International Journal of Advanced Research in Science, Engineering and Technology
ISSN: 2350-0328
Vol. 12, Special Issue, December 2025
National Conference on Earth, Elements and Energy: Interdisciplinary Perspectives (NC3EIP–2025)
IJARSET IMPACT FACTOR 7.150

Microbial Examination of Nanoparticle of Glucopyranosyl 1,2,4 thiadiazolidine Derivative

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ABSTRACT :- Thiadiazoles are among the privileged pharmacological building blocks due to their unique chemical properties for diverse biological and clinical applications. 1,2,4-Thiadiazole derivatives have recently attained a therapeutic and economic importance that they did not possess a few years ago, thus leading to growing interest in this class of heterocycles. This discipline focuses on the design, characterization, manufacture, and use of structures, devices, and systems by manipulating form and size at the nanoscale scale. Recent years have seen an increase in the branch of current study known as nanotechnology. Here we screened for their antibacterial and antifungal activities against common pathogens like *Escherichia coli, Proteus vulgaris, Staphylococcus aureus, Pseudomonas aeruginosa, Aspergillus niger* and *Penicillium.* Some compounds exhibit less to good activity while some are resistant to the said micro-organisms.

KEYWORDS: TAG Isocyanate , 1,2,4-Thiadiazole, Nanoparticles and Antimicrobial Activities.

I. INTRODUCTION

Since they may be used in so many different ways, carbohydrates and their derivatives have become vital to human existence. These chemicals, in particular, have gained medical significance since they have been successfully tested against a variety of ailments. Since the 1500s, chemical substances have been employed to cure various illnesses. Chemotherapeutic agents are chemical compounds used to treat infectious diseases and disorders brought on by the growth of cancerous cells. Antibacterial agents are any substances that either kill or stop germs from developing. Even so, a wide variety of molecules have these characteristics. The term is frequently restricted to substances that, when used at high enough concentrations, are active at levels suitable for real-world applications. Based on their mechanisms of action and the purposes they fulfil, antimicrobial drugs can be categorised into numerous groups. Division may be necessary, depending on the type of bacteria affected. Therefore, compounds that have an effect on bacteria are referred to as bacteriostatic or bacteriocidal, whereas those that have an effect on fungi are referred to as fungistatic or fungicida11. The cup plate agar diffusion method[1-3] offers a straightforward, practical, and trustworthy test that is particularly useful in standard clinical bacteriology labs. Carbohydrate represents an important chemical class as many drugs and drug intermediates[4] are based on carbohydrates chemistry and many drugs such as amino glycoside antibiotics containing carbohydrate structure.

Carbohydrates are vastly diverse group of organic compounds occurring in all known plants, animal and microbial life. The function of carbohydrate is to provide energy and strength in plants and mammalian tissues they provide a whole variety of specialized functions ranging from cell and organ differentiation to immune protection for new born babies.

Among all carbohydrates our interest is to synthesized nitrogen linked glucosyl compounds due to its applications in medicinal chemistry and in many other ways[5]. Sugar isocyanate are versatile synthetic intermediate in carbohydrate chemistry. They have attracted considerable interest in synthetic and medicinal chemistry. The glycosides have found use as divertic agent, analgesics, antidiabetic compounds and in many other way . Methyl β-lactosyl can significantly reduce the formation of tumor colonies in mice[6]. To increase its efficiency multivalent β-lactosyl have been synthesized in Roy's group. Heterocyclic derivative of sugars were found to possess anti-tumor and anti-bacterial activity Besides these and other pharmaceutical applications of glycosyl urecides, they also found to possess applications in paper[7] , textile[8] and food industries[9].

II. EXPERIMENTAL

The research work presented deals with the study of antimicrobial activities of newly synthesized Glucopyranosyl 1,2,4 thiadiazolidine against pathogenic organisms. Screening of following compounds were carried out against the microbes like E. coli, P. vulgaris, S. aureus, P. aeruginosa, A. niger and Penicillium.

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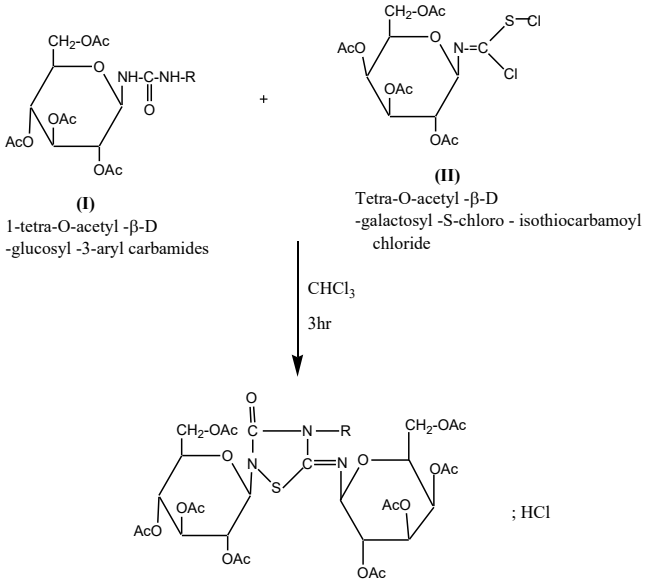
Reaction Schemes: -



(I)
1-tetra-O-acetyl -β-D -glucosyl -3-aryl carbamides

(II)
Tetra-O-acetyl -β-D -galactosyl -S-chloro - isothiocarbamoyl chloride

(III)
3-oxo-2-tetra-O-acetyl-β-D-glucosyl-4-aryl-5-tetra-O-acetyl-β-D-galactosylimino -1,2,4- thiadiazolidine(Hydrochloride)

1. **Synthesis of 1- tetra-*O*-acetyl-β-D-glucosyl-3-aryl carbamides.**

Benzene solution of 1-tetra-O-acetyl-β-D-glucosyl isocyanate (0.005 M, 1.0 g in 20 ml) was added to benzene solution of aniline (0.005 M, 0.35 g in 10 ml) and reaction mixture was kept under microwave irradiation . Afterwards, solvent benzene was removed by distillation and resultant syrupy mass was triturated several times with petroleum ether, a granular solid was obtained, crystallized from ethanol-water, m.p. 95°C.

The product was found soluble in ethanol, acetone, chloroform and benzene while insoluble in water and petroleum ether. It charred on heating with conc. sulphuric acid. It was found non-desulphurisable when boiled with alkaline plumbite solution. The product was optically active and its specific rotation was found to be $[\alpha]_D^{28} = 145.20°$ (c, 0.96 in chloroform). The purity of the product was checked by TLC, Rf value 0.93 (CCl_4 : EtOAc, 3:2).

2. **Preparation of N-Tetra-O-acetyl- β -D-galactosyl-S-chloro isothiocarbamoyl chloride :**

The N-tetra-O-acetyl-β-D-galactosyl-S-chloro isothiocarbamoyl chloride was prepared by the interaction of tetra-O-acetyl- β -D-galactosyl isothiocyanate and calculated quantity of Cl_2 gas. The details of typical experiment are as follows :

Though the chloroformic solution of tetra-O-acetyl- β -D-galactosyl isothiocyanate (0.1M, 4.0g in 20 ml) pure dry chlorine gas (C 1.9 g) was passed maintaining the temperature at 10°C. The resultant yellow solution was filtered to remove suspended impurities and the clear solution was mixed with petroleum ether (60-80°). The solvent was then removed by distillation under vacuum. The resultant oil was again diluted with petroleum ether and distilled under vacuum. N-tetra-O-acetyl- β -D-galactosyl-S-chloro isothiocarbamoyl chloride was obtained as pale yellow oil.

3. **Synthesis of 3-oxo-2-tetra-O-acetyl-β-D-glucosyl-4-aryl-5-galactosylimino 1,2,4 thiadiazolidine**

When the interaction of 1-tetra-O-acetyl- β -D-glucosyl-3-phenyl carbamide and N-tetra-O-acetyl- β -D-galactosyl-S-chloro isothiocarbamoyl chloride has been carried out in boiling chloroform medium for 3 hr. Evolution of hydrogen chloride was noticed. After heating solvent was removed by distillation, the syrupy mass was left. The residual mass triturated several times with petroleum ether (60-80°) gave a solid, crystallized from analysis of this product indicated its molecular formula as $C_{36}H_{43}O_{19}N_3S_1$, 2HCl.

4. **Preparation of nanoparticles of 3-oxo-2-tetra-O-acetyl-β-D-glucosyl-4-aryl-5-galactosylimino 1,2,4 thiadiazolidine**

Take about 1 gm of 3-oxo-2-tetra-O-acetyl-β-D-glucosyl-4-aryl-5-galactosylimino 1,2,4 thiadiazolidine and dissolve it completely in the 20ml of solvent in a 250 ml beaker and add poly vinyl alcohol as a stabilizer 1.5ml . Now put this beaker in a sonicator. The highly penetrating acoustic waves are passed through the mixture,

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which creates high-pressure bubbles in the beaker due to which breakdown of the bulk material took place and desired sized nanoparticles are formed. Then stirred mixture about 6hr. in magnetic stirrer at room tempeture.

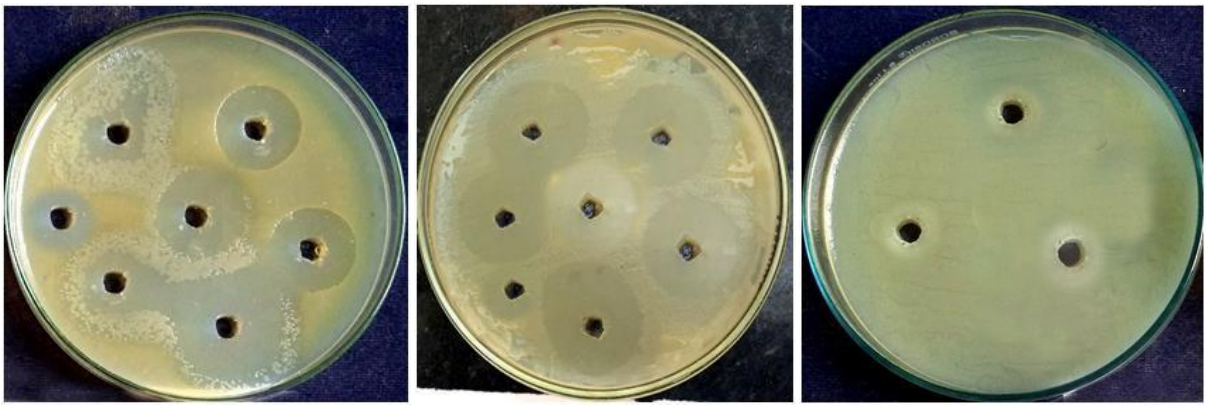
III.RESULTS AND DISCUSSION

Antibacterial Activity: These newly synthesized compounds were screened for their microbial activity against different pathogenic microbes for their antibacterial and antifungal activities using well method16. The compounds were screened for antibacterial activity against E. coli, P. vulgaris, S. aureus, P. aeruginosa, A. niger and Penicillium. in potato dextrose agar medium. Procedure for antimicrobial screening Media used (Nutrient broth): Peptone – 10 g, NaCl – 10 g and yeast extract 5 g, Agar 20 g in 1000 ml of distilled water. Initially, the stock culture of bacteria were revived by inoculating in broth media and grown at 37 0C for 18 h. The agar plates of the above media were prepared and wells were made in the plate. Each plate was inoculated with 18 h old culture (100 µL, 104 cfu) and spread evenly on the plate. After 20 min. the wells were filled with different concentrations of samples. The control wells were filled with Gentamycin. All the plates were incubated at 37 OC for 24 h and the diameter of inhibition zones were noted in mm. The activity was quantitatively assessed on the basis of inhibition zone.

Table 1 : Antimicrobial activities of 3-oxo-2-tetra-O-acetyl- β -D-glucosyl-4-aryl-5-tetra-O-acetyl- β -D-galactosylimino-1,2,4-thidiazolidives (hydrochlorides)

Compounds	*E.coli*	*P.vulgaris*	*S.aureus*	*P.aeruginosa*	*A.niger*	*Penicillium*
I -a	+++	++	+++	+++	++	+++
II -b	+++	++++	+++	+++	--	++++
III -c	+++	++++	+++	+++	++	++++

N.B. : ++++ Strongly active (above 20 mm)
+++ Moderately active (15 mm to 20 mm)
++ Weakly active (8 mm – 14 mm)
- - Inactive
Bore size = 7 mm



E. Coli S. aureus A. niger

IV. CONCLUSION

In order to clarify their structure, derivatives were synthesised and characterised. The structures were supported by a variety of spectroscopic and chemical data. A few of the synthesised compounds exhibited encouraging antibacterial properties. When tested against the tested species, the newly synthesised thiazolidine derivatives show similar antibacterial and antifungal properties. The approach used in this study is straightforward, effective, affordable, and helpful for creating pharmacologically significant compounds. The approach used for the inquiry and synthesis is straightforward, effective, and reasonably priced for creating pharmacologically significant compounds. very useful in standard clinical bacteriology labs.

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ACKNOWLEDGMENT: -

Author very much thankful to Dr. P.D.K.V. Akola for Providing and help for microbial Study and Principal, Shri R. L. T. College of Science Akola for Providing necessary facilities.

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