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Sensitivity studies of Sm(III) – Sulphonanilide systems against various bacterial species

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ABSTRACT: *Sensitivity studies of Sm(III) – Sulphonanilide systems against various bacterial species have been carried out with S. aureus, P. aeruginosa and E. coli in the present study. Their activities have been compared with sulphonanilides.*

Keywords: *Antibacterial, Samarium, Sulphonanilide.*

I. INTRODUCTION

Metal complexes play a variety of important roles in biological systems [1], which becomes clear when we realize that many enzymes, the naturally occuring catalysts that regulate biological processes, are metal complexes (Metalloenzymes), Carboxypeptase, important in digestion, contain a zinc ion coordinated to several amino acid residues of the protein, Catalase which is an efficient catalyst for the decomposition of H_20_2, contain iron-porphyrin complexes, chlorophyll, vital to photosynthesis in plants, is a magnesium complex and hemoglobin, carrying oxygen to human cells, is an iron complex. Many platinum complexes have been reported as anti-cancer agents[2] and many vanadium complexes behave as anti tumor agents[3]. Anti-inflammatory activities of some complexes of schiff's basses with cobalt have also been reported[4]. The complexing ability has been reported poor in case of lanthanide complexes and also the stability of lanthanide complexes is found similar to $[Ag(NH_3)_2]^+$ type of complex[5] but the complexes of lanthanide (III) metal ion with organic reagents are significant because of their uses in the field of industrial[6], biochemical[7] & medical chemistry. Taking into consideration, the medicinal utility of salicylates, sulphon-anilides and metal complexes, it is considered worth while to plan synthesis of compounds incorporating all the three medicinally potent moieties[8].Present work deals with the sensitivity studies of Sm(III) – Sulphonanilide systems against gram positive and gram negative bacteria. The work will be useful in finding out the minimum inhibitory concentration (MIC) and minimum bactericidal concentration(MBC) for sulphonanilides and their systems with Sm(III) ion.

II. EXPERIMENTAL

Standrad grade chemicals - $SmCl_3.6H_2O$ and re-crystallized substituted sulphonanilides (prepared in this Lab-table 1) were used.

Twenty one systems were prepared for Sm(III) ion by using standard method[9].

The ligands and their systems have been screened for sensitivity studies by Bauer- Kirby disc diffusion technique.

The sensitivity studies of these systems have been tested against gram positive cocci *(Staphylococcus aureus)* and gram negative bacilli *(Pseudomonas aeruginosa* and *E. Coli*).

III. RESULTS AND DISCUSSION

In the present work sensitivity studies of Sm(III) – Sulphonanilide systems against gram positive cocci and gram negative bacilli, following results have been observed-

Sensitivity of *Staphylococcus aureus* against Sm(III) - sulphonanilide systems:

The decreasing order of sensitivity of ***Staphylococcus aureus*** against Sm(III) - sulphonanilide systems is given **below**-

Sm(III)-L_{40} > Sm(III)-L_{21} = Sm(III)-L_{24} = Sm(III)-L_{25} = Sm(III)-L_{26} = Sm(III)-L_{31} = Sm(III)-L_{36} =Sm (III)-L_{37} = Sm(III)-L_{39} > Sm(III)-L_{22} > Sm(III)-L_{23} = Sm(III)-L_{27} = Sm(III)-L_{29} = Sm(III)-L_{32} = Sm(III)-L_{34} =Sm(III)-L_{38} > Sm (III)- L_{20} = Sm(III)- L_{28} = Sm(III)-L_{30} = Sm(III)-L_{33} = Sm(III)-L_{35}

No activity was observed in systems with L_{20}, L_{28}, L_{30}, L_{33} and L_{35}, insignificant activity was observed in systems with L_{22}, L_{23}, L_{27}, L_{29}, L_{32}, L_{34}, and L_{38} sulphonanilides, moderate activity was observed in systems

with L_{21} L_{24}, L_{25}, L_{26}, $L_{31,}$ $L_{36,}$ L_{37} and L_{39}. No system was found to have significant, appreciable and high activity.

Sensitivity of *Pseudomonas aeruginosa* against Sm(III) - sulphonanilide systems:

The decreasing order of sensitivity of ***pseudomonas aeruginosa*** against Sm(III) – sulphonanilide systems is
given **below-**

Sm(III)-L_{22} = Sm(III)-L_{23} = Sm(III)-L_{25} = Sm(III)- L_{27} = Sm(III)-L_{33} = Sm(III)-L_{38} = Sm(III)-L_{40} > Sm(III)-L_{20}= Sm(III)-L_{21} = Sm(III)-L_{24} = Sm(III)-L_{28} = Sm(III)-L_{30} =Sm(III)-L_{36} >Sm(III)-L_{26} = Sm(III)-L_{29} = Sm(III)-L_{31} = Sm(III)-L_{32} = Sm(III)-L_{34} = Sm(III)-L_{35}= Sm(III)-L_{37} = Sm(III)-L_{39}

No activity was observed in systems with L_{26}, L_{29}, L_{31}, L_{32}, L_{34}, L_{35}, L_{37} and L_{39}, insignificant activity was observed in systems with L_{20}, L_{21}, L_{24}, $L_{28,}$ L_{30} and $L_{36,}$ moderate activity was observed in systems with L_{22}, L_{23}, $L_{25,}$ L_{27}, L_{33}, L_{38} and L_{7}. No system was found to have significant, appreciable and high activity.

Sensitivity of *Escherichia coli* against Sm(III) - sulphonanilide systems:

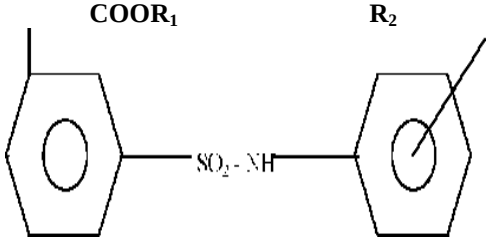
The decreasing order of sensitivity of ***Escherichia coli*** against Sm(III) – sulphonanilide systems is given **below-**

Sm(III)-L_{26} = Sm(III)-L_{21} = Sm(III)-L_{22} = Sm(III)-L_{30} = Sm(III)-L_{32} = Sm(III)-L_{38} > Sm(III)-L_{27} = Sm(III)-L_{28} = Sm(III)-L_{29} = Sm(III)-L_{35} = Sm(III)-L_{37} = Sm(III)-L_{40} = Sm(III)-L_{23} = Sm(III)-L_{24} = Sm(III)-L_{25} > Sm(III)-L_{20} = Sm(III)-L_{31} = Sm(III)-L_{33} = Sm(III)-L_{34} = Sm(III)-L_{36} = Sm(III)-L_{39}

No activity was observed in systems with L_{20}, L_{31}, $L_{33,}$ L_{34}, L_{36} and L_{39}, insignificant activity was observed in systems with L_{27}, L_{28}, L_{29}, L_{35}, L_{37}, L_{40}, L_{23}, L_{24}, and L_{25}, moderate activity was observed in systems with L_{26}, $L_{22,}$ L_{30}, L_{32} and L_{38}. No system was found to have significant, appreciable and high activity.

IV. FIGURE AND TABLES

Table 1: A Simplified representation of sulphonanilides



Sulphonanilide	Groups and their Position	
	R^1	R^2
L_{20}	C_2H_5	o-OCH_3
L_{21}	C_2H_5	p-OCH_3
L_{22}	H	o- NO_2
L_{23}	H	m- NO_2
L_{24}	H	p- NO_2
L_{25}	CH_3	o- NO_2
L_{26}	CH_3	m- NO_2
L_{27}	CH_3	p- NO_2
L_{28}	C_2H_5	o- NO_2
L_{29}	C_2H_5	m- NO_2
L_{30}	C_2H_5	p- NO_2
L_{31}	H	o-NH_2
L_{32}	H	p- NH_2
L_{33}	CH_3	o- NH_2
L_{34}	CH_3	p- NH_2
L_{35}	C_2H_5	o- NH_2
L_{36}	C_2H_5	p- NH_2
L_{37}	-CH_2-CH_2-	o-NH_2
L_{38}	CH_3	p-NH_2
L_{39}	-CH_2-CH_2-CH_3	o-NH_2
	-$CH(CH_3)_2$	
L_{40}	-$CH(CH_3)_2$	p-NH_2

Table 2: Sensitivity of *staphylococcus aureus* against sulphonanilides and Sm(III) -sulphonanilide systems. Concentration of the compound used has been taken 300 µg/disc. Compounds & Systems (20-40) have been written serially

S. No.	Sulphonanilide	Sm(III) - sulphonanilide
20.	-	--
21.	-	±
22.	±	-
23.	±	-
24.	-	±
25.	±	±
26.	±	±
27.	-	-
28.	-	--
29.	-	-
30.	--	--
31.	-	±
32.	-	-
33.	-	--
34.	-	-
35.	±	--
36.	-	--
37.	--	--
38.	--	-
39.	--	±
40.	--	±

Table 3: Sensitivity of *Pseudomonas aeruginosa* against sulphonanilides and Sm(III) – sulphonanilide systems Concentration of the compound used has been taken 300 □g/disc. Compounds & Systems (20-40) have been written serially

S. No.	Sulphonanilide	Sm(III) - sulphonanilide
20.	--	-
21.	--	-
22.	±	±
23.	-	±
24.	--	-
25.	--	±
26.	-	--
27.	--	±
28.	--	-
29.	-	--
30.	-	-
31.	-	--
32.	--	--
33.	-	±
34.	±	--
35.	±	--
36.	-	-
37.	--	--
38.	--	±
39.	--	--
40.	--	±

Diameter for zone of inhibition (in mm)
-- = zone size less than 7mm (no activity)
- = zone size 7mm to 9mm (insignificant)
± = zone size 9mm to 11mm (moderate)
+ = zone size 11mm to 13mm (significant)
++ = zone size 13mm to 16mm (appreciable)
+++ = zone size 16mm and more (high activity)

Table 4: Sensitivity of *Escherichia coli* against sulphonanilides and Sm(III) –sulphonanilide systems Concentration of the compound used has been taken 300 □g/disc. Compounds & Systems (20-40) have been written serially

S. No.	Sulphonanilide	Sm(III) - sulphonanilide
20.	-	--
21.	--	±
22.	±	±
23.	--	-
24.	-	-
25.	±	-
26.	±	+
27.	-	-
28.	--	-
29.	-	-
30.	-	±
31.	-	--
32.	-	±
33.	-	--
34.	-	--
35.	±	-
36.	-	--
37.	-	-
38.	-	±
39.	--	--
40.	--	-

Diameter for zone of inhibition (in mm)
-- = zone size less than 7mm (no activity)
- = zone size 7mm to 9mm (insignificant)
± = zone size 9mm to 11mm (moderate)
+ = zone size 11mm to 13mm (significant)
++ = zone size 13mm to 16mm (appreciable)
+++ = zone size 16mm and more (high activity)

V. CONCLUSION

- No sulphonanilide or system was found to have remarkable activity.
- No systematic trend was found among antibacterial activity of sulphonanilides and their systems with Sm(III).
- Few systems of Sm(III) were found to show moderate and significant activity against bacterial species.
- No zone of inhibition was noticed with pure solvent. No systematic trend was found among antibacterial activity for systems of Sm(III).
- The order of activity for Sm(III) systems against three micro-organisms was found as:

Staphylococcus aureus > Pseudomonas aeruginosa > E. Coli.

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