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Microbial Studies of Copper (II) Mustard Soap Complex

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Abstract

The antimicrobial properties of Copper have been identified for a lot of years while it is presented as a metal ion or as in complex form. The aim of this research work to analyse the biocidal activities of copper complex. Biocidal activities also have been studied here with Staphylococcus aureus. Rate of percent degradation has been found to increase with increase in ranges of parameters. All above the mentioned studies provides a deeper experimental knowledge of the photocatalysis processes.

Keywords: Copper (II) Mustard complex; Staphylococcus aureus; microbe; zone of inhibition.

Introduction

The bacteriostatic consequences of copper were reported by Dr.Phyllis J. Kuhn [1], who investigated that bacterial augmentation on copper and brass strips showed slight or no growth, whereas the aluminum and stainless-steel strips produced a intense growth of all the different types of microorganisms. The bacteriostatic efficacy of copper worn in paints to render surfaces self-disinfecting has also been confirmed.[2] A platform technology in textile industries has recently been developed to binds Copper ion with fibres [3] which may boast a considerable ramification.

It has been suggested that in some compounds, microbiocidal effectiveness is greatly enhanced by small amounts of copper which form chelates. Copper sulphate has been found to be a compelling molluscicide [4] and mainly used in the production of agricultural fungicides and wood preservatives. Copper naphthenate is as well used in efficient control of decompose fungi and excellent manageor improvement of wood destroying insects like termites, beetles carpenter ants and other host organisms. Control of snails may be a significant policy in combatinga number of human diseases, for instance bilharziasis.

In fact, Copper (II) chelates have been initiated to cooperate with organic systems and to illustrate anti-neoplastic activity [5-7], anticancer activity [8] and antibacterial, antifungal. [9,10] Several Copper (II) N,S,O/N,N donor chelators are excellent anticancer agents since they have tough binding capability with DNA base pair. [11]

Hence, in this study we report the synthesis of Copper (II) soap complexes (Copper (II) Mustard complexes and Copper (II) Soya complexes) which are proceed like an organic agent to control the growth of *Staphilococcus aureus*. The obtained Cu (II) complexes were tested *in vitro* against the bacterial strains *S. aureus*, which is some of the main pathogens causing nosocomial infections worldwide.

Material and Chemicals

Copper (II) soap complexes and Benzene Copper (II) Mustard complex (CMU) is synthesized in laboratory and discussed in previous study. Pure benzene is used as solvent. Purification of benzene is discussed earlier.

Abbreviation: Copper (II) Mustard Urea: CMU

Preparation of Copper (II) soap complexes solutions

Benzene is used for solution preparation and further dilution. All the Copper (II) Mustard dissolved in Benzene. After dissolving in benzene final volume for all the complexes (CMU) was 1 ml.

Two different dilutions were made from stock solution to get antimicrobial activity of complexes, two different dilutions C_1(50mg/ml) and C_2(25mg/ml) were made to get antimicrobial activity of all complexes against *Staphylococcus aureus.* Streptomycin (300mcg/ml) was used as positive control for all complexes300mcg/ml. Composition of stock solution of complexes are shown in Table -1

Table – 1 Composition of stock solutions for Copper (II) Mustard Urea (CMU) complexes.

S. No.	Name of the complex	Required concentration	Extract	Benzene	Final Volume
1.	CMU	50mg/ml	50mg	1ml	1ml

Experimental

Kirby-Bauer disc diffusion method was operated for antibacterial study which is described here in brief.

Antimicrobial Susceptibility Testing (Kirby-Bauer disc diffusion method)

A test of the antibiotic sensitivity of bacteria is also known as Kirby–Bauer test (disc-diffusion antibiotic susceptibility test, disc-diffusion antibiotic sensitivity test, KB test). Mueller-Hinton agar medium was used for antimicrobial activity of given compounds on various concentrations by disk/ well diffusion susceptibility testing.

Antibiotic discs are used to test the level of bacterial resistance by preferred antibiotics. Wafers/plates containing antibiotics are positioned on an agar plate where bacteria have been sited and then the plate is moved out to incubate. There will be an region around the wafer is found, where the bacteria have not grown enough, if an antibiotic stops the bacterial growth or, kills the microbes is called a zone of inhibition.[13]

All the Copper soap complexes derived from Mustard oil and Soyabean oil were used for their antibacterial study. For this study *S. aureus* was selected as test organism. Antibacterial study was done by incorporating

these steps.

Preparation of inoculums

Fresh Cultures of *Staphylococcus aureus* strain ATCC-25923were inoculated in Peptone water & kept for incubation for 30 minutes at 37^{o}C. Inoculum size of bacteria was adjusted using McFarland turbidity standard as reference which is described in previous section. The bacterial suspensions were compared to 0.5 McFarland Turbidity Standard.

Swabbing of the liquid cultures of *Staphylococcus aureus*

Microbial cultures were swabbed onto the Mueller Hinton Agar surface through sterile Cotton swabs sticks.

Loading of different test solutions into the wells

After proper marking of plates, 0.1 ml extracts from different dilutions prepared from stock was loaded into the respective wells.

Incubation

The *Staphylococcus aureus,*plates were kept for incubation at 37°C for 24-48 hours and results were observed.

Results and discussion

Herein we report an account of microbial activity of Copper (II) complexes. The growth profile of *Staphylococcus aureus* strain ATCC-25923was monitored for 24 h of incubation. Each plate was examined and observed a resultant inhibition zone which were consistently clear and spherical, there was a lucid lawn of growth of the *Staphylococcus aureus*. From the Table -**2**, it could be seen that by a clear zone of inhibition around each plate, all the complexes confirm high inhibition at higher concentration (50 mg/ml).

Table -2 Zone of inhibition for Copper (II) Mustard Urea (CMU)complex at two different concentrations against *Staphylococcus aureus.*

S. No.	Copper(II) soap complexes	PC	C_1(50mg/ml)		C_2(25mg/ml)		NC
			24hrs	48hrs	24hrs	48hrs	
1.	CMU	31mm	10mm	10mm	8mm	8mm	NZI

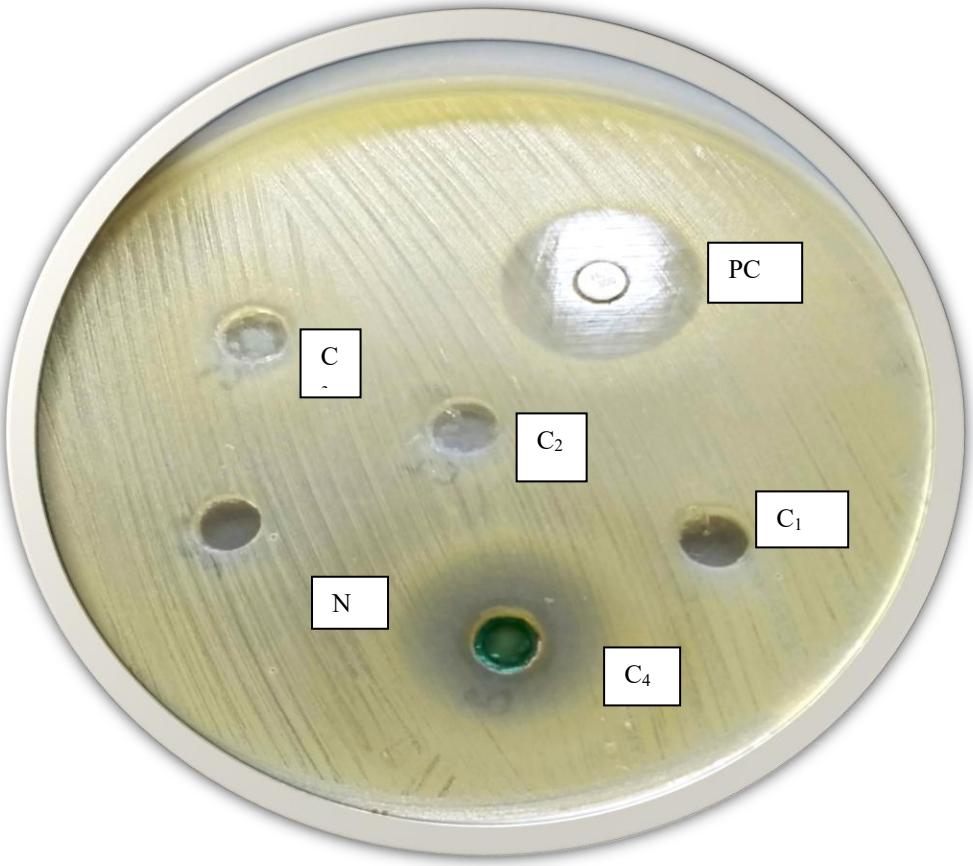

Figure-1 Results of antimicrobial susceptibility test of Copper (II) Mustard Urea complex against *Staphylococcus aureus.*

Conclusion

The work described here shows that Copper (II) Mustard complex may be appealing to release novel paths against different bacterial genus since a few of these complexes have been found to reveal an outstanding antibacterial activity. Copper (II) complex shows higher resistivity at higher concentration. Thus it is evident that concentrations enclose an essential position in increasing the extent of inhibition. By formation of chelate, complexes enhance their activity towards S. aureus bacteria and so the vicinity is still untie for advance-research.

Declaration of Conflicting Interests

The authors declare no potential conflicts of interest with respect to the research, authorship and publication of this article.

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References

1. P. J. Kuhn, Doorknobs: a source of nosocomial infection? Diagnostic Medicine,1983.
2. T. E. Cooney, Bactericidal Activity of Copper and NonCopper Paints, Infect.Control Hosp. Epidemiol, 1995, 16(8), 444-450. doi: 10.1086/648361.
3. G. Borkow, Gabbay, Putting Copper into action: Copper-impregnated products with potent biocidal activities,FASEB Journal, 2004, 18(14), 1728-1730.
4. R. Manley, The effects of copper on the behaviour, respiration, filtration and entilation activity of Mytilus edulis, JMBAUK,, 1983,63(1),205-222. doi: https://doi.org/10.1017/S0025315400049900
5. D. T. Minkel,C.H.Chanstier, D. H. Petering, Reactions of 3-Ethoxy- 2-oxobutyraldehyde Bis(N4-dimethylthiosemicarbazonato)- Zinc(II) withtumor cells andmitochondria, MolecularPharmacology, 1976, 12(6),1036–1044.
6. V. Rajendiran, R. Karthik, M. Palaniandavar , Mixedligand Copper(II)-phenolate complexes: effect of coligand on enhanced DNA and protein binding, DNA cleavage, and anticancer activity, Inorganic Chemistry, 2007,46(20), 8208–8221.
7. E. Liberta , D. X. West, Antifungal and antitumor activity of heterocyclic thiosemicarbazones and their metal complexes:current status, Biometals, 1992, 5(2), 121–126.
8. C. Marzano, M. Pellei, F. Tisato, C. Santini, Copper complexes as anticancer agents, Anti-Cancer Agents in Medicinal Chemistry, 2009, 9(2), 185–211.
9. Y. Harinath, D. H. K. Reddy, B. N. Kumar, C. Apparao, K. Seshaiah, Synthesis, spectral characterization and antioxidant activity studies of a bidentate Schiff base, 5-methyl thiophene-2- carboxaldehyde-carbohydrazone and its Cd(II), Cu(II), Ni(II) and Zn(II) complexes, Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy, 2013, 101, 264–272.
10. J. Sheikh,H. Juneja, V. Ingle, P. Ali, T. B.Hadda, Synthesis and in vitro biology of Co(II), Ni(II), Cu(II) and Zinc(II) complexes of functionalized beta-diketone bearing energy buriedpotential antibacterial and antiviral O,O pharmacophore sites, J. Saudi Chem. Soc., 2013, 17(3), 269–276.
11. S. M. Saadeh, Synthesis, characterization and biological properties of Co(II), Ni(II), Cu(II) and Zn(II) complexes with an SNO functionalized ligand, Arab. J. Chem., 2013, 6(2), 191–196.
12. D F Brown, D. Kothari, Comparison of antibiotic discs from different sources, J. Clin. Pathol. 1975, 28 (10), 779–783. doi:10.1136/jcp.28.10.779. PMC 475859. PMID 1214010
13. D F Brown, D. Kothari, Comparison of antibiotic discs from different sources, J. Clin. Pathol. 1975, 28 (10), 779–783. doi:10.1136/jcp.28.10.779. PMC 475859. PMID 1214010