Anti-microbial screening of some sulphonanilide complexes with Tm(III) ion against gram positive cocci & gram negative bacilli

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Exploración anti-microbiana de varios complejos de sulfonanilida con ion Tm(III) frente a cocos gran positivos y bacilos gram negativos

Exploració anti-microbiana de diferents complexes de sulfonanilida amb ió Tm(III) enfrontats a cocs gram positius y bacils gram negatius

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RESUMEN

Se preparó una serie de diferentes complejos de sulfonanilida con el ión metálico Tm (III) y su actividad antimicrobiana se examinó mediante la técnica de difusión de disco de Bauer- Kirby frente a especies bacterianas tales como Staphylococcus aureus, Pseudomonas aeruginosa y E. Coli (gram positiva y gram negativa), hallándose que tienen actividad entre moderada y significativa contra las especies bacterianas.

Palabras clave: Antimicrobiano, sistemas de tulio, sulfonanilide.

SUMMARY

A series of different sulphonanilide complexes with Tm (III) metal ion were prepared and the systems have been screened for anti-microbial activities by Bauer- Kirby disc diffusion technique against bacterial species such as Staphylococcus aureus, Pseudomonas aeruginosa and E. Coli (gram positive and gram negative) and were found to have moderate to significant activity against bacterial species.

Key words Antimicrobial, Thulium systems, Sulphonanilide.

RESUM

S'han preparat i s'ha avaluat la activitat anti-microbiana de diferents complexes de sulfonanilida amb l'ió metàl·lic Tm (III) y la seva activitat anti-microbiana es va determinar mitjançant la tècnica de difusió de disc de Bauer- Kirby, per a espècies bacterianes como Staphylococcus aureus, Pseudomonas aeruginosa y E. Coli (gram positiva y gram negativa), trobant que tenen activitat entre moderada i significativa contra las especies bacterianes.

Paraules clau: Antimicrobiana, sistemes de tuli, sulfonanilida.

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INTRODUCTION

The anti-bacterial activity of sulphonanilides and biochemical & medicinal activity of lanthanide complexes is well known [1-7]. Taking into consideration, the medicinal utility of sulphonanilides derivatives and metal complexes, a series of different sulphonanilides complexes with Tm (III) metal ion were prepared and systems have been screened for anti-microbial activities by Bauer- Kirby disc diffusion technique against bacterial species such as Staphylococcus aureus, Pseudomonas aeruginosa and E. Coli (gram positive and gram negative).

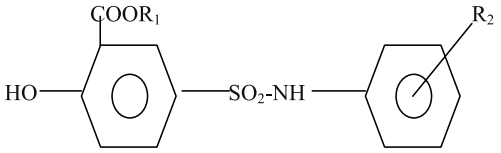
The work is also useful to finding out the comparative studies of the antimicrobial activity with other lanthanide system formed in similar condition.

EXPERIMENTAL

Standard grade chemicals – $TmCl_3.6H_2O$ and re-crystallized substituted sulphonanilides were used (table-1).

Twenty one systems were prepared for Tm(III) ion by using mentioned standard method [8] and systems have been screened against gram positive cocci (Staphylococcus aurens) and gram negative bacilli (Pseudomonas aeruginosa and Escherichia coli) by Bauer- Kirby disc diffusion technique [9].

Table – 1. *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

RESULT AND DISCUSSION

In the present work of anti-microbial screening for sulphonanilide with Tm(III) ion against gram positive cocci and gram negative bacilli, result have been given in tables 2.

(a) The decreasing order of sensitivity of Staphylococcus aureus against Tm(III)-sulphonanilides systems is given below (table-2)-

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

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

(b) The decreasing order of sensitivity of Pseudomonas aeruginosa against Tm(III)–sulphonanilides systems is given below (table-2)-

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

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

(c) The decreasing order of sensitivity of E.Coli against **Tm(III) – sulphonanilides systems is given below(table-2)-**

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

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

Table – 2. *Sensitivity of Staphylococcus aureus, Pseudomonas aeruginosa and Escherichia coli against sulphonanilides and Tm(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	Tm(III) – Sulphonanilide Systems		
		Staphylococcus aureus	Pseudomonas aeruginosa	Escherichia coli
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)

CONCLUSION

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

(i) No zone of inhibition is noticed with pure solvent.
(ii) No systematic trend was found among antibacterial activity of systems of Tm(III).
(iii) Few systems of Tm(III) were found to show moderate and significant activity against bacterial species.
(iv) Introduction of alkyl group either as substituent or in ester moiety, increased the activity of Tm(III) sulphonanilide systems.
(v) Tm(III) systems shows more activity against E. Coli in comparison to other two micro-organisms.
(vi) In case of Tm(III)-systems, significant activity was found against E Coli, when methyl group was present as substituent or in ester moiety.
(vii) Other functional groups / substituents like ethyl, methoxy and chlorine were found to have moderate effect on activity of sulphonanilides and systems.

After comparing the anti - bacterial activity of various sulphonanilides and their systems [10] the order of activity of all sulphonanilides and systems against the three micro -organisms have been found to be in the following order (fig.01) -

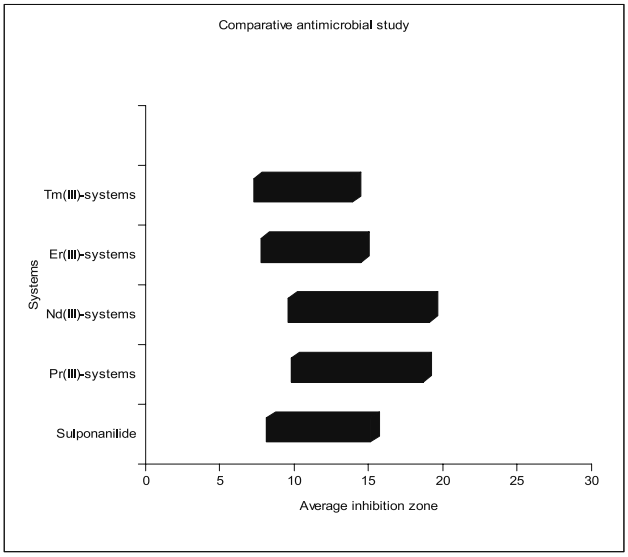


Fig. 1. *Comparative anti-microbial activity with respect to sulphonanilide and different metal systems*

Nd(III)-system > Pr(III)-system > sulphonanilide ≥ Tm(III)-system ≥ Er(III)-system

Results indicate that Nd(III) and Pr(III) systems are more active against the three micro–organisms in comparison to Er(III) and Tm(III) systems.

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