

## Synthesis and Antibacterial Study of Some Schiff Bases Complexes

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**Abstract.** Novel Schiff bases (*E*)-*N*-(4-chlorobenzylidene)-2-(2,4-dichlorophenyl) acetohydrazide and (*E*)-2-(2,4-dichlorophenyl)-*N*'-((1-methoxynaphthalen-2-yl)methylene) acetohydrazide were synthesized and further used for the synthesis of metal complexes. All these synthesized Schiff bases and metal complexes were characterized and screened for antimicrobial activity against bacteria *Escherichia coli*, *Pseudomonas aeruginosa*, and *Bacillus subtilis*.

**Keywords:** Schiff bases, metal complex, antimicrobial activity etc.

### 1 Introduction

Schiff bases and their complexes are of high interest among the researchers because of their biological activity including anti-tumor, antibacterial, fungicidal, antidepressants, antiphlogogistic, nematocide, anti-carcinogenic and catalytic activity [1-2].

The microorganisms adsorb metal ions on their cell walls and through respiration process of cells these ions are disturbed and the process of protein synthesis is blocked which is the requirement for further growth of organisms. Gram-negative bacteria membrane is surrounded by an outer lipopolysaccharide membrane. Schiff base metal complexes combine with the lipophilic layer to enhance the membrane permeability of the Gram-negative bacteria. The lipid membrane surrounding the cell favours the passage of lipid soluble materials only; thus the lipophilicity is an important factor that controls the antimicrobial activity. Increase in lipophilicity enhances the penetration of Schiff base and its metal complexes into the lipid membranes and thus restricts growth of the organism [3].

Synthesis of new coordination compounds for cobalt (II), nickel (II) and copper (II) with Schiff base ligand derived from 4-Amino antipyrine, sulphadiazine and acetoacetanilide has been studied [4]. Copper (II) complexes derived from 4-nitro-2-[(2-diethylaminoethylimino)-methyl]-phenol as the Schiff base ligand was reported by Wei *et al.* [5]. Metal complexes of Fe (II), Co (II), Ni(II), Cu(II), Zn(II) or Cd (II) with Schiff base like *N*-(2-thienylmethylidene)-2-aminopyridine have been studied by Spinu *et al.* [6]. Synthesis and antibacterial activity of schiff bases and transition metal complexes derived from 2, 3-diminopyridine and ortho-vanillin has been studied by Henri *et al.*[7]. Anil Kumar *et al.* [8] described the synthesis and antimicrobial activity of new metal [Mg(II), Fe(II), Co(II), Ni(II), Zn(II) and Cd(II)] complexes from 2-(1'/2'-hydroxynaphthyl) benzoxazoles. Gudasi *et al.*[9] synthesized and studied biological activity of dioxouranium(II) and thorium(IV) complexes of Schiff base derived from 2-amino pyridine and acetophenones. Chittilappilly *et al.* [10] have reported the synthesis and biological activity of ruthenium (III) Schiff base complexes derived from 3-hydroxy quinoxaline-2-carboxaldehyde and salicylaldehyde. In continuation of our previous work [11-12], we prompted to synthesize new Schiff bases and their complexes.

Herein, we synthesized novel Schiff bases (*E*)-*N*-(4-chlorobenzylidene)-2-(2,4-dichlorophenyl) acetohydrazide and (*E*)-2-(2,4-dichlorophenyl)-*N*'-((1-methoxynaphthalen-2-yl)methylene) acetohydrazide by the condensation of novel hydrazides with aromatic aldehydes Table 1.



## SYNTHESIS AND ANTIMICROBIAL ACTIVITY OF IMINES AND THEIR METAL COMPLEXES

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Keywords: Imines, metal complexes & microbial activity

Two new schiff bases (*E*)-(4-chlorophenyl)-(4-chlorobenzylidene)aceto-hydra-zide and (*E*)-(4-chlorophenyl)-(1-methoxynaphthalen-2-ylmethylene)aceto-hydra-zide and their metal complexes were synthesized. All of the synthesized imines and their metal complexes were characterized and screened for antimicrobial activity.

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### Introduction

Schiff bases, characterized by the azomethine group ( $-R-C=N-$ ), form a significant class of compounds in medicinal and pharmaceutical chemistry and are known to have biological applications due to their antibacterial,<sup>1,6</sup> antifungal,<sup>3,6</sup> and antitumor<sup>7,8</sup> activity. Schiff base ligands are considered "privileged ligands" because they are easily prepared by the condensation between aldehydes and amines. The incorporation of transition metals into these compounds leads to the enhancement of their biological activities and decrease in the cytotoxicity of both metal ion and schiff base ligand.<sup>9-11</sup>

Schiff bases with donors (N, O, S, etc.) have structural similarities with neutral biological systems and due to presence of imine group are utilized in elucidating the mechanism of transformation of racemization reaction in biological system.<sup>12-14</sup>

Coordination chemistry, a study of metal complexes is an important research area in inorganic chemistry. Detail reviews regarding Schiff base metal complexes and their applications have been published by several scientist in recent years. Neelima Mishra et al.<sup>15</sup> and S. Arulmurugan et al.<sup>16</sup> on Biological activities, Katarzyna Brodowska et al.<sup>17</sup> on using various fields of science, Ahmed M. Abu-Dief et al.<sup>18</sup> on veterinary application and Kavita Rana et al.<sup>19</sup> on analgesic and anti-inflammatory effect.

### Experimentals

#### Synthesis of Schiff base

In order to prepare Schiff base firstly esters of substituted phenylacetic acid were prepared, which were further reacted with hydrazine hydrate to obtain hydrazides from which Schiff base were prepared.

#### a) General procedure for the synthesis of esters

To a magnetically stirred ice cold solution of carboxylic acid (20 mmol) in methanol (20 mL), a catalytic amount of concentrated H<sub>2</sub>SO<sub>4</sub> (2-3 drops) was added dropwise. The contents were gently warmed to room temperature and then refluxed for 2-3 h. After completion of the reaction as indicated by TLC (20% ethyl acetate: n-hexane); excess methanol was removed under reduced pressure on rotary evaporator. The reaction mixture was cooled to 0°C, basified with saturated aqueous NaHCO<sub>3</sub> and finally extracted with dichloromethane (3x15 mL). The combined organic layer was washed with water, separated, dried over sodium sulphate and concentrated on rotary evaporator to afford the corresponding esters as oily liquids.

#### b) General procedure for the synthesis of hydrazides

A mixture of carboxylic ester (20 mmol) and hydrazine hydrate (100 mmol) was refluxed at 100 °C for 1h. Progress of the reaction was monitored by TLC (50 % ethyl acetate: n-hexane). After completion of reaction; the excess amount of hydrazine hydrate was evaporated under reduced pressure. The crude product was triturated with petroleum ether under ice-cold condition, washed several times with water and dried by toluene azeotrope to get the corresponding hydrazide as the crystalline white solid.

#### c) General procedure for the synthesis of Schiff base

In equimolar mixture of aldehyde (2 mmol) and hydrazide (2 mmol) in ethanol (5 ml) 2-3 drops of glacial acetic acid were added at room temperature and the contents were refluxed till completion of reaction for appropriate time.