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Synthesis and Evaluation of Thiophene Based Schiff Base Metal Drug Complexes

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Abstract

The thiophene-based Schiff base metal drug complexes' Fe(III), Ru(III), Co(II), and Cu(II) complexes were created. Conductivity measurements, infrared, electronic, mass, and ESR spectroscopy were used to characterize the complexes. The coordination of the metal to the ligands in thiophene-based Schiff base metal drug complexes occurs via the nitrogen of the Schiff base and via the sulphur of the thiophen group. The complexes' antibacterial activity was tested against Penicillium rubrum, Aspergillus niger, Salmonella typhi, Staphylococcus aurus, Basillus subtillus, and Staphylococcus aurus.

Keywords: Thiophene, Schiff bases, synthesis, complexes, antimicrobial ligands metal

Introduction

Mycobacterium tuberculae, a bacteria that is spread from person to person through the air, is the disease-causing agent in tuberculosis. An antibiotic is a molecule or substance that inhibits the growth of bacteria.[1] In order to effectively treat tuberculosis (TB), medication combinations are frequently used.[2,3] Only tablets, capsules, liquids, and injectables are available as antituberculosis medications, which are used to treat tuberculosis.[4] sulfonamides, with various subbed gatherings, show antibacterial, insulin-discharging antidiabetic, carbonic anhydrase inhibitory, high-roof diuretic, and antithyroid activities3. As of late, numerous papers have detailed a few sorts of antitumor specialists having the basic highlights of sulfonamide[5]. Sulpha drugs are the manufactured antimicrobial specialists coming about because of 4-amino benzenesulphonamide. Their antibacterial action is thought to emerge from closeness of their structures to the 4-aminobenzoic corrosive found in microbes for folic corrosive synthesis[6]. Pyridine-4-carbohydrazide is a known tuberculostatic specialist. It structures metal chelates with numerous bivalent particles. These buildings have been utilized in the assurance of the structure of Pyridine-4-carbohydrazide.[7,8] Pyrazine is a more fragile base than pyridine,

because of the acceptance impact of the subsequent nitrogen. Some pyrazines, particularly dihydropyrazines, are fundamental for all types of life. A few pyrazine subsidiaries have been utilized as cancer prevention agents. These mixes have demonstrated significant restorative applications.[9-13]

Therefore, this work is aimed as:

1. To produce additional complexes, which are novel and effective alternative medications.
2. To perform analysis on the metal drug complexes, including measurements of conductivity, solubility, melting point, and IR, NMR, mass, and ESR spectrometry.
3. To test the synthetic metal complexes against microbes using an anti-microbial analysis.

Material and Methods

The different instruments, techniques, glass wares, solvents, reagents and methods used in the synthesis of sulfonamide compounds are as follows:

- Bruker advance 300 MHz NMR
- Perkin Elmer100 FT-IR spectrophotometer
- Agilent 1100 MCD trap-5C Mass spectrometer
- Digisun conductivity meter, DI 909 model
- Perkin Elmer UV-Vis spectrophotometer. U.V lamp

Methodology

Synthesis of the Complexes.

4-(Thiophene-2-ylmethylene)aminobenzenesulfonamide [TMABS]:

To an answer of 1.72g (0.01mol) of 4-aminobenzenesulfonamide (Merck) disintegrated in 100 ml of methanol in a 250 ml round base cup, 1.22 g (0.01 mol) of thiophene-2-carbaldehyde (Fluka) was included. The arrangement was refluxed on a water shower for 3 hours. The compound isolated was separated and recrystallized from methanol to give a light yellow shaded strong. Yield (82%), MP: 140 °C.[14,15]

Thiophen-2-ylmethylidinene) pyridine-4-carbohydrazide [TMPCH]:

To an answer of 1.23g (0.01m) of pyridine-4-carbohydrazide (Finar) disintegrated in 100 ml of methanol in a 250 ml round base cup, 1.22 g (0.01 mol) of thiophene - 2-carbaldehyde (Fluka) was included. The arrangement was refluxed on a water shower for 3

hours. The compound isolated was sifted and recrystallized from methanol to give a light yellow shaded strong. Yield (86%), MP: 130°C.[16-18]

(Thiophen-2-ylmethylidinene) pyrazine-2-carboxamide [TMPCA]:

An answer containing 1.24g of pyrazinamide (Hi media) in 100 ml of ethanol in a 250 ml round base carafe was included with 1.12 g (0.01 mol) of thiophene-2-carbaldehyde. The substance were refluxed on a water shower for 2 hours. The compound isolated was separated and recrystallized from methanol to give a light yellow shaded solid.[19,20] Yield (68%), MP:178-180°C.

Antimicrobial Screening Procedure

A grouping of 5 mg/ml of each compound was set up in DMSO that had no impact on the microbial development.

Bacterial species: The accompanying Gram +ve and Gram – ve culture of human pathogens were utilized to test the antibacterial movement of the mixes.

Gram + ve : *Staphylococcus aureus*

Basillus Subtillus

Gram – ve : *Salmonell typhi*

Escherichia coli

Agar cup plate technique[21]

A normalized 1 to 2 x 107 cfu/ml 0.5 MC Furland standard was presented onto the outside of a sterile agar plate and equitably circulated inoculums by utilizing a sterile glass spreader. All the while, 6 mm wells were cut from the plate utilizing a sterile plug borer. 80 □l arrangement at a grouping of 5 mg/ml of the mixes was presented vigorously at 37 ^{o}C. After 24 hrs, the hindrance zones were estimated with a ruler and contrasted and the control well containing just DMSO and 5 mg/ml of streptomycin as the norm.

Results and Discussion

Given the relevance of this class of aggressors, the designer has chosen to combine and depict metal Schiff base buildings made of sulfonamide, carbohydrazide, pyrazinamide, and other aldehydes. The ligands TMABS, TMPCH, and TMPCA as well as a fraction of their metal structures set up for organic action have been screened in order to conduct the exams. In the current investigation, 4-

aminobenzenesulfonamide has been condensed with thiophene-2-carbaldehyde, along with pyridine-4-carbohydrazide, pyrazine-2-carboxamide, and the accompanying Schiff base ligands, which have been acquired and depicted in fig. 1, 2 and 3.

The Fe(III), Ru(III), Co(II) and Cu(II) edifices of these Schiff base ligands have been readied and basically portrayed based on basic investigation, conductance, warm, attractive and infrared, electronic and ESR ghostly information. Pertinent ends as for the geometry of the edifices have been drawn dependent on the information acquired. The work typified in the theory likewise incorporates aftereffects of fundamental examinations of natural action of the ligands: TMABS, TMPCH, TMPCA and their Fe(III), Ru(III), Co(II) and Cu(II) edifices against the two-gram positive bacterial strains: Basillus Subtillus, Staphylococcus Aurus and two-gram negative bacterial strains: Escherichia coli, Salmonella typhi, and two contagious strains: Aspergillus niger and Penicillium rubrum.

All the ligands are steady at room temperature and are non-hygroscopic. They are insoluble in water, somewhat dissolvable in methanol and $(CH_3)_2CO$ and genuinely solvent in hot methanol and dimethylformamide. The ligands have been portrayed by investigative, mass, ^1H NMR and IR ghastly information.

Proposed structure for metal complexes

(M = Fe, Ru, Cu)

Fig. 4.: Structure of Fe (III), Ru (III), Cu (II) complexes of TMABS

Conclusion

We have created mixed ligand transition metal complexes of Fe(III), Ru(III), Co(II), and Cu(II). The complexes are subjected to several forms of characterisation employing infrared spectroscopy, electric conductivity, melting point, and solubility. A chelating complex is created by the ligands. The newly discovered alternative medications were proven to be more efficient than their original ligands. The complexes' antibacterial activity was tested against Penicillium rubrum, Aspergillus niger, Salmonella typhi, Staphylococcus aurus, Basillus subtillus, and Staphylococcus aurus. Complex formation was confirmed by the combined results of the physical and spectroscopic examinations.

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