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CHEMICAL SYNTHESIS AND ANTIFUNGAL EVALUATION OF THIOPHENE METAL COMPLEXES

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Abstract

Fe(III), Ru(III), Co(II), and Cu(II) complexes of the thiophene-based Schiff base metal drug complexes were synthesized. The complexes were characterized using conductivity tests, infrared, electronic, mass, and ESR spectroscopy. In thiophene-based Schiff base metal drug complexes, the coordination of the metal to the ligands takes place through the nitrogen of the Schiff base and the sulphur of the thiophen group. The complexes were tested for their antifungal efficacy against Penicillium rubrum and Aspergillus niger.

Keywords: Thiophene, Schiff bases, Penicillium rubrum and Aspergillus niger

Introduction

Among the most widely used medications are antibacterials and antifungals. There has been a recent increase in demand for novel antibacterial and antifungal chemicals due to the seriousness of bacterial and fungal infection resistance. Due to the diversity of fungal species, the abundance of secondary metabolites, and advancements in genetic breeding and fermentation techniques, natural products from fungus are regarded as a significant source for new antibacterial and antifungal chemicals. A growing range of fungi, including marine fungus and endophytic fungi on wild plants, are having their antimicrobial activity studied in an effort to find new antibacterial and antifungal chemicals. Numerous novel bioactive natural substances with cytotoxic, anticancer, antiviral, antibacterial, or antifungal properties have been found in the last ten years from marine fungi.[1-6]

The produced antimicrobial specialists known as sulpha medicines were made possible by 4-amino benzenesulphonamide. Their structural similarity to the 4-aminobenzoic corrosive present in microbes for the manufacture of folic corrosive is assumed to be the source of their antibacterial effect.[7] An established expert in tuberculostatics is pyridine-4-carbohydrazide. It uses lots of bivalent particles to structure metal chelates. These structures were used to verify the structure of pyridine-4-carbohydrazide.[8] Because of the accepting impact of the following nitrogen, pyrrazine is a more delicate base than pyridine. Dihydropyrazines, in particular, are essential for all forms of life. Some of the pyrazine family members have been used as cancer preventatives. These mixtures have proven to have important restorative uses.[9-13]

Material and Methods

The following are the various tools, procedures, glassware, solvents, reagents, and techniques utilised in the production of sulfonamide compounds:

- 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]:

1.22 g (0.01 mol) of thiophene-2-carbaldehyde (Fluka) was added to an answer of 1.72 g (0.01 mol) of 4-aminobenzenesulfonamide (Merck) that had been broken down in 100 ml of methanol in a 250 ml round base cup. For three hours, the arrangement was refluxed on a water shower. The isolated chemical was taken from methanol, separated, and crystallised again to produce a bright, pale yellow hue. Yield (82%) and MP (140 °C).[14,15]

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

1.22 g (0.01 mol) of thiophene - 2-carbaldehyde (Fluka) was added to an answer of 1.23g (0.01m) of pyridine-4-carbohydrazide (Finar) dissolved in 100 ml of methanol in a 250 ml round base cup. For three hours, the arrangement was refluxed on a water - bath. From methanol, the isolated chemical was sifted and recrystallized to produce a pale yellow-hued solid. 130°C MP, 86 percent yield.[16-18]

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

1.12 g (0.01 mol) of thiophene-2-carbaldehyde was added to an answer containing 1.24 g of pyrazinamide (Hi medium) in 100 ml of ethanol in a 250 ml round base carafe. For two hours, the substance was refluxed in a water - bath. The isolated substance was taken from methanol, separated, and recrystallized to produce a solid with a pale yellow hue.[19,20] Yield (68%), MP:178-180°C.

Fungal species: The following fungal species were used to assess the antifungal activity of the compounds. *Pencillum rubrum* and *Aspergillus niger*

Antifungal movement: Spores from the nascent societies were collected and transferred to a test tube containing sterilised refined water for the preparation of the spore suspension. The spore suspension that was later purchased was used to evaluate the antifungal efficacy of the mixtures.

Antifungal test:

The antifungal test of the mixes was completed by agar well dispersion strategy as depicted by Magaldi et al.[21] The way of life plates hatched with the test life forms were permitted to set and punched with a sterile stopper borer (5 mm distance across) to make open wells. The wells were loaded up with 100 ⇑l arrangement at a convergence of 5 mg/ml of the mixes at 30 ^{o}C. Following 72 hours, the restraint zones were estimated and contrasted and those of the control DMSO and the standard flucnazole at a convergence of 5 mg/ml.

Results and Discussion

The designer combined and depicted metal Schiff base structures built of sulfonamide, carbohydrazide, pyrazinamide, and other aldehydes due to the importance of this class of aggressors. In order to carry out the tests, the ligands TMABS, TMPCH, and TMPCA as well as a portion of their metal structures prepared for organic action have been screened. In the present study, thiophene-2-carbaldehyde, pyridine-4-carbohydrazide, pyrazine-2-carboxamide, and the associated Schiff base ligands have been condensed with 4-aminobenzenesulfonamide. These reactions have been obtained and shown in figs. 1, 2, and 3.

These Schiff base ligands' Fe(III), Ru(III), Co(II), and Cu(II) structures have been prepared and fundamentally depicted based on basic study, conductance, warm, attractive, and infrared, electronic, and ESR ghostly information. According to the knowledge gained, pertinent conclusions on the geometry of the structures have been reached. The study exemplified by the theory also includes findings from first investigations into the natural activity of the ligands TMABS, TMPCH, and TMPCA, as well as their Fe(III), Ru(III), Co(II), and Cu(II) fortifications against two infectious strains of Aspergillus niger and Penicillium rubrum.

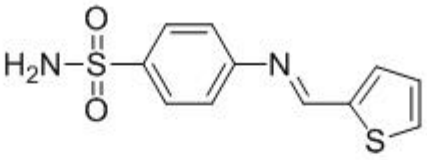


Fig. 1
4-((Thiophen-2-ylmethylene)amino)benzenesulfonamide (TMABS)

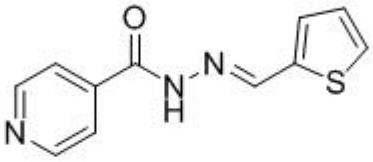


Fig. 2
N'-(Thiophen-2-yl-methylidene)-pyridine-4-carbohydrazide (TMPCH)

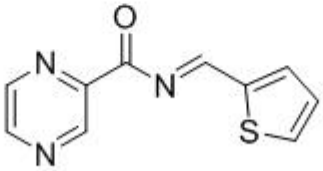
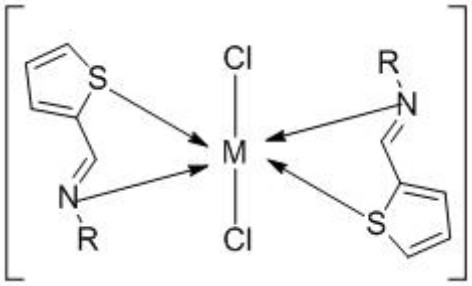


Fig. 3
N-(Thiophen-2-ylmethylidene)-pyrazine-2-carboxamide(TMPCA)

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; R = Benzenesulfonamide, pyridine-4-carbohydrazide and pyrazine-2-carboxamide)

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

Conclusion

The edifices of Fe(III), Ru(III), Co(II), Ni(II), Cu(II), Pd(II), Zn(II), Cd(II) and Hg(II) complexes with TMPCH have been portrayed by different physico-substance information. The metal : natural ligand stoichiometry has been seen as 1 : 2 with Fe(III), Ru(III) and Cu(II) complexes and 1:1 in rest of them. All the metal buildings show non electrolytic conduct in DMF except for Fe(III) and Ru(III) which display 1:1 conduct. The ligand carries on in a nonpartisan, bidentate way towards the metal particles planning through nitrogen of azomethine gathering and sulfur of thiophene ring. Fe(III), Ru(III), Co(II) and Cu(II) buildings are paramagnetic relating to five, one, three and one unpaired electrons separately while the others are diamagnetic. In view of the electronic spectra, Ru(III) and Cu(II) buildings have been proposed an octahedral geometry, Co(II) unpredictable, a tetrahedral geometry and the Ni(II) and Pd(II).

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