

Microbial Studies on (Thiazole, Oxadiazole, Thiadiazole)- Derivatives

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Abstract

In earlier research(1), we developed many compounds (oxadiazole,thiazole, thiadiazole)- five membered ring with a broad spectrum of bio-active characteristics and properties and considerable pharmacological actions due to its concentration of sulfur,oxygen, and nitrogen atoms. The irreversible solubilization of tooth mineral by acid generated by bacteria that attach to the tooth surface in bacterial colonies known as dental plaque causes dental decay. This effort entailed researching the effects of chemicals on oral microorganisms.

Keywords: Bacteria, Thiazole, Plaque, Oxadiazole, Thiadiazole, Sulfur, Oxygen, Teeth, Mouth

INTRODUCTION

Monocyclic aromatic rings are typically five-membered rings that behave as thiadiazole, thiazole, and oxadiazole. The class of heterocyclic aromatic organic compounds with five membered rings. These are azoles that include oxygen, sulphur, or nitrogen separated by one carbon atom(1-3).

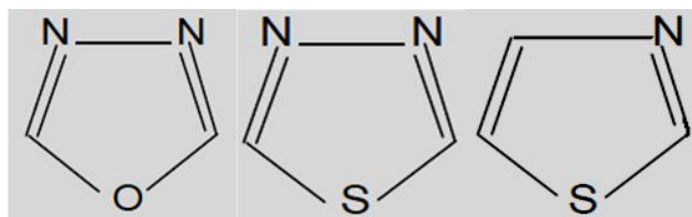


Figure:-1

Thiadiazole is a heterocyclic compound featuring both two nitrogen atom and one sulfur atom as part of the aromatic five-membered ring, it was found that among the important pharmacophores responsible for various activities See Figure 2.

Five membered rings derivatives are known for their various biological activities such as: anticancer, anti-depressant, enzyme inhibitors and anti-inflammatory, which have been investigated for their anti-inflammatory activity(8-10). Members of this ring system have found their way into such diverse several applications as pharmaceuticals, oxidation inhibitors, dyes, & metal complexing agents. All review showed that the thiadiazole nuclei have antibacterial and antifungal, anti tubercular, anticonvulsant, anti-leishmanial activities(11-16). Most of studies have indicated that the thiadiazole ring is an important framework with broad-spectrum biological activity. 1,3,4 Thiadiazole, thiazole and oxadiazole containing compounds show a wide spectrum of biological activities such as carbonic anhydrase inhibitors, analgesic, anti-inflammatory, anti-bacterial activity See Figure 3.

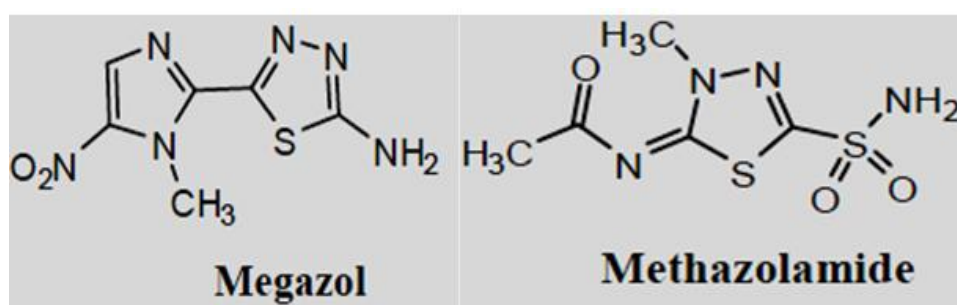


Figure:- 2

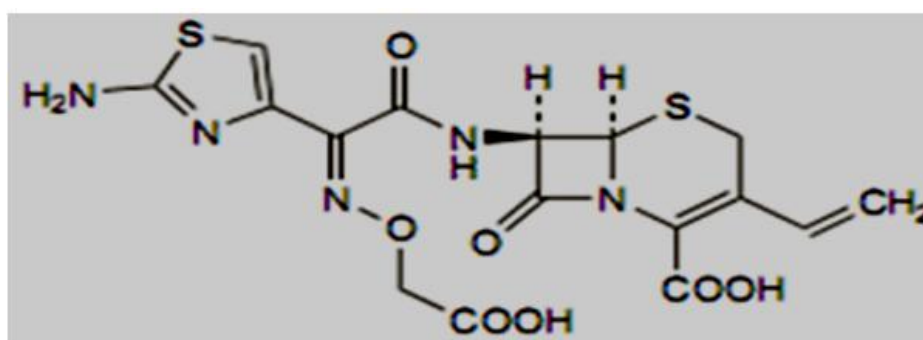


Figure: - 3

The mouth is colonized by various bacterial species, but only a limited number of these species participate in dental decay (caries) or mouth disease. These bacteria live in bacterial communities known as dental plaque which accumulates on the tooth surface. Bacteria and food can cause tooth decay.

Sticky substance called plaque is always forming on the teeth and gums. Plaque contains bacteria which feed on the carbohydrates in the food. Increasing evidence indicates that oral micro bio participate in various systemic diseases. Periodontal disease permits organisms to enter deep systemic tissues. See Figure 3

MATERIALS & PROCEDURES

The chemical materials such as Agar for bacteria and some instrumentals carried out in college of education, biological activity carried out in Bio – lab in bio department., four types of bacteria collected from samples in hospital (Lab of dentistry).

Method of Antimicrobial Assay

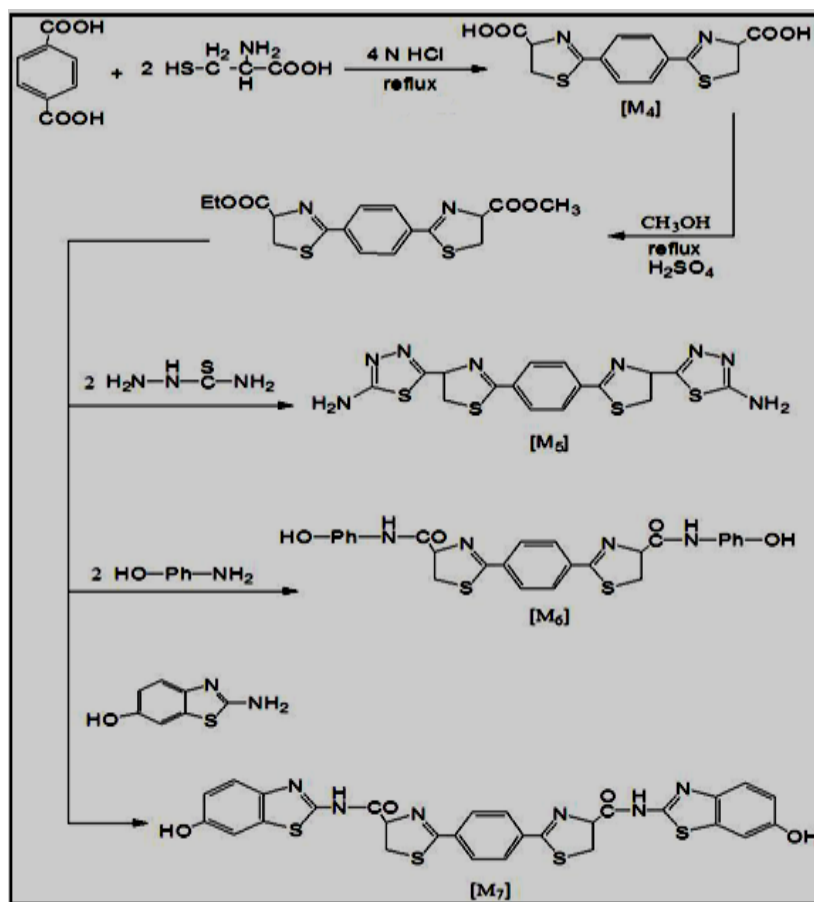
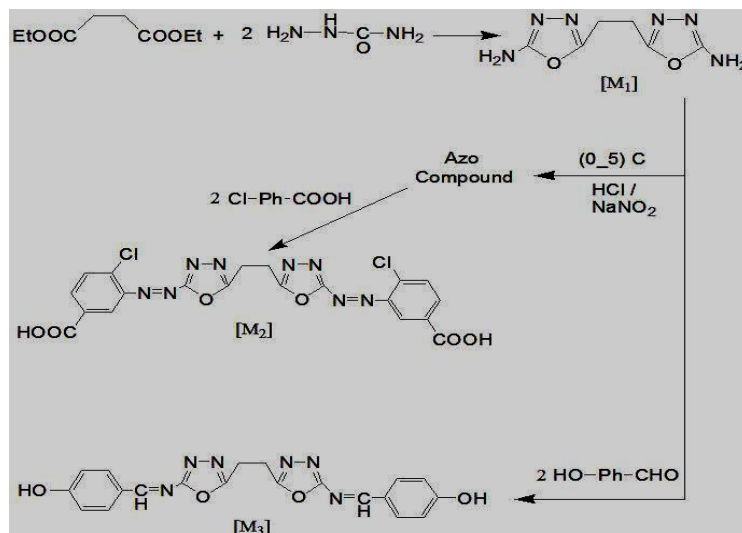
The biological activities of prepared compounds have been tested for their antibacterial activities by agar via biological methods(18,19). The antibacterial studying were tested at three concentrations (5 , 10 ,15) mg/ml concentrations in DMSO as solvent through using four types of bacteria (Streptococcus. Salivarius, Streptococcus . Mutans, Pepto Streptococcus, Lactobacillus) screened at concentrations (5 , 10 ,15) mg/ml. These bacterial strains were incubated for 24hr at 37oC .

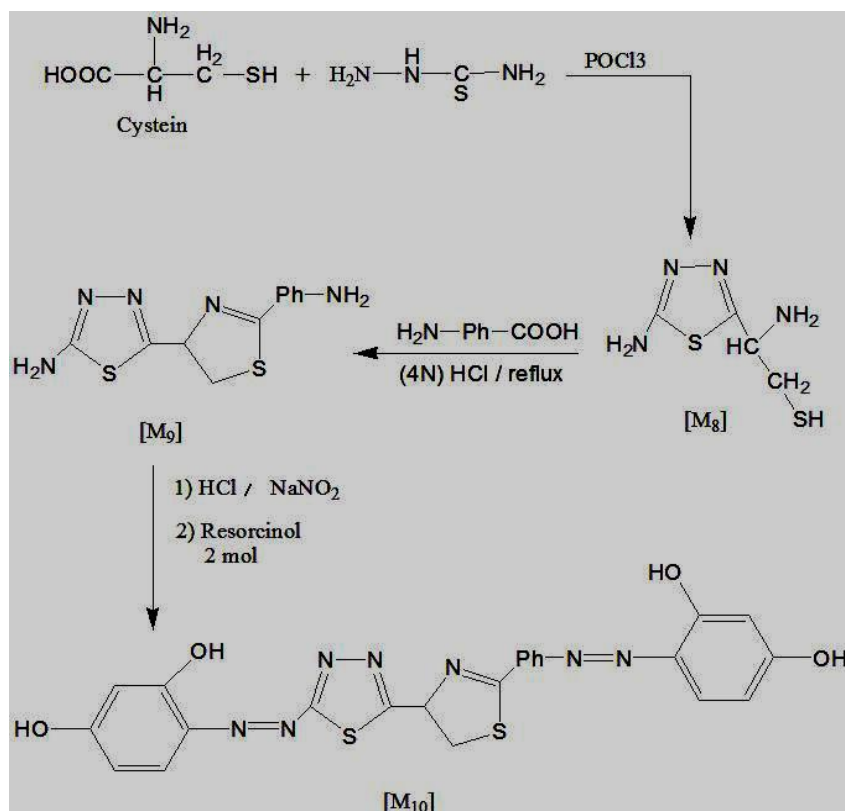


Figure:-3

Prepared Compounds in Our Previously Work (1):

In our past work, we prepared various five membered ring compounds in the following schemes, but we will study the microbial activity on mouth of patients, the compounds in this work:





RESULTS & DISCUSSION

In previously work(1), we synthesized these sulfur cyclic compounds but now we will study of antimicrobial activity against four types of mouths' bacteria.

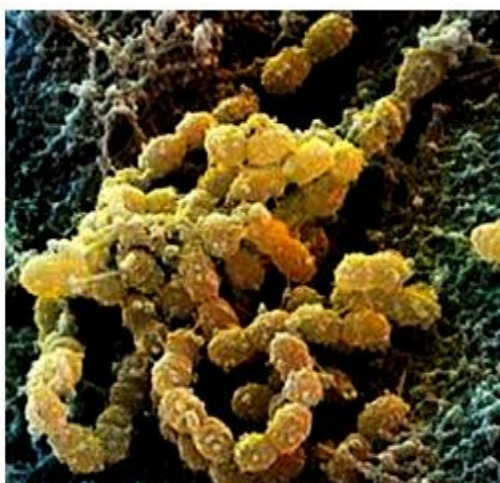
Collection of Samples and Antibacterial Assay:



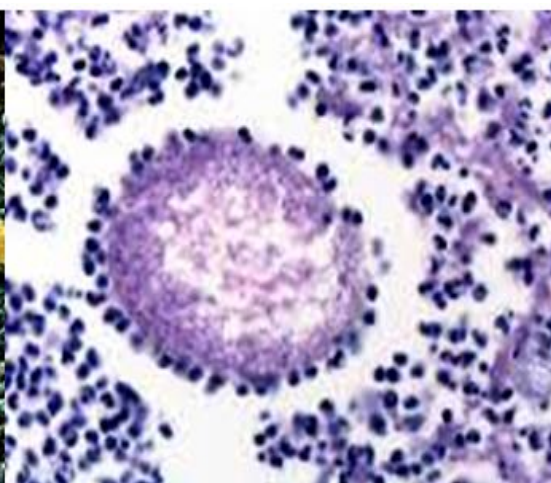
According to studying(18-20), the biological activity for compounds was tested on four types of bacteria which collected from mouth of patients in hospital, The antimicrobial

results are summarized in table (1). From results of antibacterial studies it was found to be potentially activity against all types of bacteria . while antifungal activity at concentrations (5, 10, 15 mg.ml-1)were summarized in tables (1 and 2).

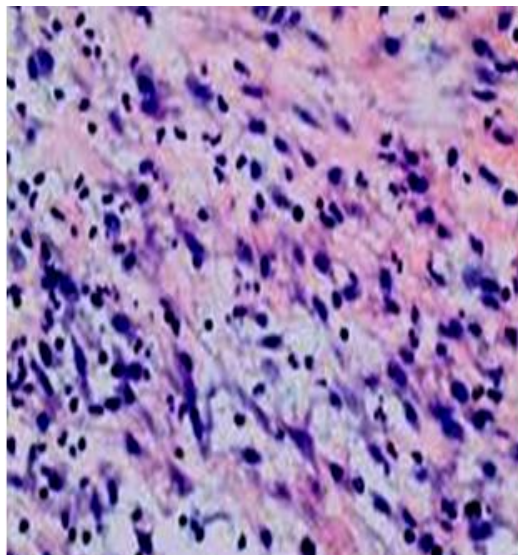
The four types of mouths, bacteria which tested: (Streptococcus Salivarius, Streptococcus Mutans , Pepto Streptococcus , Lactobacillus):



streptococcus mutans



streptococcus salivarius



Peptostreptococcus



Lactobacillus

Effect of Prepared Compounds on Mouths Bacteria :

Tables explain the compounds [1-10] that were examined based on their antibacterial activity (1, 2). The existence of a heterocyclic ring, as found in oxadiazole, thiazole, and thiadiazole, has been claimed to have an antibacterial effect, which may improve or amplify the biological activity of the nitrogen and sulphur atoms.

Tables show the antibacterial outcomes (1, 2). According to the findings of antibacterial investigations, it was discovered to have potential action against four types of bacteria, which provided excellent indications that the biological activity of all compounds has significant biological activity that inhibits the growth of bacteria.

The prepared compounds [5, 7, 10, 6] have higher activity than other compounds because of the presence of sulphur atoms in their structures(18-20). The mechanism of action for these compounds involved hydrogen bonding with the active centres of the cell constituents, resulting in interference with the normal cell process.

Table(1):Antibacterial Activity of Compounds (Inhibition Zone in (mm))as average of three Concentrations (5 ,10,15mg.ml-1)

Compounds	(average of three Measurements) <i>Streptococcus Salivarius</i>	(average of three Measurements) <i>Streptococcus Mutans</i>
[1]	10	12
[2]	14	14
[3]	12	14
[4]	20	18
[5]	22	26
[6]	20	20
[7]	22	22
[8]	14	10
[9]	14	16
[10]	18	20

The cleaning with fluoride apparently selects for the more desirable bacterial types, such as *S. sanguis* and *S. mitis*, which are capable of rapidly colonizing the tooth surfaces.

S. mutans presumably does not have an opportunity to become dominant, because the frequent debridement neutralizes its ability to be selected for by the low pH values that characterize an undisturbed plaque. Also, the 7% of fluoride paste has an immediate bacterio static effect on the plaque organisms.

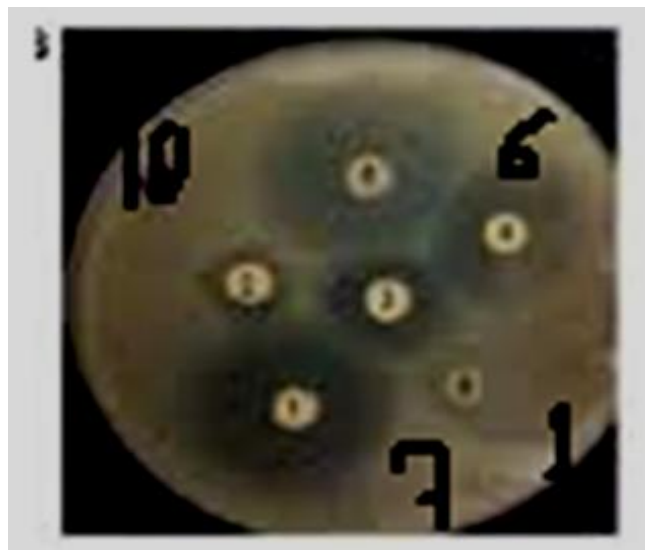


Figure (1):Antibacterial activity – *Streptococcus Salivarius*

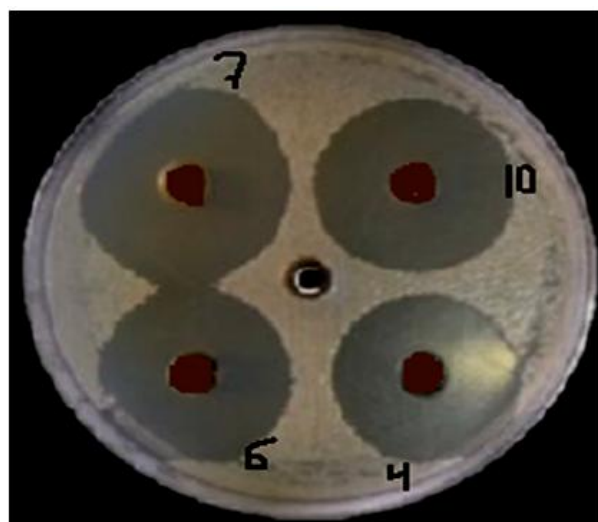


Figure (2):Antibacterial activity –*Streptococcus Mutans*

The relationship between sucrose ingestion and dental caries is reasonably well understood. The supra gingival plaque flora derives its nutrients from various sources that include diet, saliva, sloughed epithelial cells, dead microbes, and gingival crevice fluid or exudate. All sources, except the foods in the diet provide only small amounts of nutrients. See Table 2

Dental decay is tested clinically as a cavitation on the tooth surface . The cavitation is a late event in the pathogenesis of decay, being preceded by a clinically detectable subsurface lesion known as a white spot and prior to that by subsurface demineralization that can only be detected microscopically.

**Table(2):Microbial Activity of Compounds as average of three Concentrations
(5 ,10,15mg.ml⁻¹)**

Compounds	(average of three Measurements) <i>Pepto Streptococcus</i>	(average of three Measurements) <i>Lactobacillus</i>
[1]	6	8
[2]	14	10
[3]	12	10
[4]	12	14
[5]	22	20
[6]	14	14
[7]	18	18
[8]	8	10
[9]	12	12
[10]	20	16

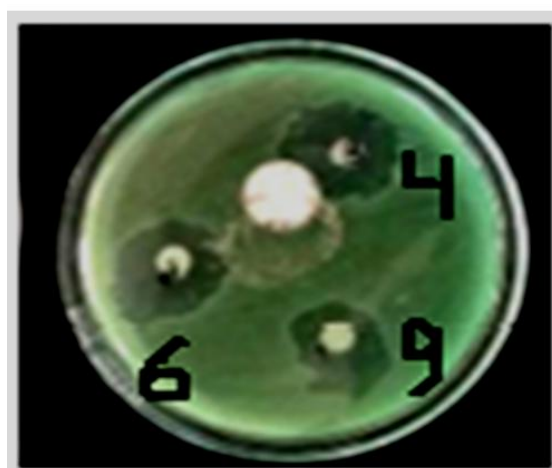


Figure (3): Anti bacterial activity –*Lactobacillus*

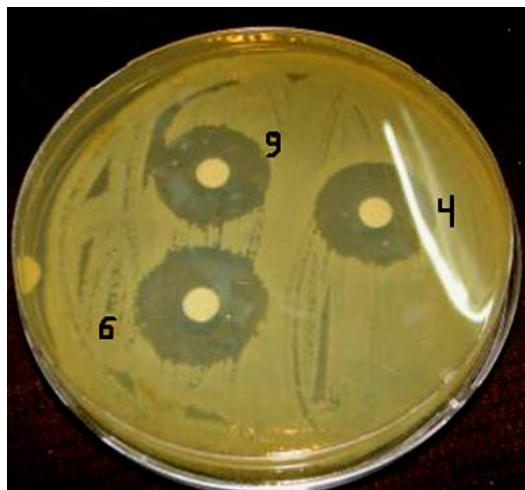


Figure (4):Antibacterial activity – Pepto Streptococcus

CONCLUSION

The action of the acid generated by plaque bacteria following consumption of meals containing fermentable carbohydrates generally causes some tooth mineral loss. The low pH in the plaque is maintained, and a net loss of mineral from the tooth occurs. This low pH favours aciduric species like *S mutans* and *lactobacilli*, which store polysaccharide and continue to release acid long after the meal has been consumed (26,27).

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