ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Synthesis of New Thorium Clioquinol Drug.

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ABSTRACT

Increase the activity of the clioquinol drug in the presence of Th (IV) metal ion by the formation of new complex. The complex was investigated spectroscopically and thermally. The infrared spectral assignments, the Th(IV) ions coordinated to Clioquinol drug through lone pair of electron on nitrogen and phenoxy group is participate in coordination. The activity of new Th(IV) Clioquinol complex are applied against four species Escherichia coli (G –ve), Bacillus subtilis (G +ve), Aspergillus niger and Aspergillus flavus. The resulted data of Th(IV) complex found to has a highly activity against bacteria and fungi. This work is very industrial and biological important. The metal drug complex has significant effect on therapeutic action of the drugs.

Keywords: Clioquinol, thorium(IV), coordination compound, thermogravimetry.

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ISSN: 0975-8585

INTRODUCTION

Clioquinol drug (Fig. 1) is an antibiotic effective drug that used in the treatment of infections for skin (1-3). Clioquinol structure is one of quinoline derivative, that coordinated with gallium(III) in complexation for which achieved a therapeutic action (4-6). The clioquinol drug was used for treatment of Alzheimer's disease (7). The clioquinol zinc(II) complex has been significant allied with protein degeneration process in the brain (8). In literature, the clioquinol copper(II) complex was synthesized in chemical stable form (5). The aim of this article is discussed the chemical structure and biological assessment of Th(IV) Clioquinol complex.

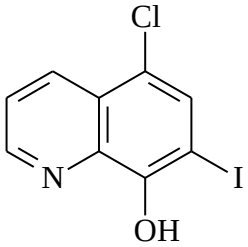

Fig 1: Chemical structure clioquinol free drug ligand

EXPERIMENTAL

Materials

Reagents (Clioquinol and Th(IV) nitrate) are purest laboratory grade in and used in the preparation of samples.

Instrumentations

The analysis percent of (carbon, hydrogen and nitrogen) were carried out using CHN-2400 analyzer instrument. The infrared spectra were scanned within 400-4000 cm^{-1} on Bruker FT-IR spectrophotometer. The absorption spectra of Th(IV)/clioquinol complex measured using Perkin-Elmer Lambda 4B spectrophotometer in DMSO. The thermogravimetric measurements were operated in nitrogen atmosphere using thermal analyzer from Schimadzu TGA-50H model.

Synthesis

Stirring 1 mmol of $Th(NO_3)_4.5H_2O$ which dissolved in least amount of distilled water with 25 mL of methanolic solution of clioquinol 4 mmol. The pH of mixture was adjusted at 7 using ammonia solution. The mixtures were refluxed and left to dry slowly overnight. The obtained chelated drug has been isolated in solid form. This precipitate was washed with hot methanol and finally dried at 70 °C.

Microbiological investigation

Th(IV) complex was tested against fungi and bacteria to study the biological activity. The organisms used in this paper is two bacteria (E. coli Gram –ve) (B.subtilis Gram +ve), and two fungi (Aspergillus flarus andAspergillus niger. The results of biological investigations of bacterial and fungi against synthesized Th(IV) complex were assessments.

RESULTS AND DISCUSSION

Element analyses

The resulted percent of %carbon, %hydrogen and %nitrogen are matched with the theoretical values (Table 1). The elemental analyses results are support that NO_3^- ions not present in the prepared complex. The Th(IV)/clioquinol complex has high melting point.

ISSN: 0975-8585

Table 1: Elemental analyses and physical results of Th(IV) complex

$[Th(clio)_2(OH)_2].2H_2O$	M.wt (g/mol)	%C		%H		%N		%M		Λ (Ω^{-1}. $cm^2.mol^{-1}$)
		Found	Calcd.	Found	Calcd.	Found	Calcd.	Found	Calcd.	
	892.5	30	24.6	1.56	1.34	3.7	3.2	25.8	26	50

Molar conductivity

The conductivity measurement Th(IV)/ Clioquinol chelating drug in the suitable solvent dimethyl sulfa oxide with concentration of $1.00x10^{-3}$ M was recorded small value 50Λ (Ω^{-1}. $cm^2.mol^{-1}$) at 25 °C. This data confirmed that the complex is non-electrolytes.

3-3- Infrared spectra

The infrared result of Th(IV)/clioquinol complex are listed in Table 2 and shown in Fig. 2. From the infrared spectra of Th(IV) complex, it is found that, the band at 3782 cm^{-1} give indication about presence of H_2O in the mode of coordination. The frequency of ν(C=N) bands has been changed after co-ordination. The appearance of two band at 607 and 438 cm^{-1} which refer to ν(M-O) and ν(M-N) vibration also(deprotonating of –NH and of –OH) are participate in binding .

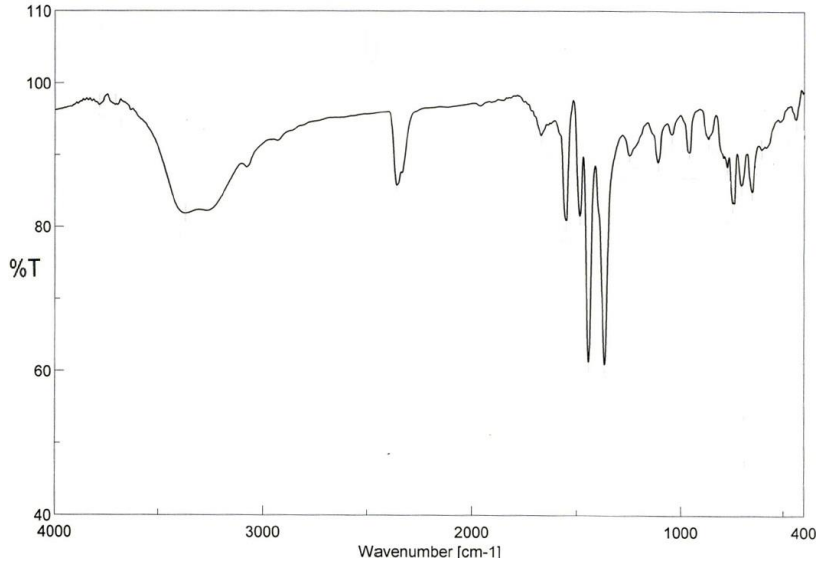

Fig 2: FT-IR spectrum of Th(IV) complex

Table 2: IR frequencies within 4000-400 cm^{-1} of Th(IV) complex

Compound	ν(OH) ; H_2O	ν(C-H) Aromatic	ν(C=N)	ν(C-O) phenyl group	ν(M-O)	ν(M-N)
[Th(IV)complex	3782,3369	3065	1667	1246	607	438

ISSN: 0975-8585

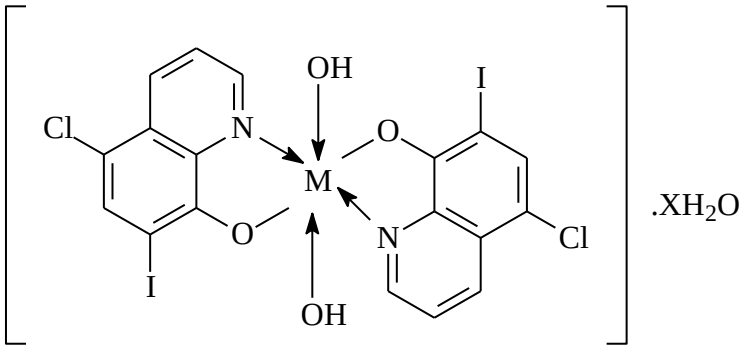

Fig 3: The structure Suggested for Th(IV) complex.

UV-vis. Spectra

The clioquinol drug binding through lone pair of electron on nitrogen and phenoxy group , this is refer to the two absorption band for π-π* and n-π* has been shifted to longer wavelength.

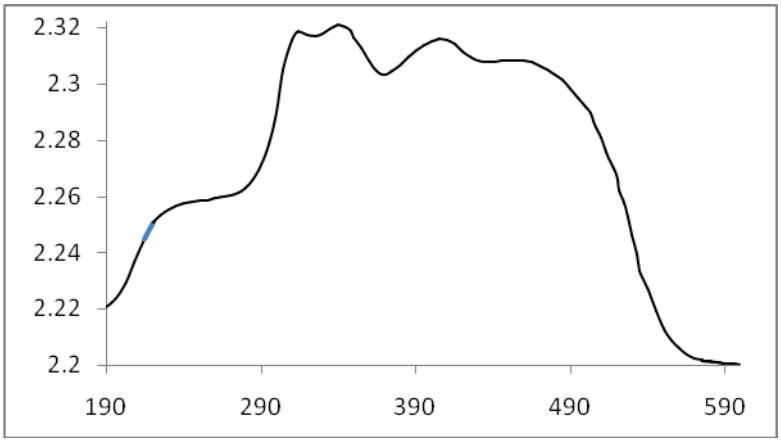

Fig 5: UV-Visible absorption spectraof Th(IV) Clioquinol complex

Thermo gravimetric analyses

The thermal analysis was performed in nitrogen atmosphere with rate of heating 10°C/min. from thermogram The loss in weight was measured from room temperature till 800 °C. The thermo gravimetric curve of Th(IV) /clioquinol complex is shown in Fig. 4. The thermal decomposition of Th(IV)/clioquinol complex occurred at four step. The first step occurs volatilization of un coordinated H_2O and the last three steps occur decomposition of complex. The residual product is thorium oxide at 800°C

ISSN: 0975-8585

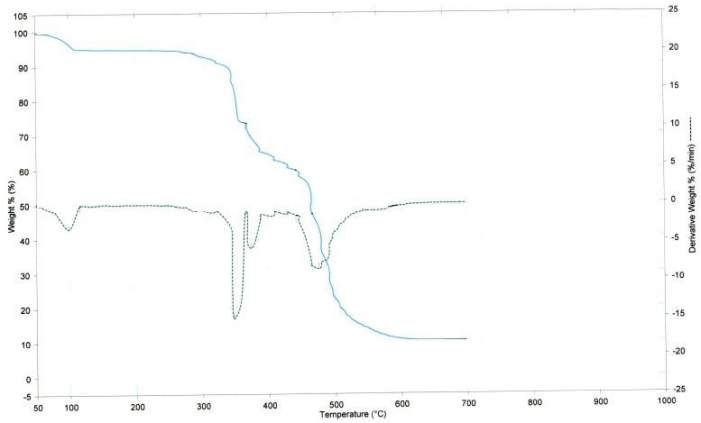

Fig 6: TG/DTG curve of Th(IV) complex of Clioquinol

Microbiological investigation

The activities of Clioquinol complex are carried against four species Escherichia coli (G –ve), Bacillus subtilis (G +ve) and Aspergillus niger and Aspergillus flavus. The microbiological activity investigation based on the size of inhibition zone. Th(IV) /clioquinol complex listed in Table 3 and is shown in Fig. 4 is found to has high activity against fungi than bacteria.

Table 3: Antimicrobial data of Clioquinol complex

Sample	Bacillus subtilis	E. coli	Aspergillus niger	Aspergillus flavus
Control	0	0	0	0
Th(IV) complex	2.2	1.4	2.1	2.7

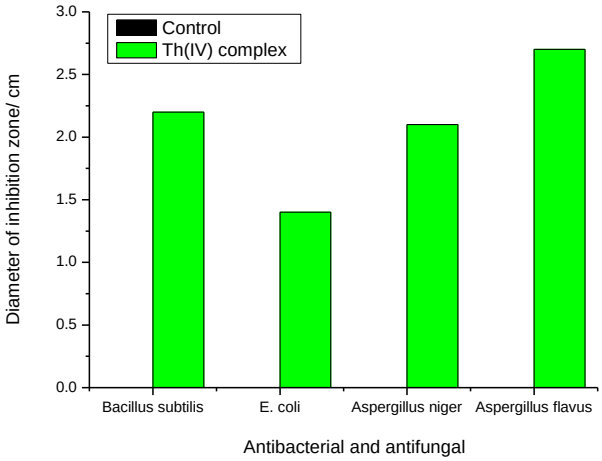

Fig 7: Statistical data of biological activities of DMSO control and Th(IV) complex

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