REDVET - Revista electrónica de Veterinaria - ISSN 1695-7504
Vol 25, No. 1 (2024)
http://www.veterinaria.org
Article Received: 10/05/2024 Article Revised: 22/05/2024 Article Accepted: 01/06/2024

Synthesis, Characterization and Anti bacterial activity of Benzimidazolium Dichromate

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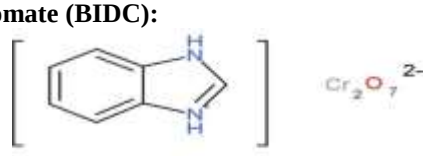
Abstract:
This study aims to describe the synthesis and determination of antibacterial activity of Benzimidazolium dichromate.Melting point,IR&UV spectral data were confirm the structure of compound and antibacterial activity was characterized by the nature of biological activities. The antibacterial activity of the prepared compound was employed by using the agar well diffusion method and tested against Gram positive (*S. aureus,*) and Gram negative (*Klebsiella pneumonia,*) bacterial strain.

KEYWORDS: BIDC, Microbial study,Agar well diffusion method, Bacteria,

Introduction:
Benzimidazole is an important heterocyclic aromatic organic compound having important pharmacophore and a privileged structure in medicinal chemistry[1]. It is a Bicyclic in nature which consists of an imidazole ring containing two nitrogen atom at adjacent position fused to benzene ring. Nitrogen atom and the position of N is in 1stand 3 rd position of the molecule. Being a major constitute of various natural products, including purine, histamine, histidine and nucleic acid, benzimidazole derivatives have occupied a unique place in the field of medicinal chemistry, thus incorporation of the benzimidazole nucleus to prepare or synthesis novel benzimidazole derivatives has always carried the attention of many medicinal chemist and hence proved to be vital synthetic strategy in drug discovery.
Benzimidazole derivatives is used in different ways such as analgesic, anti-inflammatory, antibacterial antimicrobial, antifungal, antiviral, anti-helmenthic, anticonvulsant anticancer, antihypertensive[2,3]
Antiphrastic activity Firstly benzimidazole was synthesised by Hoebrecker in 1872, who obtained 2, 5(or 2, 6) dimethylbenzimidazole by the using of 2-nitro-4-methylacetanilide.
Nowadays is a moiety of choice which possesses many pharmacological properties. The most prominent benzimidazole compound in nature is N-ribosyl-dimethylbenzimidazole, which serves as an axial ligand for cobalt in vitamin B12. In 1990 various benzimidazole derivatives were synthesized with substitution of fluorine, propylene, tetrahydroquinoline and cyclised compound which resulted in compounds with increased stability, bioavailability and significant biological activity. In 1991 benzimidazole derivatives were synthesized by derivatization at N-H of benzimidazole by electron donating group and substitution with long chain of propyl, acetamido, thio, thiazole-amino, tetramethyl piperidine on pyridine resulting in good analgesic activity. Nowadays Infectious microbial diseases are causing problems world-wide, because of resistance to number of antimicrobial agents (β-lactam antibiotics, macrolides, quinolones, and vancomycin). A variety of clinically significant species of microorganisms has become an important health problem globally. One way to fight with this challenge is the appropriate usage of the available marketed antibiotics the other is the development of novel anti-microbial agents. Hence, there will always be a vital need to discover new benzimidazole derivatives as an chemotherapeutic agent..Benzimdazolium fluoro chromate is one type of Chromium (VI) compound . It is used in biological activity[4]. There fore, another one derivative is Benzimidazolium dichromate. The derivative of benzimidazolium dichromate is the chromium (VI)compound used as a mild, efficient, stable and selective oxidizing agent in synthetic organic chemistry.

Structure of benzimidazolium dichromate (BIDC):



This compound is screened for their biological activities towards gram positive & negative bacterias

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Experimental Methods:
Materials:
AnalaR grade of reagents used for the preparation of benzimidazolium dichromate

Preparation of benzimidazolium dichromate (BIDC):
A solution of chromium trioxide (10 g, 0.1 mol) in 12mL water was cooled to room temperature with vigorous stirring, (11.8g 0. lmol), benzimidazole was slowly added in. Light yellow powders were produced and the solution was stirred for additional 20 minutes. The product was collected on a sintered glass funnel and dried in a vacuum desiccator. yield 19.8g (81%) mp. 138-140°C. This crude product was recrystallised from water as orange column crystal, 170-171°C.

Characterization of Prepared compound:
The structure of Benzimidazolium dichromate was confirmed by its elemental analysis. Further, this compound was confirmed by melting point, characterized by electronic spectroscopy (Perkin Elmer, Model: Lambda 35, Range: 190 nm - 1100 nm) in the UV visible range and the FT-IR spectra were obtained using the BRUKER ALPHAFT-IR MB 102 spectrophotometer, in the 4000-400 cm^{-1} region on KBr pellets.

Antibacterial Screening:
The prepared compound was characterized with anti bacterial screening by using the agar well diffusion method. Bacterial cultures such as gram positive (*S. aureus*,) and gram negative (*Klebsiella pneumonia*,) bacterial strain were obtained from Kirnd Institute of Research and Development Pvt.Ltd, Tiruchirappalli. 100 ml of a fresh culture containing 1×10^8 CFU/ml of bacteria was spread onto the Mueller Hinton Agar (MHA) plates using the sterile swab. The perti-plate was tested at a 10 mg/ml, 20 mg/ml, 30 mg/ml concentration of the compounds were dispersed in dimethyl sulphoxide (DMSO). Zone of inhibition levels (mm) was measured subsequently for 24 h at 37 °C. For positive control, standard antibiotic Streptomycin (10 µg disc) was used.

Results And Discussion
Vibrational Spectroscopy of Benzimidazolium dichromate:
Based on infrared (IR) spectrum shown in **figure 1**,the compound contains several functional groups.
First there is a strong peak at 3355.31 cm^{-1} indicates the nitrogen– hydrogen (N-H) bond.**(Table -1)**
Additionally, there would be a peak at 1634.46 cm^{-1}shows the carbon nitrogen double bond (C=N).
There should a peak of carbon nitrogen single bond (C-N)at 1288.35 cm^{-1}.
At the peak1579.06cm^{-1}there is an Arene bond (alternative double and single bond in aromatic rings).
IR Spectrum of BIDC also aromatic Cr=O groupat1000.77 cm^{-1}

Table1: FT-IR Spectral Data of Benzimidazolium Dichromate

FUNCTIONALGROUP	**IRFREQUENCY(cm^{-1})**
N-H	3314.28
C=N	1634.46
C=C(ARENE)	1579.06
C-N	1288.35
Cr=O	1000.77

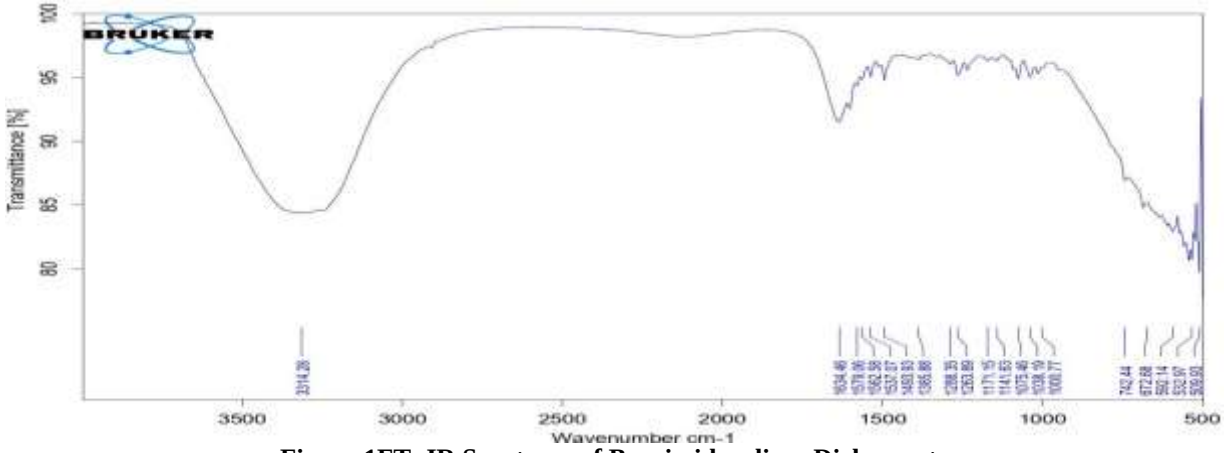

Figure:1FT- IR Spectrum of Benzimidazolium Dichromate

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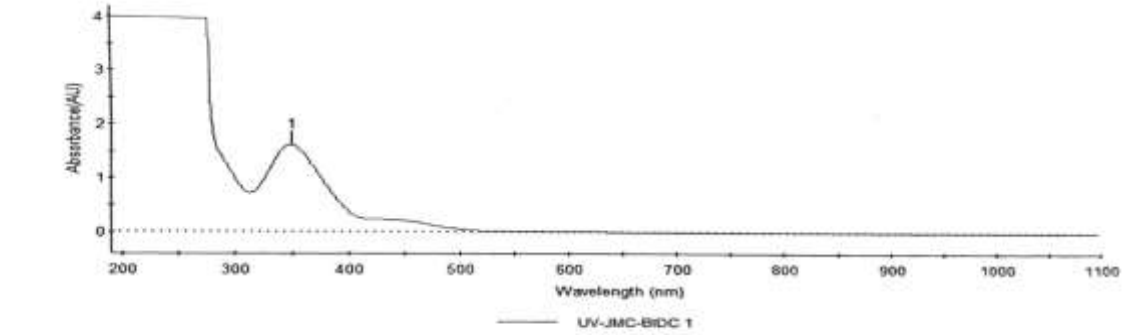
Electronic Spectroscopy of Benzimidazolium dichromate:
The Electronic spectra of benzimidazolium dichromate show the absorption bands at 250,300 nm chromophore group and aromatic ring. These bands explain the indication of n→ π * and π→ π* transitions of the present azomethines, chromophore group and aromatic ring. An additional absorption band was observed 350 nm in the electronic spectra of the benzimidazolium dichromate charge transfer transition **(Figure-2)**

Figure:2 UV Spectrum of Benzimidazolium Dichromate



Name	No.	Peak(nm)	Peak(AU)	No.	Valley(nm)	Valley(AU)
UV-JMC-BIDC	1	350.45	1.6375			

Antibacterial Activity of Benzimidazolium dichromate:
The antibacterial activity of the prepared Benzimidazolium dichromate was employed by using the agar well diffusion method and tested against gram positive(*S.aureus,*) and gram negative(*Klebsiellapneumonia,*) bacterial strain. 100 ml of a fresh culture containing 1×10^8 CFU/mL of bacteria was spread on to the Mueller Hinton Agar (MHA) plates using the sterile swab. The perti-plate was tested at a 10mg/ml, 20 mg/ml, 30 mg/ml concentration of the Benzimidazolium dichromate dispersed in dimethylsulphoxide (DMSO). Zone of inhibition levels (mm) was measured subsequently for 24 h at 37 °C. For positive control, standard antibiotic Streptomycin(10µgdisc)was used.
The antibacterial activity result of the benzimidazolium Dichromate showed **(Figure-3)** a varying degree of inhibition zone in tested microbes. The antibacterial activity of the test samples rises with rises in the concentration **(Table -2)** In this study Streptomycin was used as a standard antibiotic. Gram positive bacteria *S. aureus showsa higher activity in 30 mg/ml and also* Gram negative bacteria (*Klebsiellapneumonia,*)*a higher activity in 30 mg/ml.*

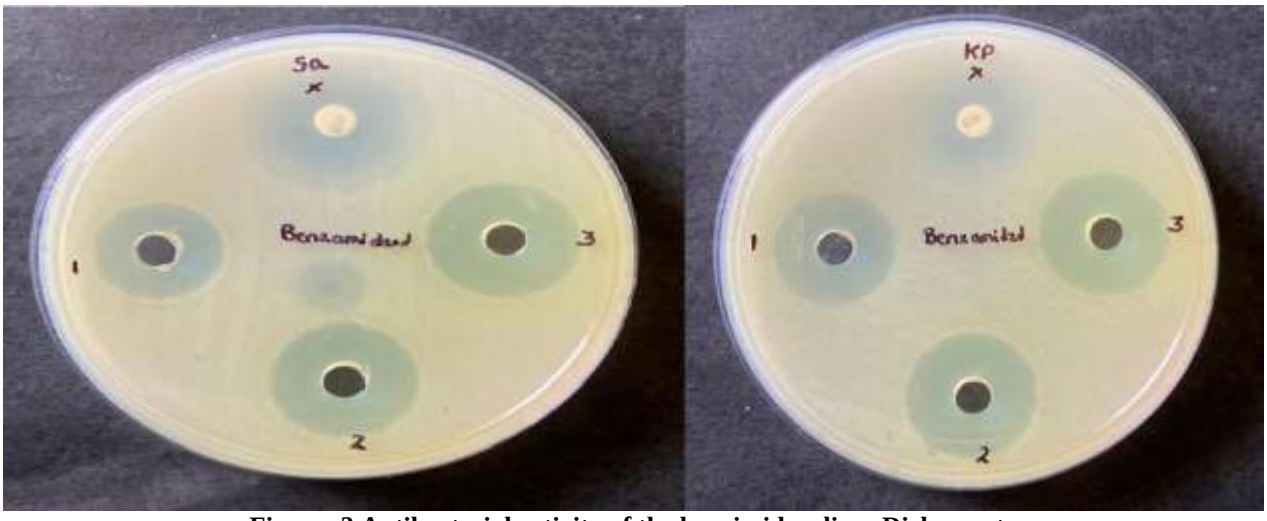


Figure :3 Antibacterial activity of the benzimidazolium Dichromate

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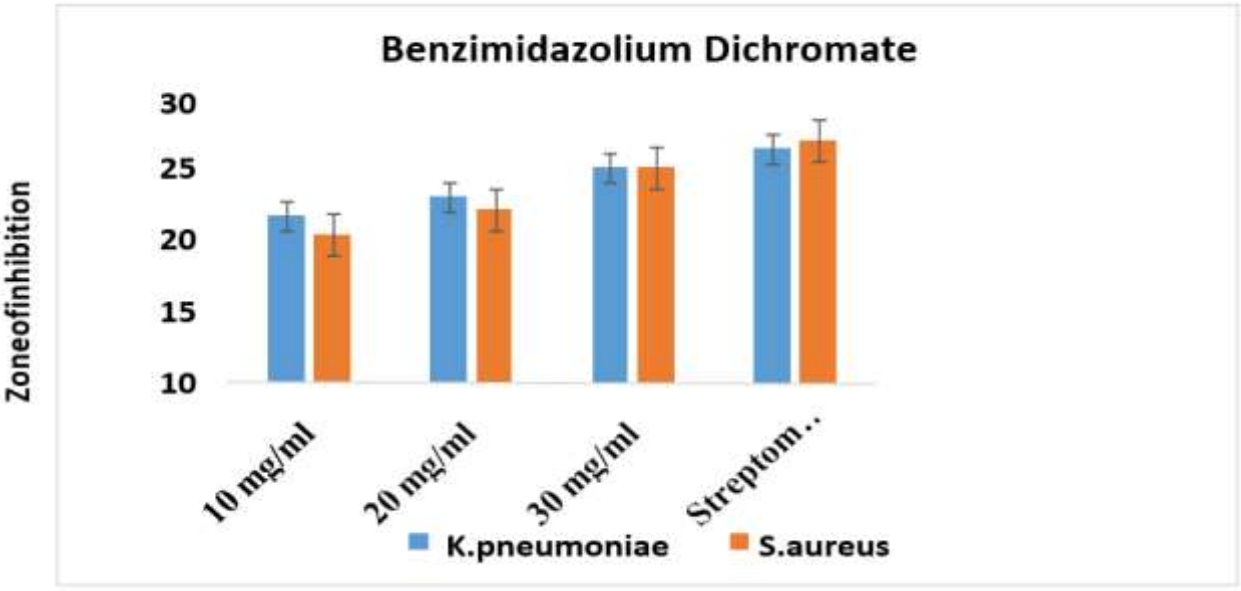

Table2: Antibacterial activity of benzimidazolium Dichromate

Organisms	**DMSO Extract added in the Zone Inhibition(mg/ml)**			
	10mg/ml	**20mg/ml**	**30mg/ml**	**Streptomycin**
K.pneumonia	18	20	23	25
S.aureus	16	18.5	23	26

CONCLUSION

We have synthesized and characterized benzimidazolium dichromate using IR & UV spectroscopic analysis. This compound was screened against two gram-positive and gram-negative bacteria The concentration of the benzimidazolium dichromate compound increases with an increase in activity. The gram-positive bacteria *S. aureus* showed only nearly higher activity in 30*mg/ml.* But, the gram-negative bacteria *K. pneumonia*has a nearly higher activity in 30 *mg/ml* for benzimidazolium dichromate as compared to *Streptomycin*.

ACKNOWLEDGEMENT

The authors thank the Principal and Management, Jamal Mohamed College(Autonomous), Tiruchirappalli, Tamilnadu, India for providing necessary facilities and encouragement

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