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SPECTRAL AND MICROBIOLOGICAL STUDY OF QUINOXALINIUM DICHROMATE

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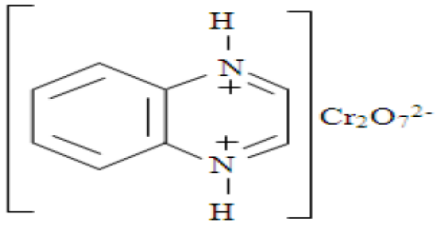
ABSTRACT

In modern aspects, the heterocyclic ring systems are playing a very important role in pharmaceutical drug synthesis. The present study was aimed to synthesis and evaluates the pharmacological potential of heterocyclic compound such as chromium (VI) compound. Microbiological potential of the prepared compound quinoxalinium dichromate (QxDC) was evaluated by disc diffusion method. Based on the results, we found that compound QxDC having significant potential against the selected organisms. The spectral characterization also revealed that the synthesized compound has heterocyclic ring system.

Keywords: Heterocyclic ring, Disc diffusion, Pharmaceutical, Pharmacological, Spectral characterization

INTRODUCTION

Metal ion complexes of Mannich bases have been studied extensively in the recent years due to their selectivity and sensitivity towards biologically important metal ions[1-6]. In the view of heterocyclic compounds sensitivity towards biological importance are necessary for kinetic measurements[7-9] and storage capacity. Quinoxalinium Dichromate $(C_8H_6N_2H_2)Cr_2O_7$ (QxDC) is one of the chromium (VI) compound used as a mild, efficient and selective oxidizing reagent in synthetic organic chemistry. QxDC was prepared by a known procedure[10]. But the quality was not satisfied compared with the quantity due to their some characteristics of the compound. This study was aimed to synthesize QxDC with high quality and to evaluate their microbiological potential.



Quinoxalinium dichromate

EXPRIMENTAL

All chemicals were of AnalaR grade. The reaction mixture was homogeneous throughout the course of the reaction.

Preparation of Quinoxalinium Dichromate

A solution of 26.4 g quinoxaline (0.2 mol) in 60 mL water was slowly added to a cold solution of 21.0 g chromium trioxide (0.2 mol) in 20 mL water. Reaction mixture was diluted after 30 min, with 40 mL acetone and cooled to -15 ºC. A light orange color, non-hygroscopic and stable solid compound was obtained. It was filtered, washed with acetone and then dried in vacuum. The compound was melted at (116 ºC) (literature value of m.p. 115-116 ºC). The yield was 80% and it was taken for further analysis.

Evaluation of Microbiological Potential

QxDC solutions were prepared with various concentrations such as 50 µL, 75 µL, 100 µL and 150 µL by dissolving QxDC in DMSO solvent. These solutions were tested against the selected organisms.

Disc Diffusion Method

Two Gram positive bacteria (*Staphylococcus aureus* and *Bacillus subtilis*) and Gram negative bacteria (Pseudomonas aeruginosa and Escherichia coli) and the fungi (*Aspergilus niger* and *Penicillium chrysogenum*) were used in this study. The bacterial inoculums was prepared from overnight broth culture in physiological saline (0.8 % of NaCl) in order to obtain an optical density ranging from 0.08–0.1 at 625 nm. Muller-Hinton agar (MH agar) and MH agar supplemented with 5% sheep blood for fastidious bacteria were poured in Petri dishes, solidified and surface dried before inoculation.

Sterile discs (6 mm Φ) were placed on inoculated agars, by test bacteria, filled with 10µL of mother solution and test solution. DMSO was used as negative control. Streptomycin for gram positive, Cefoperazone and Amikacin for gram negative were used as positive control. Bacterial growth inhibition was determined as the diameter of the inhibition zones around the discs. All tests were performed in triplicate. Then, Petri dishes were incubated at 37°C for 24 – 48 hours aerobically (Bacteria) and at 25°C for 7 days (fungi). After incubation, inhibition zone diameters were measured and documented[11].

RESULTS AND DISCUSSION

Structural Characterization of QxDC

On the basis of spectral data (Fig.-1), the structure of compound QxDC has been confirmed. For the asymmetric group of CrO_3 peak obtained at range 945cm^{-1} and for symmetric group of CrO_3 at 911cm^{-1}. At 749 cm^{-1} peak obtained for Cr-O-Cr for this characteristic we have used as reference.

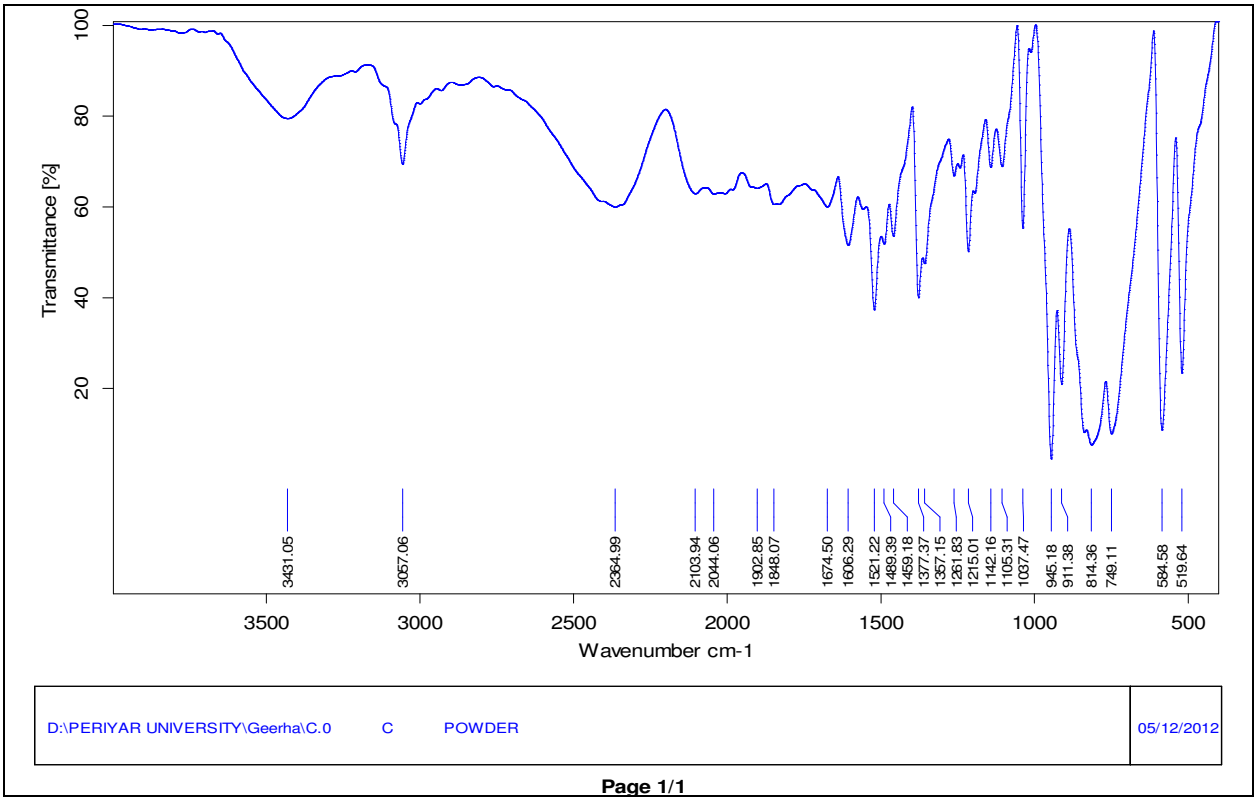


Fig.-1: IR Spectrum of QxDC

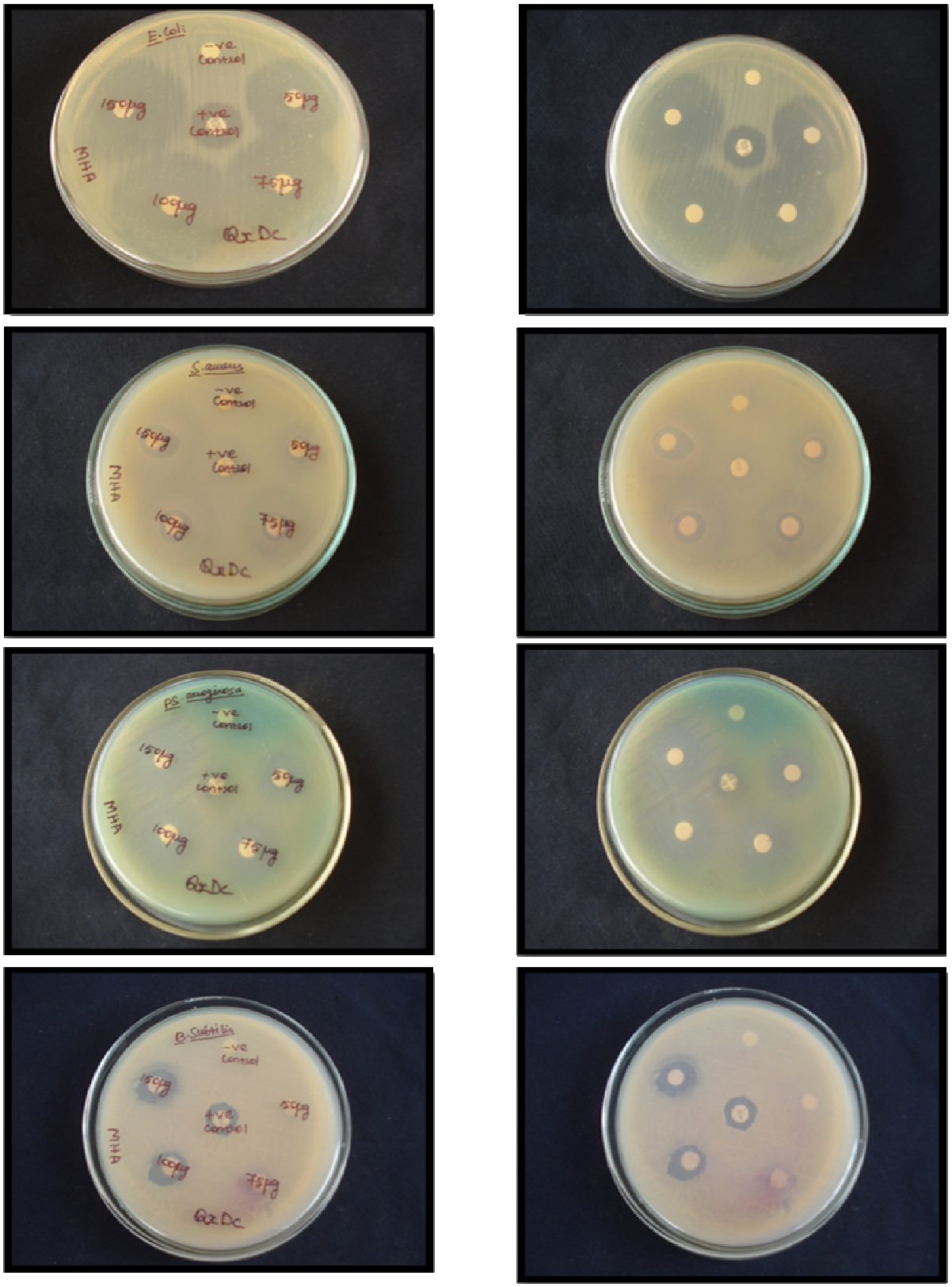


Fig.-2: Photographs of Anti Microbial Activity of QxDC

Antimicrobial Activity of QxDC

The synthesized compound has been screened for their antibacterial activity against the selected microbes and for antifungal activity against Aspergillus Niger and Penicillium Chrysogenum. The zones of inhibition obtained by the synthesized compound were furnished in Table-1 and 2. It is seen that antimicrobial activity of the test samples increases with increase of their concentrations and it was shown in the figure-2. Results were revealed that the synthesized compound possessing antibacterial activity against the test organisms which observed from the zone of inhibition.

Table- 1:Anti Bacterial Activity of QxDC

S.No.	Sample Marking	Concentration	G +ve		G -ve	
			S.Aureus	B.Subtilis	E.Coli	Ps.Aeruginosa
1	Positive Control	-	S 10 mcg	S 10 mcg	CFS 75/30 mcg	Ak 30 mcg
2	Negative Control	DMSO 100 µL	NA	NA	NA	NA
3	QxDC	50 µL	5 mm	NA	14 mm	5 mm
4		75 µL	6 mm	5 mm	15 mm	7 mm
5		100 µL	7 mm	7 mm	16 mm	8 mm
6		150 µL	8 mm	10 mm	19 mm	11 mm

Table-2: Anti Fungal Activity of QxDC

S.No.	Sample Marking	Concentration	Fungai	
			Aspergillus Niger	Penicilinium Chrysogenum
1	QxDC	50 µL	NA	NA
2		75 µL	NA	Having Activity
3		100 µL	Having Activity	Having Activity
4		150 µL	Having Activity	Having Activity

Biological screening result of the synthetic compound QxDC showed varying the degree of inhibition zone in tested microbes. The inhibitory activity of QxDC with 50 µL concentrations was 5 mm for S.aureus, 14 mm and 5 mm noticed against E.Coli and Ps.Aeuginosa respectively. The compound is not active against B.Subtilis. In 75 µL solution, potential found against gram positive microbes were 6 mm, 5 mm and for gram negative which were 15 mm and 7 mm.

The compound showed equal inhibition against S.aureus and B.subtilis was better compared with E.Coli and Ps.aeuginosa at 100 µL. Moderate activity of the compound for gram positive bacteria (8 mm and 10 mm) and higher activity (19 mm, 11 mm) against gram negative bacteria in150 µL.

Antifungal screening data showed appreciable activity of the test sample. It is interesting to note that at higher concentration of sample showed significant activity against Aspergillus niger and penicillium chrysogenum, but not in case of lower concentration.

CONCLUSION

Based on the data we concluded that synthetic compound having heterocyclic ring and also confirmed quinoxalinium dichromate (QxDC) showing the maximum potential against the gram positive and gram negative microbes in higher concentration.

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