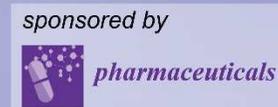




2nd International Electronic Conference on Medicinal Chemistry

1-30 November 2016

chaired by Dr. Jean Jacques Vanden Eynde



Antibacterial activity of zinc(II) and copper(II) terpyridine complexes

Tanja Soldatović^{1,*}, Enisa Selimović¹, and Braho Ličina²

¹ Department of Chemical-Technological Science, State University of Novi Pazar, Vuka Karadžića bb, 36300 Novi Pazar, Serbia;

² Department of Biomedical Science, State University of Novi Pazar, Novi Pazar, Vuka Karadžića bb, 36300 Novi Pazar, Serbia.

* Corresponding author: tsoldatovic@np.ac.rs



Antibacterial activity of zinc(II) and copper(II) terpyridine complexes



Abstract:

Antibacterial activity of model $[\text{ZnCl}_2(\text{terpy})]$ and $[\text{CuCl}_2(\text{terpy})]$ complexes was tested against seven strains of bacteria. The complexes were more effective against Gram-positive than Gram-negative bacteria. Between complexes, stronger effect has shown by $[\text{CuCl}_2(\text{terpy})]$ complex. The best effect was exhibited against *Sarcina lutea* (5 mg/ml). *Escherichia coli* showed low sensitivity to the both complexes. During the investigation of antibacterial activity the effect on the permeability of the proteins these complexes haven't been shown.

Keywords: Zinc(II); Copper(II); Biomolecules; Antibacterial activity;



Introduction

Zinc(II) and copper(II) complexes with organic molecules are used in clinical medicine, e.g. complex of zinc(II) acetate with erythromycin is used for ache therapy [1]. Copper chelating agents were developed to treat Wilson disease, an autosomal recessive genetic disorder that causes copper accumulation primarily in the liver, after that the same agents were investigated for their capacity to control angiogenesis to impair cancer growth and metastasis [2]. In general, biomolecules can contribute to better transport of metal ions through the lipophilic regions of cell membranes [3]. Our focus is to investigate the interaction between zinc and copper and bio-ligands in proteins environmental and studies related to the biological activity and medical application of model Zn(II) and Cu(II) complexes structurally similar to catalytic centres in metalloenzymes.



Results and discussion

Antibacterial activity

Antibacterial activity of $[\text{ZnCl}_2(\text{terpy})]$ and $[\text{CuCl}_2(\text{terpy})]$ complexes was tested against seven strains of bacteria. The results of tested bacterias are presented in Table 1. The complexes were more effective against Gram-positive than Gram-negative bacteria.



Table 1. Antibacterial activity of [ZnCl₂(terpy)] and [CuCl₂(terpy)] complexes.

<i>Bacteria</i>	[ZnCl ₂ (terpy)]		[CuCl ₂ (terpy)]	
	MIC ^a	MBC ^b	MIC	MBC
<i>Bacillus subtilis</i>	10	>20	10	10
<i>Bacillus subtilis</i> ATCC 6633	>20	20	5	10
<i>Staphylococcus aureus</i>	>20	>20	>	>20
<i>Staphylococcus aureus</i> ATCC 25923	10	20	10	20
<i>Sarcina lutea</i>	5	>20	1.25	5
<i>Escherichia coli</i>	10	>20	>	>20
<i>Escherichia coli</i> ATCC 25922	10	>20	10	>20

^a Minimal inhibitory concentration (MIC).

^b Minimum bactericidal concentration (MBC) values are given as mg/ml.



Between complexes, stronger effect has shown by $[\text{CuCl}_2(\text{terpy})]$ complex (Table 1). The best effect was exhibited against *Sarcina lutea* (5 mg/ml). *Escherichia coli* showed low sensitivity to the both complexes. During the investigation of antibacterial activity the effect on the permeability of the proteins these complexes haven't been shown.

Similar studies have shown that two new synthesized Cu(II) and Zn(II) complexes with xylitol have antibacterial effect against *P. aeruginosa* and *C. albicans*. Both copper and zinc complexes presented higher MIC against *P. aeruginosa* than the free xylitol, showing that these complexes could be better local antibacterial compounds than xylitol [4]. The square-pyramidal $[\text{Cu}(\text{Imx})(\text{phen})(\text{NO}_3)] \cdot 5\text{H}_2\text{O}$ has shown minimum inhibitory concentration (MIC) in various *E. coli* strains and comparison with free lomefloxacin indicated that the Cu(II) complex is an antimicrobial which is as efficient as the free antibiotic but strongly suggest that the cell intake route of both species is different [5].



Conclusions

In conclusion, this study demonstrated stronger antibacterial activity of $[\text{CuCl}_2(\text{terpy})]$ than $[\text{ZnCl}_2(\text{terpy})]$ this can be in correlation of stronger affinity of Cu(II) to biomolecules. Absence of permeability of the proteins through cell membrane is probably due to the low thermodynamic stability of the prepared complexes and their dissociation in the solution.



Acknowledgments

The authors gratefully acknowledge financial support from State University of Novi Pazar, Novi Pazar, Republic Serbia and T. Soldatović also gratefully acknowledge financial support from Ministry of Education, Science and Technological Development, Republic of Serbia (Project No. 172011)

Reference

- [1] C. L. Feucht, B. S. Allen, D. K. Chalker, J. Am. Acad. Dermatol., 3(1980) 483.
- [2] European Association for Study of Liver, J. Hepatol. 56 (2012) 671.
- [3] R. B. Martin" in Metal Ions in Biological Systems, Vol. 20, H. Sigel, Ed. Marcel Dekker, New York and Basel, 1986.
- [4] E. Santi, G. Facchina, R. Faccio, R.P. Barroso, A.J. Costa-Filho, G. Borthagaray, M. H. Torre, J. Inorg. Biochem. 155 (2016) 67.
- [5] P. Fernandes, I. Sousa, L. Cunha-Silva, M. Ferrerira, B. de Castro, E.F. Pereira, M.J. Feio, P. Gameiro, J. Inorg. Biochem. 131 (2014) 21.

