

Antibacterial Activity of Some Synthesized Metal Complexes of Embelin

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Abstract: The antimicrobial activity of embelin (2,5 dihydroxy 3-undecyl- p-benzoquinone) and its complexes with Co(II), Ni(II), Cu(II) and Zn(II) have been evaluated against *Staphylococcus aureus* and *Pseudomonas aeruginosa* by using agar diffusion method. These compounds showed significant enhancement in activity at higher concentrations of the complexes but moderate activity as compared to rifampicin.

Key words: Embelin, Metal complexes, Antibacterial activity, Agar diffusion method

INTRODUCTION

Embelia ribes is a benzoquinone derivative used as herbal medicine, belongs to the family *Myrsinaceae*. It possesses great medicinal importance. The whole plant is used in anti-inflammatory treatment to relieve rheumatism and fever [1]. Decoction of the leaves is used as a blood purifier [2]. Dried berries of this plant have a traditional reputation for showing anti-fertility activity [3]. Embelin is used in Ayurveda, Siddha as well as in Unani medicine system as anthelmintic and to cure skin diseases [4,5]. Embelin also shows analgesic, anti-inflammatory [6], antibacterial [7], antitumor [8] and free radical scavenging activities [9]. It was reported that the embelin is used as a cathode in zinc based secondary battery using $ZnCl_2-NH_4Cl$ electrolyte [10]. Copper (II) complexes of embelin have been found to display fairly good catalytic activity for the reduction of molecular oxygen [11]. The derivatives of embelin also play an important role in the anticancer activity [12]. It was reported that the phospholipid complex of embelin acts as an effective drug delivery tool [13]. The authors have reported the speciation of binary complexes of embelin with some biologically important metal ions [14]. Based on stability constants of binary complexes of embelin with different metal ions obtained by speciation studies and in view of its

relevance in biological systems the authors have synthesized, characterized and reported the Co(II) [15], Ni(II) [16], Cu(II) [17] and Zn(II) [18] complexes of embelin in 1:2 molar proportion. In view of the various bioactivities exhibited by embelin and its complexes and derivatives we attempted to investigate the antibacterial activity of binary complexes of embelin with Co(II), Ni(II), Cu(II) and Zn(II).

MATERIALS AND METHODS

Isolation of Embelin

Isolation of the embelin was carried out according to Indian herbal pharmacopeia. The seeds were cleaned, dried and powdered. An amount of 250 g of the powdered fruits of *Embelia ribes* was extracted with n-hexane using a soxhlet extractor for 6 hrs. The extract was evaporated on water bath and cold petroleum ether was added to it. It was stirred and filtered through buchner funnel under vacuum. The residue was washed with cold petroleum ether. The residue was dried and re-crystallized with chloroform to obtain pure embelin [19]. The melting point was found to be 142 °C. All reagents were of analytical grade.

Synthesis of Complexes

Preparation of the Dichlorobis(embelinate) metal(II): Hydrated metal chloride (5mmol) and

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embelin(10mmol) were dissolved in ethanol (20cm³) separately and mixed. Acetone (10cm³) was added to the solution and it was stirred for 30min. The precipitated complex was filtered, washed with ethanol and dried under vacuum at room temperature.

Tested Compounds

Embelin was isolated from the berries by a method described previously. Metal complexes were synthesized by the above method. Solutions of all these compounds were prepared at the concentrations of 2mg/ml, 3mg/ml and 4mg/ml using dimethyl sulfoxide.

Antibacterial Activity

This activity was determined by employing the agar diffusion method [20]. All the metal complexes were evaluated for *in vitro* antibacterial activity against *Staphylococcus aureus* and *Pseudomonas aeruginosa*. Nutrient agar was used as

a medium for cultivating bacteria in the laboratory. The inoculated medium was transferred in to sterile Petri dishes, evenly distributed and allowed to solidify. Thereafter the cups (8mm) were made with a sterile stainless steel borer. Into each of these cups 50 µL of the test compound was added. Each 50 µL of the Rifampicin and dimethyl sulfoxide were used as a standard and control respectively. All the zone diameters were average of three readings.

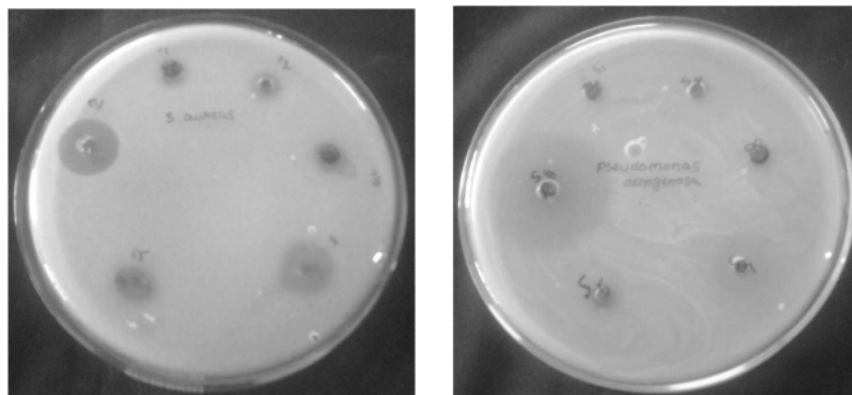
The activity of each compound was evaluated at 100, 150 and 200 µg mL⁻¹ concentrations. Rifampicin as standard was also tested under similar conditions for the comparison of the results. Bacteria used in this procedure were obtained from the Institute of Microbial Technology, Chandigarh, India.

RESULTS AND DISCUSSION

Inhibition zone diameters were measured and reported in Table 1 and shown in Fig. 1.

Table 1
Effect of Embelin and its Complexes on Bacteria

Compound	Zone of inhibition (mm)					
	<i>S. aureus</i>			<i>P. aeruginosa</i>		
	100 µg mL ⁻¹	150 µg mL ⁻¹	200 µg mL ⁻¹	100 µg mL ⁻¹	150 µg mL ⁻¹	200 µg mL ⁻¹
Embelin C ₁₇ H ₂₆ O ₄	09	10	11	09	09	10
Co(C ₁₇ H ₂₅ O ₄) ₂ Cl ₂	10	12	14	-	-	-
Ni(C ₁₇ H ₂₅ O ₄) ₂ Cl ₂	09	11	13	-	-	-
Cu(C ₁₇ H ₂₅ O ₄) ₂ Cl ₂	08	10	12	-	-	-
Zn(C ₁₇ H ₂₅ O ₄) ₂ Cl ₂	10	12	20	09	12	20
Standard (Rifampicin)	22	23	25	42	42	43
Control (DMSO)	00	00	00	00	00	00



S₁: Co-Complex, S₂: Ni - Complex, S₃: Cu- Complex, S₄: Zn Complex, S₅: Embelin and S₆:Rifampicin.

Figure 1: Inhibition Zone Diameters of Embelin and its Complexes at 200 µg mL⁻¹.

Conclusion

Embelin dissolved in dimethyl formamide showed significant antibacterial activity in the higher concentrations [7]. The metallation can increase the antibacterial activity than metal free ligand [21]. Complexes of embelin with Zn exhibited moderate activity against *Staphylococcus aureus* and *Pseudomonas aeruginosa* at 200 µg mL⁻¹.

Co, Ni and Cu-complexes showed feeble activity against *Staphylococcus aureus* even at higher concentrations and did not exhibit any activity against *Pseudomonas aeruginosa*.

ACKNOWLEDGEMENTS

The authors are thankful to Dr. D.Venkata Rao, Professor of the Department of pharmaceutical chemistry, University college of Pharmaceutical sciences, Andhra University, for providing necessary research facilities for screening of antibacterial activity.

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