Oriental Journal of Chemistry Vol. **26**(4), 1557-1560 (2010)

Antimicrobial studies of doped Er(III) ion in the solution of some N & O donor atom ligands

H.K. PANDEY[1], GOURAV CHAWLA[1], SEEMA GAKHAR[2] and ARTI CHAWLA[1]

[1]Rare Earth Research Laboratory, P. G. Department of Chemistry,
Govt. Dungar College, Bikaner (India).
[2]P. G. Department of Chemistry, M. N. Institute of Applied Science, Bikaner (India).

(Received: October 09, 2010; Accepted: November 10, 2010)

ABSTRACT

Antimicrobial studies of doped Er (III) ion in the solution of sulphonanilides have been carried out *S. aureus, P. aeruginosa* and *E. coli* were used for the present study. Their activity has been compare with sulphonanilide.

Key words: Antimicrobial, Erbium systems, Sulphonanilide.

INTRODUCTION

Complex compounds play an essential role in numerous system of chemical and biological importance[1], which becomes clear when we realize that 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 there uses in the field of industrial[6], biochemical[7] & medical chemistry[8]. Complexes of Er(III) with different sulphonanilides have been reported earlier[9].

Present work deals with the antimicrobial studies of these complexes 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 Er(III) ion.

EXPERIMENTAL

Standrad grade chemicals – $ErCl_3.6H_2O$ and re-crystallized substituted sulphonanilides (prepared in this Lab-table 1) were used.

Twenty one systems were prepared for Er(III) ion by using mentioned standard method[10].

The ligands and their systems have been screened for anti-microbial activities by Bauer- Kirby disc diffusion technique.

The anti-microbial activity of these systems have been tested against gram positive cocci (*Staphylococcus aureus*) and gram negative bacilli (*Pseudomonas aeruginosa* and 2 to 4).

RESULTS AND DISCUSSION

In the present work of anti-microbial screening for sulphonanilide and their systems with Er(III) against gram positive cocci and gram negative bacilli, following results have been observed

Sensitivity of *Staphylococcus aureus* against Er(III) – sulphonanilide systems

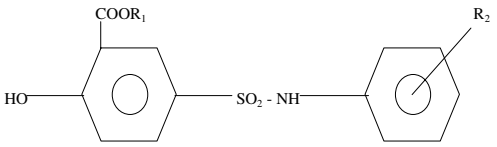
The decreasing order of sensitivity of *Staphylococcus aureus* against

Er(III) – sulphonanilide systems is given below

Er(III)-L_5 > Er(III)-L_3 = Er(III)-L_4 > Er(III)-L_7 > Er(III)-L_{19} > Er(III)-L_{17} > Er(III)-L_6 = Er(III)-L_{12} > Er(III)-L_{15} > Er(III)-L_1 = Er(III)-L_2 = Er(III)-L_8 = Er(III)-L_9 = Er(III)-L_{10} = Er(III)-L_{11} = Er(III)-L_{13} = Er(III)-L_{14} = Er(III)-L_{16} = Er(III)-L_{18} = Er(III)-L_{20} = Er(III)-L_{21}

No activity was observed in L_1, L_2, L_8, L_9, L_{10}, L_{11}, L_{13}, L_{14}, L_{16}, L_{18}, L_{20} and L_{21} Insignificant activity was observed in L_6, L_{12}, L_{15}, L_{17} and L_{19} sulphonanilides. Moderate activity was observed in L_3, L_4, L_5 and L_7. No system has significant, appreciable and high activity.

Table 1: A Simplified representation of sulphonanilides



Sulphonanilide	Groups and their Position	
	R^1	R^2
L_1	H	o - CH_3
L_2	H	m - CH_3
L_3	H	p - CH_3
L_4	CH_3	o - CH_3
L_5	CH_3	m - CH_3
L_6	CH_3	p - CH_3
L_7	H	o – Cl
L_8	H	m – Cl
L_9	H	p - Cl
L_{10}	CH_3	o – Cl
L_{11}	CH_3	m – Cl
L_{12}	CH_3	p - Cl
L_{13}	C_2H_5	o – Cl
L_{14}	C_2H_5	m – Cl
L_{15}	C_2H_5	p - Cl
L_{16}	H	o - OCH_3
L_{17}	H	p - OCH_3
L_{18}	CH_3	o - OCH_3
L_{19}	CH_3	p - OCH_3
L_{20}	C_2H_5	o - OCH_3
L_{21}	C_2H_5	p - OCH_3

Sensitivity of *Pseudomonas aeruginosa* against Er(III) – sulphonanilide systems

The decreasing order of sensitivity of *Pseudomonas aeruginosa* against

Table 2: Sensitivity of *staphylococcus aureus* against sulphonanilides and Er(III) – sulphonanilide systems
Concentration of the compound used has been taken 300 µg/disc. Compounds & systems (1-21) have been written serially

S. No.	Sulphonanilide	Er(III) - sulphonanilide
1.	-	--
2.	-	--
3.	±	+
4.	±	+
5.	-	+
6.	±	-
7.	±	±
8.	-	--
9.	-	--
10	-	--
11.	--	--
12.	-	-
13.	-	--
14.	-	--
15.	-	-
16.	±	--
17.	-	±
18.	--	--
19.	--	±
20.	--	--
21	-	--

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)

Er(III) – sulphonanilide systems is given below

$Er(III)\text{-}L_{13} > Er(III)\text{-}L_4 > Er(III)\text{-}L_1 = Er(III)\text{-}L_2 = Er(III)\text{-}L_6 = Er(III)\text{-}L_{17} > Er(III)\text{-}L_9 = Er(III)\text{-}L_{20} > Er(III)\text{-}L_{16} = Er(III)\text{-}L_3 = Er(III)\text{-}L_5 = Er(III)\text{-}L_7 = Er(III)\text{-}L_8 = Er(III)\text{-}L_{10} = Er(III)\text{-}L_{11} = Er(III)\text{-}L_{12} = Er(III)\text{-}L_{14} = Er(III)\text{-}L_{15} = Er(III)\text{-}L_{18} = Er(III)\text{-}L_{19} = Er(III)\text{-}L_{21}$

No activity was observed in L_3, L_5, L_7, L_8, L_{10}, L_{11}, L_{12}, L_{14}, L_{15}, L_{18}, L_{19} and L_{21}. Insignificant activity was observed in L_1, L_2, L_6, L_9, L_{16}, L_{17} and L_{20} sulphonanilides. Only L_4 and L_{13} have moderate activity. No system have significant, appreciable and high activity.

Sensitivity of *E.coli* against Er(III) – sulphonanilide systems

The decreasing order of sensitivity of E.Coli against Er(III) – sulphonanilide systems is given below-

Table 3: Sensitivity of *Pseudomonas aeruginosa* against sulphonanilides and Er(III) – sulphonanilide systems
Concentration of the compound used has been taken 300 µg/disc. Compounds and systems (1-21) have been written serially

S. No.	Sulphonanilide	Er(III) - sulphonanilide
1.	--	-
2.	--	-
3.	±	--
4.	-	±
5.	--	--
6.	--	-
7.	-	--
8.	--	--
9.	--	-
10	-	--
11.	-	--
12.	-	--
13.	--	±
14.	-	--
15.	±	--
16.	±	-
17.	-	-
18.	--	--
19.	--	--
20.	--	-
21	--	--

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 action)

Table 4: Sensitivity of *Escherichia coli* against sulphonanilides and Er(III) – sulphonanilide systems
Concentration of the compound used has been taken 300 µg/disc. Compounds & systems (1-21) have been written serially

S. No.	Sulphonanilide	Er(III) - sulphonanilide
1.	-	-
2.	--	-
3.	±	-
4.	--	±
5.	-	-
6.	±	--
7.	±	-
8.	-	-
9.	--	--
10	-	-
11.	-	-
12.	-	--
13.	-	--
14.	-	-
15.	-	-
16.	±	-
17.	-	--
18.	-	--
19.	-	--
20.	--	-
21	-	-

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)

$Er(III)\text{-}L_4 > Er(III)\text{-}L_1 = Er(III)\text{-}L_3 > Er(III)\text{-}L_2 > Er(III)\text{-}L_5 = Er(III)\text{-}L_7 = Er(III)\text{-}L_8 = Er(III)\text{-}L_{10} = Er(III)\text{-}L_{11} = Er(III)\text{-}L_{14} = Er(III)\text{-}L_{15} = Er(III)\text{-}L_{16} = Er(III)\text{-}L_{20} = Er(III)\text{-}L_{21} > Er(III)\text{-}L_6 = Er(III)\text{-}L_9 = Er(III)\text{-}L_{12} = Er(III)\text{-}L_{13} = Er(III)\text{-}L_{17} = Er(III)\text{-}L_{18} = Er(III)\text{-}L_{19}$

No activity was observed in L_6, L_9, L_{12}, L_{13}, L_{17}, L_{18} and L_{19}. Insignificant activity was observed only by L_1, L_2, L_3, L_5, L_7, L_8, L_{10}, L_{11}, L_{14}, L_{15}, L_{16}, L_{20} and L_{21} sulphonanilide. Only L_4 has moderate activity and No system have significant, appreciable and high activity.

After comparing the anti - bacterial activity of various sulphonanilides and their systems, the following conclusions can be drawn

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

Staphylococcus aureus > Pseudomonas aeruginosa > E. coli.

ACKNOWLEDGEMENTS

The authors are grateful to Principal Dungar College, Bikaner for providing necessary facilities and to Dr (Mrs.) Rama Gupta, Dr Anil Gupta, Dr Narender Bhojak, Dr K. P. Soni, Dr S. Jain and Dr P. C. Tater for fruitful discussion and keen interest in the work.

REFERENCES

1. T. Gunnlaugsson, *Jeremy: Polyhedron* **22**: 711 (2003).
2. N. J. Wheate, J. G. Collins: *Coordination Chem. Reviews*, **241**: 133 (2003).
3. D. Djordjevic, L. G. Gonshov: *Inorganica Chimica Acta*, **79**: 301 (1983).
4. Parasher R. K., Sharma R. C.; *Ind. Coun. Chem*. **2**: 197 (1986).
5. R. Nagar, P. C. Driwedi: *Indian J. Chem*. **28**A: 722 (1989).
6. Lozy Kausk, H. J. Alshawa, A. K. Brown: I. *J. Appl. Phy*. **76**: 4836, (1994).
7. Vans C. H.: Biochemistry of Ln Plenum Press, New York 8, (1990).
8. Ishiwara F, Gaun **21**: 1, (1927).
9. H. K. Pandey, G. K. Joshi, S. S. Srimali: *Asian J. Chem*. **11**: 1418 (1983).
10. Joshi G. K. *Indian J. Pure & Appl. Phys*., **21**: 224 (1983).