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INNOVATIVE NONALIGNED MULTIPLEXES OF ALKALI METALS FOR CONFORT UNAFFECTED MICROORGANISM

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Abstract

Innovative nonaligned multiplexes of alkali metals [ML_2] like M = Li, Na, K, Rb & Cs] with p-bromoisonitrosoacetophenone have been synthesized and characterized by elemental analysis, conductivity measurement, magnetic susceptibility and spectral studies. Antimicrobial activities of ligands and its complexes were screened by sensitivity test, minimum inhibition concentration and minimum bacterial concentration technique. Metal chelate shows antimicrobial activity is associated with the control of ligands.

Keywords: *Innovative, nonaligned, multiplexes, sensitivity, inhibition, bacterial & chelate.*

Introduction:- The ligand p-bromoisonitrosoacetophenone has been previously investigated for possible complex formation with transition metals [1-2]. Here in this communication we are reporting the neutral complexes of this ligand with alkali metals. The present work has been carried out in the above context and includes preparation of ligands. The purity of ligands has been confirmed by elemental analysis and melting point determination. Solid complexes of alkali metals have been synthesized and characterized by techniques such as elemental analysis, molecular weight determination, conductivity measurements, magnetic susceptibility .

Materials and Methods

P-bromoisonitrosoacetophenone was prepared by the procedure described by Muller and pechmann.[3]. The basic principle underlying this preparation in that of Claisen for the preparation of p-bromoisonitrosoacetophenone, reagent isoamylnitrate was needed which was prepared from isoamylalcohol and sodium nitrate[4]. The chemicals used were of analytical AR grade. Again 1:1 stoichiometric ratios of these salts and the ligand p-bromoisonitrosoacetophenone were subjected to the above procedure. The change in colour of solution indicated the formation of complexes. The precipitates so formed were filtered, washed with ethanol or ether as the case needed and subjected to melting point measurement, elemental analysis and IR spectrum studies. Authenticity of formation of complexes was established from the comparative studies.

Results and Discussion

Table 1 lists the physical properties of the ligand (HL), its alkali metal salts (ML) and the new neutral complexes (MLHL); where M= Li, Na, K, Rb and Cs; HL = p-bromoisonitrosoacetophenone, and L=anion of (HL) ligand.

Almost all the alkali metal salts and their respective complexes were found to be coloured and stable in air but stability decreased on exposure to moisture leading ultimately to decomposition, hence all the salts and complexes made were kept in a desiccators over solid anhydrous calcium chloride.

From the results it was evident that almost all the alkali metal salts and their complexes undergo transformation at a temperature which were considerably higher than the melting point of the ligand used with a few exceptions indicating greater stability, most of the complexes were soluble

in polar solvents such as ethanol but insoluble in non-polar solvents like benzene, ether etc. Physical properties and analytical data of complex listed in the following table number 1.

Alkali metal complexes of the ligands [P-BrHINAP] were reported to possess good antimicrobial activity and hence they have been synthesized and evaluated for their antimicrobial activity.

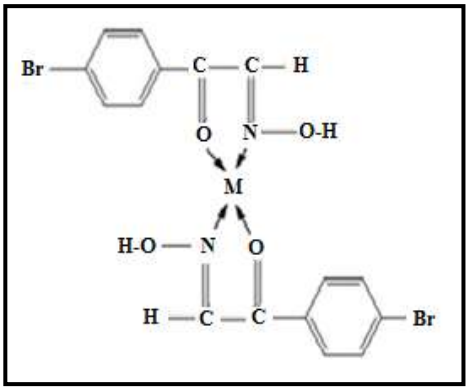
Table - 1: Physical Properties and analytical data of complexes

Type of Complex	Colour of complex	MP / DT / TT in ^{0}C	% Metal ion & elements with calculated values			
			%C	%H	%N	%M
[P-BrHINAP]	Light cream	147 D	66.32 (66.26)	5.60 5.52	8.55 (8.58)	----- -----
[Li(BrINAP)$_2$]	Colourless	297 D	64.27 (64.16)	5.27 5.21	8.14 (8.19)	14.43 (14.41)
[Na(BrINAP)$_2$]	Cream	284 D	62.50 (62.07)	4.92 (4.89)	7.92 (8.05)	16.68 (16.61)
[K(BrINAP)$_2$]	Yellow	186 D	59.80 (59.34)	4.70 (4.67)	7.58 (7.69)	10.72 (10.71)
[Rb(BrINAP)$_2$]	Yellow	115 D	52.72 (52.68)	4.22 (4.15)	6.90 6.83	(20.79) 20.73
[Cs(BrINAP)$_2$]	Bright yellow	110 D	46.85 (47.16)	4.42 (3.71)	6.05 (6.11)	29.28 (29.04)

¥ Theoretically calculated values are given in parentheses

Structure and Bonding

On the basis of elemental analysis, the general molecular formula of the neutral complexes of p-bromoisonitrosoacetophenone was found to be ML HL; [M(BrINAP)$_2$] where M = Li, Na, K, Rb and Cs; HL = P-bromosonitrosoacetophenone [P-BrHINAP] and L = anion of the ligand HL. Based on experimental results and discussions on spectral studies, following structure have been confirmed for the complexes of alkali metals with ligand P-bromoisonitrosoacetophenone.



Antimicrobial screening

All synthesized alkali metal complexes were screened *in vitro* for antibacterial activities against Gram-positive *Staphylococcus aureus* (NCIM 2901), *Bacilus subtillis*, *Bacilus cereus* and Gram-negative *Pseudo aeruginosa* (NCIM 5031), *Eschierichia coli* (NCIM 2256) and *Klebsiella pneumonae* as well as antifungal activities against *Candida albicans* (MTCC 227), *Aspergilus niger* (MTCC 1344) and *Fujarium oxysporium* by disk diffusion method. Gentamycin and miconazole were used as standard for antibacterial and antifungal activity respectively. The agar dilution method was perform using Mueller-Hinton agar (Hi Media) medium for antibacterial activity and Saburoud's dextrose agar (Hi Media) medium for antifungal activity. This method depends on diffusion of drug from bore through the solidified agar layer of Petri dish to an extent that, growth of inoculated microorganism is prevented entirely in a circular area "zone" around cup containing solution of compound under test. The medium was sterilized by autoclaving at 15 lb pressure for 30 minutes. One loop of the stock culture was inoculated in 10 ml of agar slant in previously sterilized test tubes then incubated at 37 ^{0}C for 24 hrs. for bacteria. About 3 ml of distilled water was added to the test tube and after shaking for few minutes a suspension of culture was obtained. The analytical data of antibacterial tests are shown in the following table number 2 with reference to the zone of inhibition of antibacterial activity.

Table – 2 : Zone of Inhibition

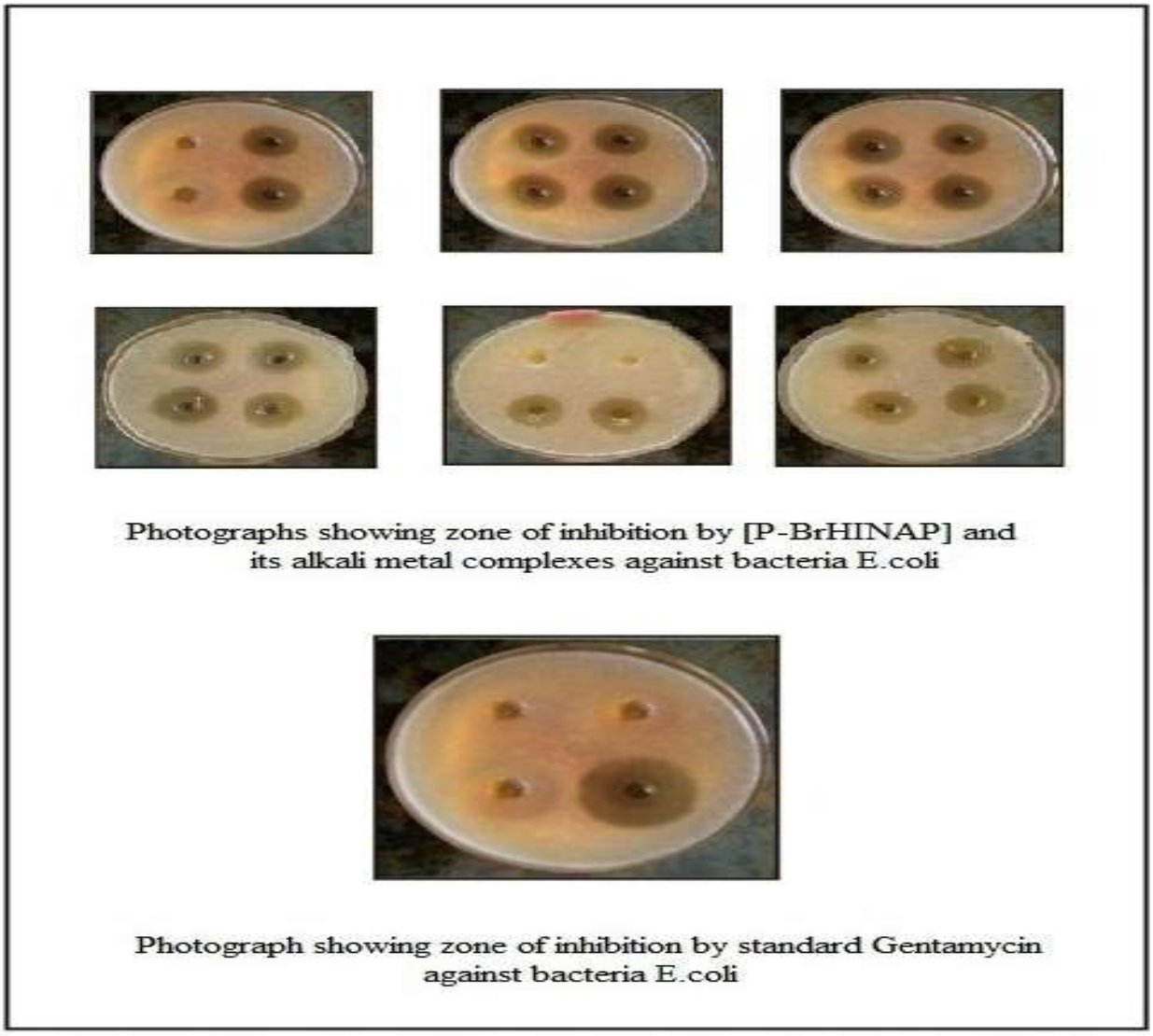
Antibacterial Activity Data of [P-BrHINAP] and its Complexes

Complexes	Bacteria along with zone of inhibition (mm)					
	E. coli	S. aureus	P. aeruginosa	B. Subtilis	B. Cereus	K. Pneumonae
[P-BrHINAP]	11	13	12	12	13	11
$[Li(P\text{-}BrINAP)_2]$	14	16	17	14	17	15
$[Na(P\text{-}BrINAP)_2]$	17	19	18	17	20	19
$[K(P\text{-}BrINAP)_2]$	16	19	15	14	16	18
$[Rb(P\text{-}rINAP)_2]$	12	14	16	13	17	16
$[Cs(P\text{-}BrINAP)_2]$	13	15	14	15	13	14
Gentamycin	17	21	19	18	21	20

The synthesis of proliferation of antibiotics over past three decades has caused gratification about the threat of bacterial resistance. The bacteria become resistant to antimicrobial agents in consequence of chromosomal changes or the exchange of genetic material. Hence there is necessity to synthesizing some new antimicrobial agents which are more effective against the resistant strains of bacteria.

Antibacterial activity of synthesized alkali metal complexes of P-bromoisonitrosoacetophenone was examined against the bacteria *E. coli, S. aureus, P. aeruginosa, B. subtilis, B. cereus* and *K. pneumonae* similarly the antifungal activity of the same complexes was examined against the fungi *C. albicans, A. niger and F. oxysporium*. The assays were performed in agar media with final concentration of about 500 mg/ml as all the synthesized complexes are effective at this concentration. From the table no.2 its concluded that the complex $[Na(P\text{-}BrINAP)_2]$ were shown maximum zone of inhibition and hence were found to inhibit the growth of all tested strains of bacteria and fungi. It may be caused by more penetrating power of sodium complex to the cell wall of bacteria which prevents the biosynthesis of peptidoglycan or may find better fit at the receptor site as compared to other complexes. The complexes $[Li(P\text{-}BrINAP)_2]$, $[K(P\text{-}BrINAP)_2]$ and $[Rb(P\text{-}BrINAP)_2]$ were found to show moderate activity

while the Complex $[Cs(P\text{-}BrINAP)_2]$ marginal activity against all the tested strains of bacteria and



Photographs showing zone of inhibition by [P-BrHINAP] and its alkali metal complexes against bacteria E.coli

Photograph showing zone of inhibition by standard Gentamycin against bacteria E.coli

fungi. Though the ligand exhibited antibacterial and antifungal activity against all the tested strains, its activity is less when compared with its alkali metal complexes and hence suggested its unsuitability against all the strains. None of the synthesized complex exhibit more activity as compared to the standard drug. The experimental results screening zone of inhibition by ligand and its alkali metal complexes against bacteria and Gentamycin is represent in the subsequent photograph.

Conclusion:

The results showed that, the ligand and its synthesized complexes condensed antibacterial and antifungal activity against all the tested strains. Though the ligand exhibited antibacterial and antifungal activity against all the tested strains, its activity is less when compared with its alkali metal complexes and hence suggested its unsuitability against all the strains.

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