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SYNTHESIS, CHARACTERIZATION AND ANTI BACTERIAL ACTIVITY OF PYRIDINIUM CHLOROCHROMATE

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ABSTRACT

This study aims to describe the synthesis and determination of antibacterial activity of Pyridinium chlorochromate. Melting point and IR spectral data was 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: *PCC, Microbial study, Agar well diffusion method, Bacteria.*

INTRODUCTION

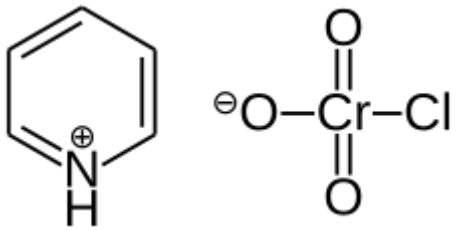
PCC (pyridinium chlorochromate), also referred to as the Corey-Suggs reagent, is widely used for the oxidation of alcohols to corresponding ketones and aldehydes. PCC has several advantages over other commercial oxidants. An air-stable yellow solid, it is only slightly hygroscopic. Unlike other oxidizing agents, PCC requires only about 1.5 equivalents to complete a single oxidation. (PCC) is a yellow-orange salt with the formula $[C_5H_5NH]^+[CrO_3Cl]^-$. It is a reagent in organic synthesis used primarily for oxidation of alcohols to form carbonyls. A variety of related compounds are known with similar reactivity. PCC offers the advantage of the selective oxidation of alcohols to aldehydes or ketones, whereas many other reagents are less selective.

PCC consists of a pyridinium cation, $[C_5H_5NH]^+$, and a tetrahedral chlorochromate anion, $[CrO_3Cl]^-$. Related salts are also known, such as 1-butylpyridinium chlorochromate, $[C_5H_5N(C_4H_9)][CrO_3Cl]$ and potassium chlorochromate.

Hence, there will always be a vital need to discover new benzimidazole derivatives as an chemotherapeutic agent. The derivative of benzimidazolium chlorochromate is the chromium (VI) compounds used as a mild, efficient, stable and selective oxidizing agent in synthetic organic chemistry.[4]

Structure of Pyridinium chlorochromate (PCC)

Structure of Pyridinium Chlorochromate



PCC is commercially available. Discovered by accident, the reagent was originally prepared via addition of pyridine into a cold solution of chromium trioxide in concentrated hydrochloric acid:

$C_5H_5N + HCl + CrO_3 \rightarrow [C_5H_5NH][CrO_3Cl]$

In one alternative method, formation of chromyl chloride (CrO_2Cl_2) fume during the making of the aforementioned solution was minimized by simply changing the order of addition: a cold solution of pyridine in concentrated hydrochloric acid was added to solid chromium trioxide under stirring.

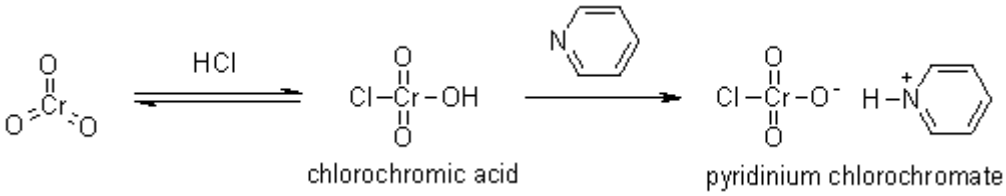
Experimental Methods

Materials

AnalaR grade of reagents used for the preparation of pyridinium chlorochromate.

Preparation of pyridinium chlorochromate (PCC)

Chlorochromic acid can by prepared by the dissolution of chromium trioxide in 6 M aq. hydrochloric acid. Addition of pyridine gives pyridinium chlorochromate as orange crystals.



The properties of PCC can be compared with those of PDC: it is not particularly hygroscopic, is stable, commercially available and can be stored. PCC is soluble in many organic solvents, and especially dichloromethane at room temperature has been used in most cases, whereas DMF promotes the over-oxidation of primary alcohols into carboxylic acids.

PCC is more acidic than PDC, but acid-labile compounds can be oxidized in the presence of sodium acetate or other buffers such as carbonates. Another drawback is the formation of viscous materials that complicate product isolation. Addition of Celite, powdered molecular sieves or magnesium sulfate to PCC oxidation reaction mixtures can simplify the work-up, because the reduced chromium salts and other reagent-derived byproducts are deposited onto these solids, which can then be readily removed by filtration.

Characterization of Prepared compound

The structure of pyridinium chlorochromate was confirmed by its elemental analysis. Further, this compound was confirmed by melting point and characterized by vibrational spectroscopy (perkin Elmer, Model Spectrum Two, Range: 4000 nm -400 cm in the IR range.

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

The FT-IR spectra of Pyridinium chlorochromate is given below:

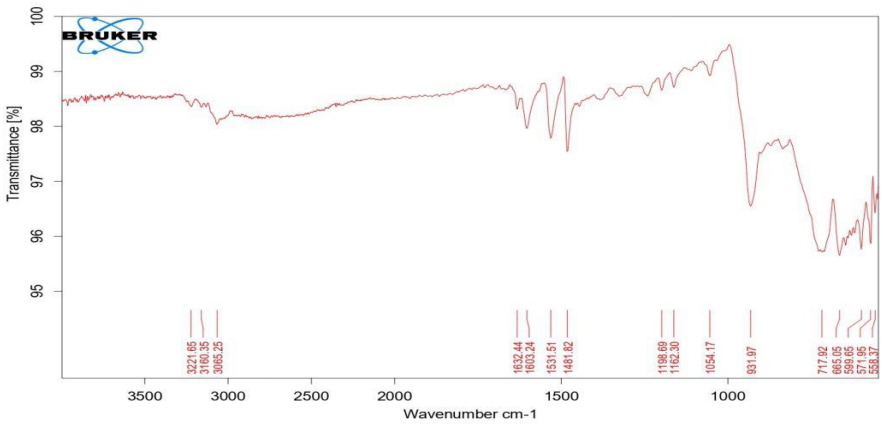


Figure: 5 FT - IR Spectrum of Pyridinium Chlorochromate.

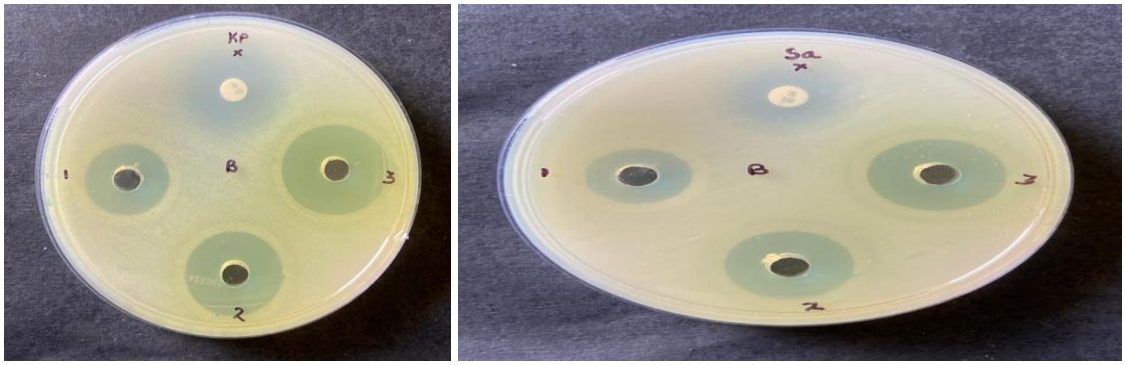
Table 1: FT - IR Spectral Data of Pyridinium Chlorochromate.

FUNCTIONAL GROUP	IR FREQUENCY (cm^{-1})
N-H	3221.65
C=N	3065.25
C=C (Arene)	1632.44
C-N	1198.69
C-Cl	717.92
Cr = O	931.97

- Based on infrared (IR) spectrum shown in Figure -1, the compound contains several functional groups.
- First there is strong Nitrogen –Hydrogen bond (N-H) at 3221.65 cm^{-1}.
- Additionally it also shows the Nitrile bond (C=N) at 3065.25cm^{-1} and Amine bond (C-N) at 1198.69 cm^{-1}
- It has an arene bond (C=C) at 1632.44 cm^{-1}

Antibacterial Activity of Pyridinium chlorochromate

The antibacterial activity of the prepared pyridinium chlorochromate was employed by using the agar well diffusion method and tested against gram positive (*S. aureus*,) and gram negative (*Klebsiella pneumonia*,) bacterial strain. 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 pyridinium chlorochromate 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.



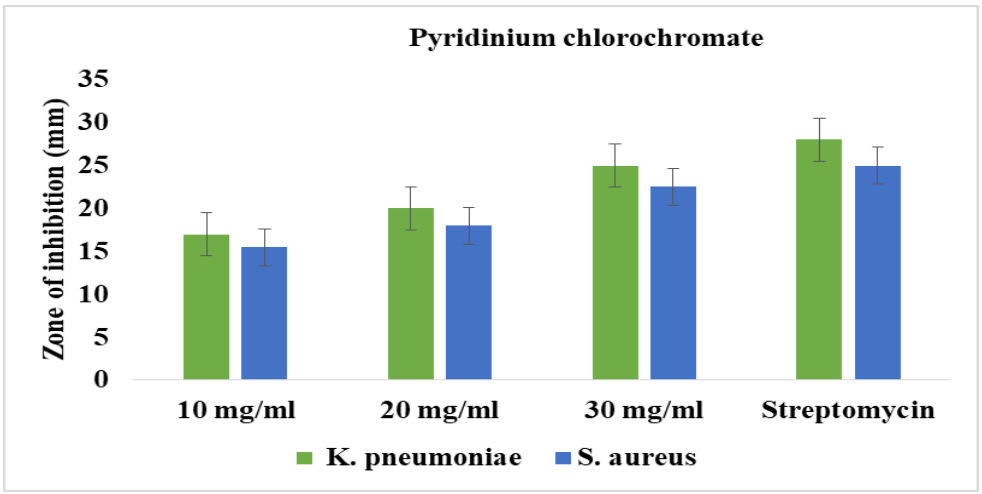


Figure: 2 Antibacterial activity of pyridinium Chlorochromate.

Table 2: Antibacterial activity of Pyridinium Chlorochromate.

Organisms	DMSO Extract added in the Zone Inhibition(mg/ml)			
	10 mg/ml	20 mg/ml	30 mg/ml	Streptomycin
K. pneumoniae	17	20	25	28
S. aureus	15.5	18	22.5	25

The antibacterial activity result of the Pyridinium Chlorochromate showed**(Figure-2)** 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 shows a higher activity in 30 mg/ml and also* Gram negative bacteria (*Klebsiella pneumonia,*) *a higher activity in 30 mg/ml.*

CONCLUSION

We have synthesized and characterized pyridinium Chlorochromate using IR spectroscopic analysis. This compound was screened against two gram-positive and gram-negative bacteria The concentration of the pyridinium chlorochromate 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 pyidinium chlorochromate as compared to *Streptomycin*.

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