

NOTE

Synthesis and Microbial Activity of Transition Metal Complexes of 3-Phenyl Rhodanine

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Compounds containing thiazole moiety are known to possess various biological activities. Rhodanine and substituted rhodanine, which contain toxiphoric dithiocarbamate chromophore (NCSS) are reported to be excellent fungicides and bacteriocides. A large number of 3- and 5-substituted rhodanine derivatives were synthesized and investigated for antibacterial and antifungal activities. It is known that some drugs have increased activity when administered as metal complexes. In cancer treatment it has been shown that the active species is the metal chelate of the drug. Antimicrobial activity of 3-phenyl rhodanine and its metal complexes in dimethyl formamide was studied by serial tube dilution technique. The solution was added to N-Broth to get 200, 100, 50, 25, 12.5 6.25, 3.125 and 1.56 µg/mL concentration. 3-Phenyl rhodanine is found to be active against *S. aureus* and *P. aeruginosa*. Minimum inhibitory concentration value is found to be 200 µg, which is important from the clinical viewpoint. The compound is less active against *B. subtilis* and *E. coli* and MIC values are found to be above 200 µg. Metal complexes of 3-phenyl rhodanine are found to be less active than parent compound and MIC was above 200 µg except Cu.

Key Words: Transition metal, Complexes, 3-Phenyl rhodanine, Antimicrobial activity.

Compounds containing thiazole moiety are known to possess various biological activities. Rhodanine is a well-known metal complexing agent. Rhodanine and substituted rhodanine, which contain toxiphoric dithiocarbamate chromophore (NCSS) are reported to be excellent fungicides and bacteriosides^{1,2}. A large number of 3- and 5-substituted rhodanine derivatives were synthesized and investigated for antibacterial and antifungal activities³⁻⁶. It is known that some drugs have increased activity when administered as metal complexes. A number of metal chelates inhibit tumour growth. In cancer treatment it has been shown

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that the active species is the metal chelate of the drug. On the basis of these observations it was thought of interest to prepare 3-phenyl rhodanine and its metal complexes and they were screened for microbial activities.

Synthesis of 3-Phenyl Rhodanine: 3-Phenyl rhodanine has been prepared as reported in the literature^{7,8}. All chemicals used were of extra pure grade. Melting points were taken in open capillary and were uncorrected. The products were routinely checked for their purity by TLC on silica gel. The compound gave satisfactory C, H, N and S analysis. IR spectra were taken as KBr pellets on Shimadzu 8201 PC FTIR. A mass spectrum was recorded on Jeol D-300 (EI/CI).

Synthesis of metal complexes: Ethanolic solutions of metal acetates (Co, Ni, Cu and Zn) were treated separately with ethanolic solution of 3-phenyl rhodanine in 1 : 2 ratio and refluxed on a water bath for 1 h, when the metal chelate separated out. These were filtered, washed with ethanol/acetic acid followed by ether and dried *in vacuo*. The colour of Co, Ni and Cu complexes is brown while that of Zn is white.

The elemental analysis is in complete agreement with the molecular formula, *i.e.*, C₉H₇NOS₂ and found to contain (%) C = 61.07, H = 3.7, N = 7.39 and S = 18.50. Calcd. (%): C = 61.01, H = 3.95, N = 7.90 and S = 18.07.

The IR spectrum has typical absorbance at 3065, 1710 and 1085 cm⁻¹ for rhodanine derivatives⁹. Weak sharp absorption band at 3055 cm⁻¹ shows the $\nu(\text{C}-\text{H})$ for aromatic compounds. A strong band at 1720 cm⁻¹ is due to the stretching of (C=O) group.

A methylene group next to carbonyl/sulphur has strong band but lower in frequency due to methylene deformation occurring at 1455 cm⁻¹ $\delta(\text{CH}_2)$. In thiocarbonyl derivatives where C=S linked to the carbon, sulphur, oxygen, chlorine, etc., the C=S stretching frequency is found around 1180 cm⁻¹. This band appears at $\nu(\text{C}=\text{S})$ 1178 cm⁻¹ in 3-phenyl rhodanine. The three medium to strong bands consistently appear at 1054, 1327 and 1386 cm⁻¹ are in agreement with N—C=S and —N—C=S groups^{10,11}.

The C—S stretching frequency generally appears as a band of weak intensity^{12,13} in the range 720–570 cm⁻¹ and it appears as a weak band at 693 cm⁻¹.

Microbial activity

Antimicrobial activity of 3-phenyl rhodanine and its metal complexes in dimethyl formamide was studied by serial tube dilution technique. The solution was added to N-broth to get 200, 100, 50, 25, 12.5, 6.25, 3.125 and 1.56 $\mu\text{g}/\text{mL}$ concentration. MIC values (Table-1) for the 3-phenyl rhodanine and its metal complexes were found to be as follows:

3-Phenyl rhodanine is found to be active against *S. aureus* and *P. aeruginosa*. Minimum inhibitory concentration value is found to be 200 μg , which is important from the clinical viewpoint. The compound is less active against *B. subtilis* and *E. coli* and MIC values are found to be above 200 μg . Metal complexes of 3-phenyl rhodanine are found to be less active than parent compound and MIC was above 200 μg except Cu for *S. aureus*.

TABLE-1
MICROBIAL ACTIVITY OF 3-PHENYL RHODANINE
AND ITS METAL COMPLEXES

S. No.	Compound	<i>E. coli</i>	<i>S. aureus</i>	<i>B. subtilis</i>	<i>P. aeruginosa</i>
1.	3-phenyl rhodanine	+	++	+	++
2.	Nickel complex	+	+	+	+
3.	Cobalt complex	+	+	+	+
4.	Copper complex	+	++	+	+
5.	Zinc complex	+	+	+	+

MIC values: ++ > 200 µg/mL, + < 200 µg/mL.

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