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**SYNTHESIS, PHYSICOCHEMICAL AND BIOLOGICAL
 PROPERTIES OF 3, 4, 5-TRIMETHOXYBENZOATES OF Mn(II),
 Co(II), Ni(II) AND Zn(II)**

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ABSTRACT

The complexes of Mn(II), Co(II), Ni(II), Cu(II) and Zn(II) with 3,4,5-trimethoxybenzoic acid have been synthesized and characterized by elemental analysis and IR spectroscopy. The carboxylate groups bind as monodentate or bidentate chelating or bridging ligands. The metal complexes have also been tested in vitro for their antibacterial and anti-fungal activity. The experimental results suggest that metal complex is more potent in anti-bacterial and anti-fungal activities.

Keywords: 3,4,5-trimethoxybenzoates of Mn(II), Co(II), Ni(II), Cu(II) and Zn(II), thermal stability, IR spectroscopy, Anti-bacterial and Anti-fungal activities.

INTRODUCTION

It has been reported that metal complexes show enhanced biological activity as compared to free ligands due to reduction in polarity of metal after complexation. Though many structure-activity correlation studies of transition metals have been reported [1-10].

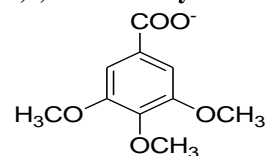
The complexes of various isomers of mono-, di- and trimethoxybenzoic acid anions with some metal ions have been described [11–20]. 3,4,5-Trimethoxybenzoic acid of formula C₁₀H₁₂O₅ is a white, crystalline solid, sparingly soluble in water but readily soluble in alcohol, ether and chloroform.

EXPERIMENTAL

The complexes of 3,4,5-trimethoxybenzoates of Mn(II), Co(II), Ni(II), Cu(II) and Zn(II) were Prepared by the addition of equivalent quantities of 0.1 M ammonium 3, 4,5-trimethoxybenzoate (pH 5) to a 0.1M hot aqueous solution containing the nitrates of these metal ions and crystallizing at 293 K. The solids were filtered off, washed with hot water and methanol to remove ammonium ions and dried at 303 K to constant mass. The contents of carbon and hydrogen in the complexes were determined by elemental analysis using a CHN 2400 Perkin – Elmer

analyser. The contents of M²⁺ metals were established by the ASA method.

Figure 1. L: 3,4,5 trimethoxy benzoic acid ligand



The 3,4,5-trimethoxybenzoates of Mn(II), Co(II), Ni(II), Cu(II) and Zn(II) show similar solid state IR spectra. However, the characteristic frequencies related to the carbonyl group are altered markedly when the acid is compared with the salts. The band at 1684 cm⁻¹ originating from the –COOH group vibration, present in the spectrum of the acid, disappears in the spectra of the complexes and two bands arising from the asymmetric and symmetric vibrations of the COO⁻ group occur at 1552–1576 cm⁻¹ and 1388–1400 cm⁻¹, respectively. 43–46 Bands attributed to asymmetric and symmetric C–H stretching modes of the –CH₃ groups are observed at 2944–2960 cm⁻¹ and 2840 cm⁻¹, respectively. The bands due to metal–oxygen bond vibrations occur at 408–416cm⁻¹.

Their values increase in the following order: Mn(II) < Ni(II) < Zn(II) < Co(II) < Cu(II).^{42,43,46} The values of the frequencies of the absorption bands of the valency vibrations of the COO⁻ group, as(OCO) and s(OCO) indicate the various ways of the coordination of the carboxylate group in the 3,4,5-trimethoxybenzoates of Mn(II), Co(II), Ni(II), Cu(II) and Zn(II). This indicates the various degrees of ionic bonds in the analysed complexes and the different dentates of the carboxylate groups. The degree of ionic bond is smaller in the complexes of Mn(II) and Co(II) and greater in the 3,4,5-trimethoxybenzoates of Ni(II), Cu(II) and Zn(II) than that in the sodium salt. Accordingly, taking into account the spectroscopic criteria and with regard to the Nakamoto criterion, the carboxylate groups appear to be monodentate (in the complexes of Zn(II) and Ni(II)), bidentate chelating (in the complexes of Mn(II) and Co(II)) and bidentate bridging (in the Cu(II) complex).

Microbial studies

Antimicrobial activity of the synthesized compounds was screened using the disc diffusion method against *Escherichia coli*. The compounds were dissolved in DMSO and sterilized. Sterile Whatmann filter paper discs (previously sterilized in U.V. lamp) were impregnated with synthesized compounds at a concentration of 25,100 mg/disc. This was placed in the organism-impregnated petri plates under sterile condition. The plates were left for 30 min to allow the diffusion of compounds at room temperature.

Antibiotic discs of Amoxicillin (100 µg /disc) used as positive control, while DMSO used as negative control. Then the plates were incubated for 24 h at 37 ± 1° C for antibacterial activity. The zone of inhibition was calculated by measuring the minimum dimension of the zone of no microbial growth around the disc.

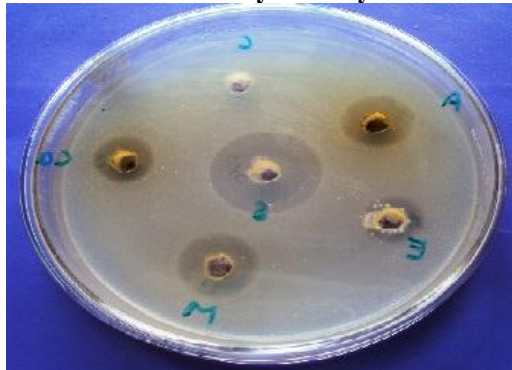
Table 1. Analytical Data

Complex L=	C / %		H / %		M / %		Solubility Mol dm ⁻³
	Calcd.	Found	Calcd.	Found	Calcd.	Found	
C10H11O5							
MnL2H2O	48.49	48.4	4.85	4.7	11.09	11.5	3.42X10 ⁻²
CoL2H2O	48.10	48.3	4.81	4.7	11.80	12.2	6.19X10 ⁻²
NiL26H2O	40.76	40.6	5.77	5.1	9.97	10.3	6.15X10 ⁻³
[Cu2L4(H2O)2]	47.66	47.8	4.77	4.7	12.6	12.9	6.58X10 ⁻⁴
ZnL2	49.24	49.4	4.51	4.4	13.41	13.2	4.01X10 ⁻²

Table 2. Spectroscopic data of the 3,4,5-trimethoxybenzoates of Mn(II), Co(II), Ni(II), Cu(II), Zn(II) and Na(I) and 3,4,5-trimethoxybenzoic acid (cm⁻¹)

Complex L= C10H11O5	v(C=O)	V as(OCO)	vsy(OCO)	Δv(OCO)	v(M-O)
MnL2H2O	-	1552	1400	152	408
CoL2H2O	-	1560	1400	160	420
NiL26H2O	-	1576	1388	188	410
[Cu2L4(H2O)2]	-	1572	1396	176	440
ZnL2	-	1576	1396	180	416
NaL	-	1580	1410	170	-
HL	1684	-	-	-	-

Figure 2. Antimicrobial activity of the synthesized compounds



Description of markings on the petri plate. Observations after 24 hrs.

C – Control, ca - Standard (amoxicillin), E – Mn(II) 20 mg of the sample, A – Co(II) 20 mg of the sample, S – Ni(II) 20 mg of the sample, M – Zn(II) 20 mg of the sample.

SUMMARY AND CONCLUSION

The synthesized 3, 4, 5-trimethoxybenzoates of Mn(II), Co(II), Ni(II) and Zn(II) compound showed more active than standard drug amoxicillin. Above 3, 4, 5-trimethoxybenzoates of Mn(II), Co(II), Ni(II) and Zn(II)-shows inherent new generation of series of

pharmaceutically important compound. The synthesized compound therefore, presents a new scaffold that can be used to yield potent antimicrobial compounds. It can be concluded that these compound certainly holds great promise towards good active leads in medicinal chemistry.

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