation [27]. The new bands observed at 597–623 cm^{-1} and at 549–715 cm^{-1} could be attributed to $\nu(\text{M}-\text{O})$ and $\nu(\text{M}-\text{O})$ vibrations [29,30]. When a Schiff base ligand is coordinated to a metal ion, at least one additional atom is introduced into the ligand vibrating system. It is thus expected that bond lengths, angles, and interacting forces within the ligand would be altered even at least slightly.

Antibacterial activity results

The ligand and its synthesized chelates were screened for their possible antibacterial activities against three types of bacteria. The ligand and its chelates showed moderate to good antibacterial activities against *Staphylococci*. Antibacterial activities were performed by the cup plate method. Inhibition zones were recorded by measuring the diameter of the inhibition zone in mm at the end of 24 h [31]. At room temperature, the results of the antibacterial study are tabulated in Table 1. The widest inhibition zone was formed around

EColi of the complexes of Mn (II), with Schiff from salicylaldehyde with aniline

Table3. Antibacterial activity results (mm) for the Schiff base and its complexes.

Compounds	Zone of inhibitions (mm)	
	E.Coli	Staphylococci
DmsO(negative standred)	0	0
L1(C ₁₃ H ₁₀ ON)	14	20
L1Mn. Cl ₂ 2H ₂ O	13	20
Amoxicillin (positive stander)	33	35

CONCLUSION

Schiff bases are highly versatile members of coordination compounds. They show various physiological and chemical properties along with active biological activity. The complex of Schiff base with metal ion has various applications such as antiviral, antitumor, antipyretic or anti-inflammatory agents. Many on going researches are focused on the chemotherapeutic activity of these complexes. In this research copper complex of Schiff base was prepared from salicylaldehyde and aniline using a conventional method. activity against *E. coli*. and *S. aureus*. Further, many modified compounds can be formed using this method and lead to development of drugs for cancer.

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