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Synthesis and Characterization of Metronidazole

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Abstract –

The discussions about "Synthesis and characterization of Metronidazole" is elaborately described in this paper. The development of the MTZ uses due to the severe diseases and drug resistance are elaborately discussed. The produced and required development for the biological properties are referred to be in this topic. Different methodologies and their comparison with the activity is mentioned in this paper. The effects of uses, the methodology, antibacterial and antimicrobial activity of the compound followed by its cytotoxicity are well discussed in this topic. Few recommendations to avoid the risk associated have been described here.

Keywords - Metronidazole, Antibacterial agents, Giardiasis, Cytotoxicity

I. Introduction

Various uses of different antibiotics without or with the doctor's prescription is increasing rapidly worldwide. Metronidazole (MTZ) is one of the most extensively used antiparasitic and antibacterial drug having some certain limitations. This study will be based upon the ambition of synthesizing different characterizations of MTZ drugs which could be the new lead for better use of medication in the world. Contained with nitrogen and oxygen, there has been various heterocyclic drug compounds that exhibits different biological properties. MTZ consists of azole compounds which are the type of five different heterocyclic complex, produced by containing nitrogen and other heteroatom without having the carbon atoms as part of the complex's ring. These compounds are different from other natural compound and have various significant chemical and as well biological properties within these compounds. Derivative of these compounds are used in the various anticancer, anti-inflammatory, antifungal, analgesic and antibiotic treatments. Generally, the designs and synthesizes of the product is developed.

II. Objectives

- To reduce some common side effects of different therapeutic agents.
- To synthesize of a new drug for prevention of some resistant microorganisms.
- To develop a biologically active compounds that produce a significant scavenging radical activity.
- To increase their properties of anti-oxidant using DPPH

III. Methodology

Different instruments and methods are considered for synthesizing and characterization of MTZ drugs. A Stuart SMP3 melting apparatus point is considered for the measurement of previous wrongly measured melting points. Thin layer of the machine chromatography is closely monitored while the reactions are occurred through the use a silica gel coated plate (0.25 mm,60G/F254) [2]. An infrared spectrophotometer with the Fourier transform has been used for recording the produced FTIR spectra at a rate of 400-4000 per cm. A spectrometer of Advance Bruker aV-500 is used to record the "carbon and hydrogen nuclear magnetic resonance (NMR)" spectrum. A scan spectrophotometer of "Shimadzu UV-1800 UV/Vis" is also used for recording the visual lighting and ultraviolet absorption by the sample products. An analyser of the compulsion has been used on the "Carlo Erba automated elemental analyser" with the model of 1106 [1]. Comprising of all the required elements to synthesize the MTZ antibiotic has been provided in the process of achieving the substances in this research methodologies.

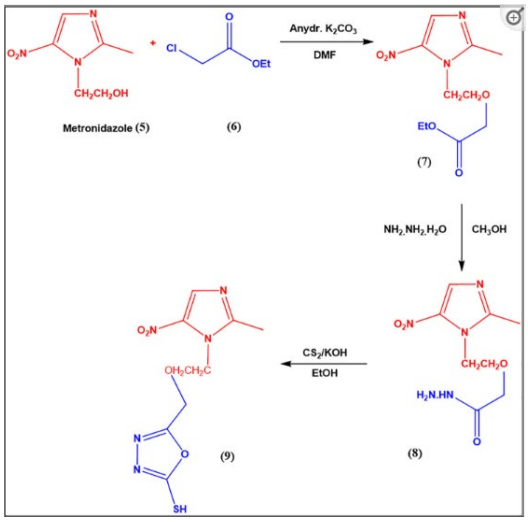

Figure 1: Process to synthesize MTZ

IV. Characteristic of Metronidazole

Metronidazole (MTZ) is one of the most used antibiotic drugs with the structure consisting of 5-nitroimidazole and it is also used to the treatment of giardiasis. The use of this important drug is stayed in the limit as it is not so effective in the emergence of different strains of drug-resistance and also in children. So, it has become more significant for different novel MTZ derivatives that involves with 1, 3, 4- oxadiazole. In the process of synthesis, all the produced complexes are chemically and as well biologically active in the process of the productions of different essential scavenging activities [3]. However, a hypothesis may be made about the properties of antibacterial, antimicrobial and pharmacological properties against the others different diseases. The MTZ will be prepared in accordance with the methods described in the methodology procedures. It can be made by mixing 0.01 mole of MTZ5 with different ethyl chloroacetate 6 and the dissolvent of dimethylformamide with having anhydrous potassium carbonate in the solution. After mixing all these compounds, it has to be stirred for about 10 hours at the temperature of 25 degree centigrade. However, methanol solution with hydrazine hydrate (0.02 mol) and potassium hydroxide with ethanol are also to be mixed in the previous solutions. The solution should be heated for about ten hours and then it is to be acidified and concentrated with dilute solution of hydrochloric acid. The desired compound should be purified by the use of chromatography process.

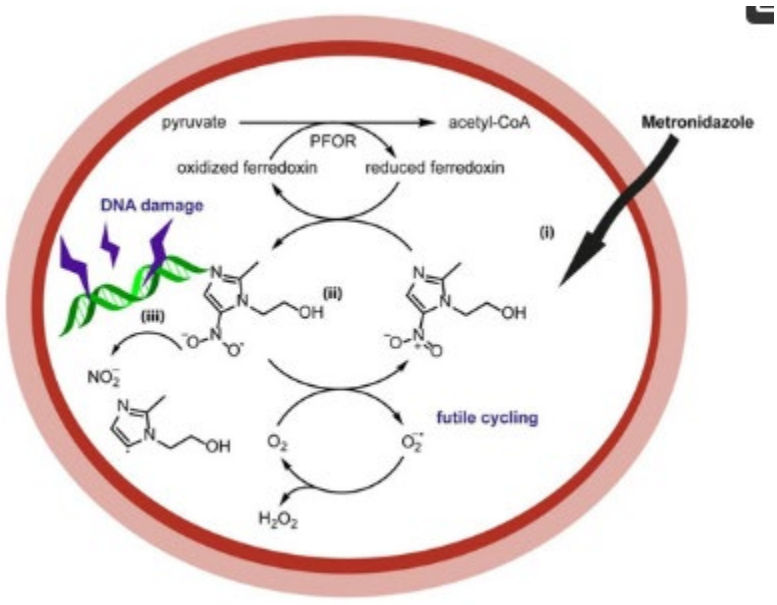

Figure 2: Mechanism of MTZ

V. Antimicrobial activity of MTZ

The evaluation of antimicrobial component for the synthesized product is to be performed using DDM method. This experiment should be carried out within the petri dishes. There has been used some strains of gram negative and gram-positive bacteria including some staphylococcus and streptococcus and other bacteria. The solution of dimethyl sulfoxide (DMSO) is used at concentration of 60 microgram per millilitre from each sample [4]. There has been the use of agar solution and the plate to culture the gram bacteria. There have been different antibacterial as well antimicrobial activities may be observed for the MTZ derivatives as shown in table 1.

Compound	Staphylococcus bacteria	Streptococcus Bacteria	Viridans streptococci bacteria
Metronidazole	-	-	-
10a	++	++	+++
10b	++	++	++
10c	++	-	++
10d	+	+	++
10e	++	+	+++
10f	+++	+++	+++
DMSO	-	-	-

VI. Antigiardial activity of MTZ

To observe the effectiveness in giardiasis disease, there is the use of the derivatives within bioassay to evaluate the process. Different biological and as well the chemical activities can be observed for a standard MTZ as shown in table 2. Three different strains from both the gram negative and gram-positive bacteria have been used [5]. These activities are measured by the calculation of the diameter of different zones effecting the inhibition around the used discs.

Compound	Staphylococcus bacteria	Streptococcus Bacteria	Viridans streptococci bacteria
Metronidazole	-	-	-
10a	++	++	+++
10b	++	++	+++
10c	+	+	+
10d	++	++	+
10e	++	+	++
10f	+++	+++	+++

DMSO	-	-	-

VII. Cytotoxicity Measurement for MTZ

MTZ derivative is also used for measuring cytotoxicity. The compounds 10a-10f's various activities are evaluated by the use of Vero cells and Caco-2 Cells [6]. The results are shown in the table below by measuring different cell viability.

Compound	Cell viability* (%)	
	Vero cells	Caco-2 cells
10a	98.4±3.2[a]	91.8±19.2
10b	103.5±4.4	97.5±4.2
10c	102.4±7.1	112.5±5.2
10d	106.2±8.2	145.8±4.3
10e	104.2±6.2	95.7±4.4
10f	106.7±2.2	109.4±4.5

Figure 3: Cytotoxicity measurement with cell viability for the effect of MTZ

VIII. Discussion

Different evaluation of antimicrobial, antiquarian activities have been shown in the process against Giardia for developing antiparasitic drugs. The synthesisation is very important as there is the scarcity of the required available drugs in the market which can combat against bacteria and also the parasitic protozoa. Modification is also required for avoiding the side effects and drug resistance (3). The result of these activities is showing some significant activity for these developed compounds consisting of oxygen, nitrogen and sulphur atoms. Cytotoxicity is also measured for determining its non-toxicity.

IX. Problem Statement

The requirement of synthesizing of MTZ derivative is effective for the treatment of giardia or other drug resistance. The synthesis of other derivative of MTZ is also required to develop its biological properties (5).

Conclusion

This newly produced MTZ compound has been synthesized and its different pharmacological properties and biological properties have been observed and determined about its effectiveness. Compared with the previous original MTZ derivatives, this new synthesized derivative gives an essential activity in the prevention of giardia and other important biological properties. Further studies should be made for better understanding of additional properties and characteristics of Metronidazole.

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