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Synthesis and Antimicrobial Activity of Some Transition Metal Complexes of *o*-Vanillin-L-Histidine

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Complexes of Fe(II), Co(II), Ni(II) and Cu(II) with *o*-vanillin-L-histidine have been synthesised. Physical and spectral data of the chelates were determined by elemental and spectral analysis. The synthesised complexes were screened against microorganisms isolated from prawn and soil for antibacterial activity.

Key Words: Synthesis, Antimicrobial activity, Transition metal complexes, *o*-Vanillin-L-histidine

INTRODUCTION

In continuation of our work on the synthesis of vanillin complexes[1, 2] we have prepared some new *o*-vanillin chelates. The methods for the synthesis and characterisation of the chelates of present study have been reported[3]. Amino acids play a vital role owing to their wide range of biological activities[4–7]. Complexes of *o*-vanillin were also studied for their antibacterial, antifungal and amoebicidal activity *in vitro*[8]. These observations prompted us to study the antibacterial activity of *o*-vanillin-L-histidine (*o*-VALH) chelates.

EXPERIMENTAL

AnalaR grade chemicals and commercially available media purchased from BDH, Oxoid, Glaxo, Sisco and E. Merck were used. Prawn samples for the present study were collected from the market and the soil samples from an agriculture land. The procedure for estimation of bacterial count is that of U.S. Food and Drug Administration[9].

Determination of Antibacterial Activity

The analyses of antibacterial activity of the present complexes were done by paper disc method. Fe(II), Ni(II) and Cu(II) chelates of *o*-VALH were carefully and aseptically weighed and transferred to different sterile 150 mL conical flasks. 1% Solutions of the complexes were prepared by dissolving them in suitable solvents. From 1% solution three different dilutions (0.25, 0.2 and 0.1%) were made by adding required solvent.

Pre-set antibiotic agar plates were prepared, dried the surface at 56°C for 45 min and cooled to room temperature. Each plate was divided in to four quarters by drawing lines on the bottom so as to get one plate for three different

concentrations and one for blank. The sterile filter paper discs were dipped in different concentrations of the complex solution taken in a sample dish, drained by pressing against the inside wall of the dish and placed on the surface of the respective quarter of the agar plate. Each sterile filter paper disc dipped in 0.25, 0.2 and 0.1% solution of the complexes contains 12.5 μg, 10 μg and 5 μg of the metallic complex respectively. The plates were then incubated without inverting for 24 h and examined for clear zones of inhibition around the discs using hand lens.

After 24 h of the inhibition at 37°C, the zones of inhibition formed around each disc were measured in mm and the results of the growth inhibition of different bacterial cultures were recorded.

RESULTS AND DISCUSSION

The growth inhibition of the known bacterial genera by the Fe(II), Co(II), Ni(II) and Cu(II) chelates were determined and presented in Tables 1–8.

TABLE-1
EFFECT OF $[FeL(H_2O)_3]$ ON BACTERIA ISOLATED FROM PRAWN

Bacteria (Genus)	Number of cultures tested	Average diameter of inhibited area at different concentrations of the complex (mm)		
		0.25%	0.2%	0.1%
Alcalgenes	3	15	13	11
Bacillus	2	9	8	6
Lactobacillus	2	15	13	11
Maraxella	2	20	18	10
Micrococcaceae	2	12	11	10
Pseudomonas	3	21	19	14
Vibrio	3	17	15	12

TABLE-2
EFFECT OF $[FeL(H_2O)_3]$ ON BACTERIA ISOLATED FROM SOIL

Bacteria (Genus)	Number of cultures tested	Average diameter of inhibited area at different concentrations of the complex (mm)		
		0.25%	0.2%	0.1%
Alcalgenes	3	14	13	11
Bacillus	4	9	8	6
Micrococcaceae	5	16	15	12
Pseudomonas	4	17	16	14

TABLE-3
EFFECT OF $[CoL(H_2O)_3]$ ON BACTERIA ISOLATED FROM PRAWN

Bacteria (Genus)	Number of cultures tested	Average diameter of inhibited area at different concentrations of the complex (mm)		
		0.25%	0.2%	0.1%
Alcalgenes	3	12	10	7
Bacillus	2	11	10	8
Lactobacillus	2	10	9	7
Maraxella	2	12	10	7
Micrococcaceae	2	11	10	7
Pseudomonas	2	14	13	10
Vibrio	3	12	9	7

TABLE-4
EFFECT OF $[CoL(H_2O)_3]$ ON BACTERIA ISOLATED FROM SOIL

Bacteria (Genus)	Number of cultures tested	Average diameter of inhibited area at different concentrations of the complex (mm)		
		0.25%	0.2%	0.1%
Alcalgenes	3	11	10	7
Bacillus	4	9	8	6
Micrococcaceae	5	10	9	7
Pseudomonas	4	12	10	7

TABLE-5
EFFECT OF $[NiL(H_2O)_3]$ ON BACTERIA ISOLATED FROM PRAWN

Bacteria (Genus)	Number of cultures tested	Average diameter of inhibited area at different concentrations of the complex (mm)		
		0.25%	0.2%	0.1%
Alcalgenes	3	10	9	7
Bacillus	2	8	6	5
Lactobacillus	2	12	10	9
Maraxella	2	9	8	6
Micrococcaceae	2	12	11	9
Pseudomonas	2	15	14	12
Vibrio	3	13	11	9

TABLE-6
EFFECT OF $[NiL(H_2O)_3]$ ON BACTERIA ISOLATED FROM SOIL

Bacteria (Genus)	Number of cultures tested	Average diameter of inhibited area at different concentrations of the complex (mm)		
		0.25%	0.2%	0.1%
Alcalgenes	3	13	12	10
Bacillus	4	7	6	5
Micrococcaceae	5	12	11	9
Pseudomonas	4	14	13	11

TABLE-7
EFFECT OF $[CuL(H_2O)_3]$ ON BACTERIA ISOLATED FROM PRAWN

Bacteria (Genus)	Number of cultures tested	Average diameter of inhibited area at different concentrations of the complex (mm)		
		0.25%	0.2%	0.1%
Alcalgenes	3	9	8	6
Bacillus	2	13	11	8
Lactobacillus	2	11	9	7
Maraxella	2	10	9	7
Micrococcaceae	2	11	7	6
Pseudomonas	2	14	12	9
Vibrio	3	11	8	6

TABLE-8
EFFECT OF $[CuL(H_2O)_3]$ ON BACTERIA ISOLATED FROM SOIL

Bacteria (Genus)	Number of cultures tested	Average diameter of inhibited area at different concentrations of the complex (mm)		
		0.25%	0.2%	0.1%
Alcalgenes	3	9	7	6
Bacillus	4	8	7	6
Micrococcaceae	5	9	7	6
Pseudomonas	4	12	10	7

Thirtytwo bacterial cultures were isolated, sixteen from prawn and sixteen from soil. All the purified cultures are identified up to the generic level[10]. The cultures isolated from prawn includes *Alcalgenes, Bacillus, Lactobacillus, Maraxella, Micrococcaceae* and *Pseudomonas. Alcalgenes, Maraxella, Pseudomonas* and *Vibrio* are found to be gram negative and the remaining bacteria listed above are gram positive. Antimicrobial evaluation of the different metal complexes Fe(II), Co(II), Ni(II) and Cu(II) was also carried out by standard methods against gram positive and gram negative bacteria. Fe(II) chelate showed remarkable activity when compared to the other.

Generally the activity is more in isolates from prawn than soil. Three cultures namely *Bacillus, Pseudomonas* and *Micrococcaceae* were isolated from two sources, *viz.*, prawn and garden soil and were common. The antibacterial activity of the chelates were more in isolates of biological origin namely prawn than from the soil.

Chelates are more sensitive towards gram positive bacteria. For example, *Pseudomonas* is more sensitive than gram positive in all cases.

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REFERENCES

1. B. Sleema and Geetha Parameswaran, *Asian J. Chem.*, **13**, 709 (2001).
2. ———, *Asian J. Chem.*, **14**, 139 (2002).
3. ———, *Asian J. Chem.*, **14**, 961 (2002).
4. Bi Siwei, Gao Enqing, Tian Junlian, Li Yantuan, Tian Laijin, Liu Shuxiang and Li Guizhi, *Ying Yong Huaxue*, **12**, 13 (1995).
5. Tian Laijin Tian Junlian, Li Tantuan, Li Guizhi, Bi Siwei, Gao Enqing and Liu Shuxiang, *Huaxua Shiji*, **18**, 114 (1996).
6. Bi Siwei and Liu Shuxiang, *Wuji Huaxue Xuebao*, **12**, 423 (1996).
7. M. Tarek Ibrahim, A. Ahmed Shahana and A. Hamdy Hammad, *Arch. Pharmacol. Res.*, **15**, 130 (1992).
8. Offiong, Offiong E. Fanga, Etok, Comfort and Martelli, *Sante Fasmaco*, **51**, 801 (1996).
9. U.S. Food and Drug Administration, Bacteriological Analytical Manual, 6th Edn., Association of Official Analytical Chemists, Arlington, U.S.A. (1984).
10. P.K. Surendran and K. Gopakumar, *Fishery Technology*, **18**, 133 (1981).

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