AIRO JOURNALS
Free / Unpaid
Peer Reviewed
Multidisciplinary
International

ISSN: 2320-3714
Volume 1 Issue 3
March 2022
Impact Factor: 10.2
Subject Chemistry

# AN IMPLEMENTATION AND FORMULATION OF HETEROCYCLIC COMPOUNDS USING SPECTRAL STUDIES

**Priyanka Mankar**
Research Scholar,
Mansarovar Global University, Bhopal (MP)
**Dr. Mamta Gour**
Faculty Department of Chemistry,
Mansarovar Global University, Bhopal



## Abstract

Several novel tetrazole and 1, 3-oxazepine derivatives have been synthesised in the current work, beginning with the reaction of L-ascorbic acid in dry acetone in the presence of dry hydrogen chloride to produce the acetyl. The latter's reaction with p-nitrobenzoyl chloride in pyridine produced an ester, which when dissolved in ethanol with (65%) acetic acid produced a glycol molecule. Glycol and sodium periodate were combined to create the aldehyde compound in distilled water. By reacting 2-phenyl 4H-benzo[d][1,3]oxazin-4-one with glycine and glacial acetic acid, the chemicals 2-(4-oxo-2-phenylquinazolin3 (4H)-yl) acetic acid and 2-(1,3-dioxoisoindolin-2-yl) acetic acid were created. By reacting substances with thionyl chloride and subsequently condensing those substances with hydrazine hydrate, substances were produced. By reacting hydrazide and aldehyde molecules, the isomethene compounds were created. By condensing an amine molecule with sodium azide and phthalic anhydride, respectively, oxyazepine and tetrazole compounds were created. Physical parties and spectroscopic techniques, including the Fourier transform, were used to identify the produced compounds' structures.

**Keywords:** Heterocyclic Compounds, Schiff base, 1, 3-oxazepine, L-ascorbic acid, Tetrazole.

AIRO JOURNALS
Free / Unpaid
Peer Reviewed
Multidisciplinary
International

ISSN: 2320-3714
Volume 1 Issue 3
March 2022
Impact Factor: 10.2
Subject Chemistry

## 1. INTRODUCTION

Due to their importance in terms of chemistry, biology, and technology, heterocyclic compounds are abundant in both naturally occurring and synthetically produced substances. Hetero cyclic ring systems are found in many different chemicals, including alkaloids, antibiotics, vital amino acids, vitamins, hormones, haemoglobin, and a sizable number of colours and synthetic pharmaceuticals.

In this work, a number of three-member heterocycles that have been produced, including aziridine, act as anti-cancer activity. Aziridine has been widely used as structural units in natural products and in other pharmaceutically relevant compounds. Diazetidine, one of the four-member rings that are also produced, is a crucial component in chemical and medicinal chemistry. This study included several five-membered rings, including 1,3,4-thiadiazole, thiazolidine, and benzimidazole. Due to their biological activity, these compounds have a wide range of medical applications, with thiadiazole being used as an antibiotic, anticancer, antifungal, and anti-microbial (11,12). Thiazolidinones are an essential structural component in the development of new drugs and are used as anti-inflammatories, anti-HIV drugs, and anti-convulsants (13) The anti-cancer, anti-fungal, anti-micro 1, and antiviral properties of benzimidazol derivatives are also significant in the medical area (14,15) This effort created thiazepine, a seven-membered ring that is present in a wide range of physiologically active natural and synthetic compounds. It is employed in medicine as an enzyme inhibitor, an anticonvulsant, an anti-cancer drug, and for other purposes.

In recent years, numerous techniques for creating an oxazepine ring have been published. However, due to its significance as a medicinal medicine and an active component in biological systems, the practical and effective method of creating oxazepine rings is still chosen. Due to their use in physiologically active natural products, medications, synthetic materials, and catalysts, heterocyclic compounds with rings containing 7 to 11 atoms have attracted a lot of attention in synthetic organic chemistry over the past two decades.

One of the most effective ways to produce chiral propargylamines, which are crucial synthetic intermediates for the creation of physiologically active nitrogen-containing chemicals and natural products, is through asymmetric alkynylation of imines.

AIRO JOURNALS
Free / Unpaid
Peer Reviewed
Multidisciplinary
International
ISSN: 2320-3714
Volume 1 Issue 3
March 2022
Impact Factor: 10.2
Subject Chemistry

The usage of these compounds in synthetic organic chemistry has been necessitated by the abundance of O and N containing six- and seven-member rings in medicines and agrochemicals. There haven't been any reports of oxazepine core modifications as liquid-crystalline compounds up till now. As the inserted atoms are said to be more polarizable than carbon, their integration can cause a considerable alteration in the liquid-crystalline phase. Tetrazole and its derivatives have drawn a lot of attention among the heterocyclic compounds that have been reported so far because of their diverse bioactivities.

Due to their unique qualities of high nitrogen levels, terazole compounds and their derivatives have attracted considerable attention and have been the subject of intensive research. Designing and producing energetic salts is a successful strategy among those used to increase the stability and decrease sensitivity of energetic materials. The tetrazole ring is a crucial pharmacophore in medicinal chemistry, and pharmaceutical uses for it have received extensive study. Many active pharmaceutical drug intermediates of tetrazole derivatives played their part in the pharmaceutical and agrochemical industry and act as multidimensional biological active drug candidates, including the inhibition of the Angiotensin (AT1) and Angiotensin (AT2) receptor (hypertension), antimicrobial, protein arginine deiminase inhibitor, antiviral, antifungal analgesic, antioxidant, anticancer, anti-inflammatory, corrosion inhibitor, crystal growth inhibition.

Chromene (Benzopyran) is a special type of medicinal pharmacophore that functions as a crucial structural element in natural compounds and has drawn significant interest due to its alluring biological actions. 1 They display a variety of biological actions, such as estrogenic, antifungal, anti-HIV, anti-tumor, anti-tumor proliferative, anti-tumor, anti-and Alzheimer's anti-Parkinson disease, and CNS activity. 2 4H-chromene compounds are quite uncommon compared to 2H-chromene compounds, and just a few instances of natural products with this structure have been identified.

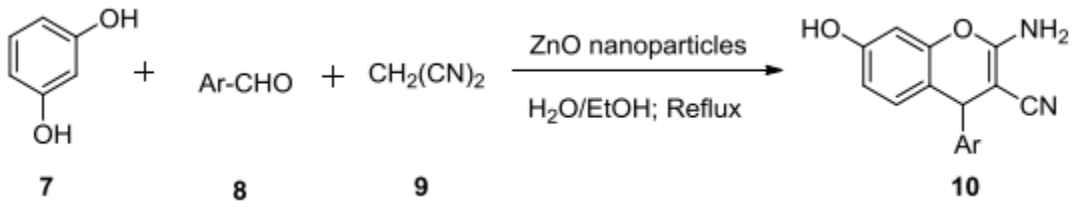
## 2. LITERATURE REVIEW

Because this class of natural and synthesised chemicals has several physiologically and pharmaceutically significant activities, chromene heterocycles are of great interest. When these

AIRO JOURNALS
Free / Unpaid
Peer Reviewed
Multidisciplinary
International
ISSN: 2320-3714
Volume 1 Issue 3
March 2022
Impact Factor: 10.2
Subject Chemistry

skeletons are coupled to other hetero rings or chemical functional groups, they become more reactive. Functionalized chromenes have been found to be the primary structural component in several biologically and naturally active substances. Cyano-functionalized chromenes are used to treat cancer, psoriatic arthritis, and rheumatoid arthritis. These also have applications as pigments, optical brighteners, and laser dyes. As a result, various methods for the synthesis of chromene derivatives have been disclosed. They participate in multi-component reactions involving phenols, - and -naphthols, malononitrile and -keto esters, various enolizable C-H activated acidic compounds, substituted aldehydes, and malononitrile. Numerous techniques employ various homogeneous and heterogeneous catalysts. These methods' advantages include excellent yields and a friendly environment for reactions, while their drawbacks include toxic solvents and expensive catalysts. The three-component condensation reaction has been the subject of numerous environmentally friendly catalyst developments.

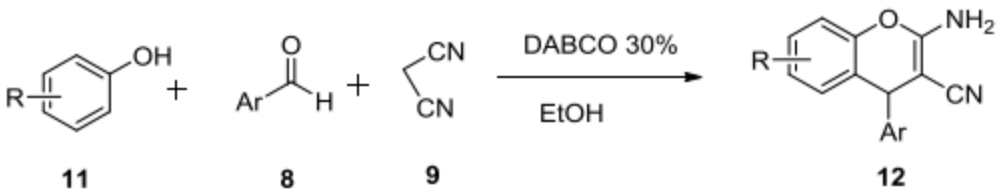
A green approach for 2-Amino-7-hydroxy-4-aryl-4Hchromene-3-carbonitrile compounds was described by Mobinikhaledi et al. The reaction was carried out in aqueous medium with ZnO nanoparticles under reflux conditions using the aromatic aldehyde derivatives 8, malononitrile 9, and resorcinol 7. (Scheme 1)




Scheme 1: Chromenes are created by synthesising ZnO nanoparticles.

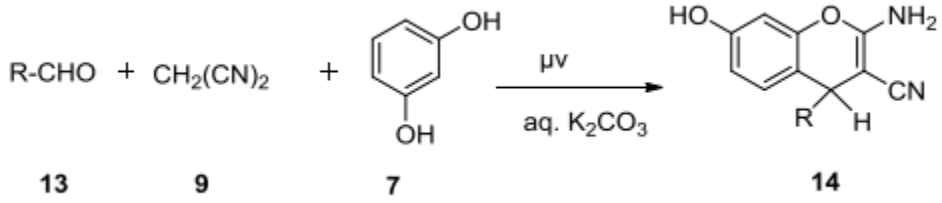
Diazabicyclo[2.2.2]octane (DABCO) was utilised by Balalaie et al. to create 2-Amino-3-cyano naphthopyran derivatives 12 by a moderate and effective three-component reaction involving aromatic aldehydes 8, naphthols 11, and malononitrile 9, all at room temperature. (Scheme 2)

AIRO JOURNALS
Free / Unpaid
Peer Reviewed
Multidisciplinary
International
ISSN: 2320-3714
Volume 1 Issue 3
March 2022
Impact Factor: 10.2
Subject Chemistry




Scheme 2: Naphthopyran synthesis is aided by the DABCO catalyst.

In water under microwave irradiation, Kidwai et al. described a quick, environmentally acceptable method for producing 2-Aminochromenes 14, 16, and K2CO3 was utilised as a green catalyst. Only water is needed for this method's reaction phase and final step. (Scheme3)




Scheme 3: Substituted chromeno heterocyclic synthesis in aqueous medium

A technique for the production of benzopyranes 20, 23, and 24 was created by Goswami et al. whereby a green catalyst made of 3-Nitrophenylboronic acid 19 was employed. With aromatic aldehydes (17), substituted phenols (18), and malononitrile (9), three component condensation processes were carried out in an ethanol solvent.

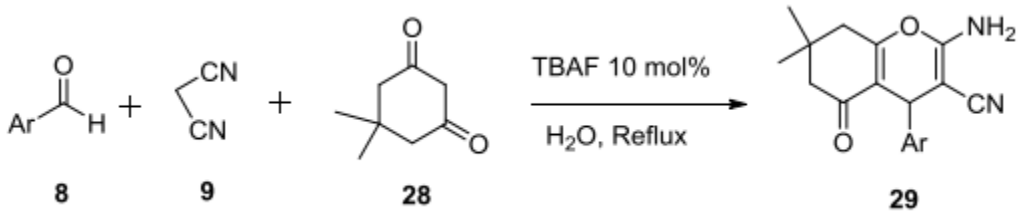
In a multicomponent reaction including phenols 7, aldehydes 17, and malononitrile 9, sulfonated reduced graphene oxide (RGO-SO3H) and pyrane substituent 25 were utilised as effective catalysts under environmentally friendly circumstances by Behravesh et al. As a green solvent, water was used to carry out the reaction.

Abdolmohammadi et al. used two distinct techniques to create 4H-chromene. Diammoniumhydrogenphosphate (NH4)2HPO4 (DAHP), an efficient catalyst for reaction in

AIRO JOURNALS
Free / Unpaid
Peer Reviewed
Multidisciplinary
International
ISSN: 2320-3714
Volume 1 Issue 3
March 2022
Impact Factor: 10.2
Subject Chemistry

aqueous media under mild circumstances at room temperature with aromatic aldehyde 8, malononitrile 9, and 4-Hydroxycoumarin 26, produces the matching Dihydropyrano[c]chromenes 27 in high yields. (S)- Another neutral trigger for this reaction at reflux has been proline.

For 4H-chromenes 29 and Narylquinoline derivatives 31, Gao et al. created a fantastic technique. As a result of the condensation of aromatic aldehyde 8, malanonitrile 9, dimidone 28, and phenylamino-cyclohexone 30, which was catalysed by tetrabutylammonium fluoride (TBAF), both chromene derivatives were produced. (Scheme 4)




Scheme 4: 4H-chromene derivatives produced by TBFA in the presence of water

A green method for synthesising a few novel 4H-pyran derivatives was disclosed by Albadi et al. 33, 35. Use another reaction in place of 32 in a multi-component reaction refluxed by substituted aldehyde 8, active methylene 9, and 1,3-dicarbonyl compounds 32. In the presence of green recyclables, 3-methyl-1-phenyl-2-pyrazolin-5-one Copper iodide (CuI) nanoparticle catalyst supported by poly(4- vinylpyridine) (P4VPy-CuI) in water.

The multicomponent manufacture of Dihydropyrano[3,2- c]chromene derivatives 27 using DABCO as a catalyst in solvent-free neat conditions is described by Jain et al. from different aldehydes 8, malononitrile 9, and 4-Hydroxycoumarin 26.

Khalafi-Nezhad et al. investigated the production of chromene derivatives utilising magnetic nanoparticles with catalyst L-cysteine-functionalized (LCMNP). The usefulness of the LCMNP material was assessed in a one-pot manufacture of 2-Amino-4H-chromene-3-carbonitrile derivatives 40 in a three-component coupling process between a nucleophile 38, salicylaldehyde

AIRO JOURNALS
Free / Unpaid
Peer Reviewed
Multidisciplinary
International
ISSN: 2320-3714
Volume 1 Issue 3
March 2022
Impact Factor: 10.2
Subject Chemistry

39, and malononitrile 9 as the catalyst. In this reaction, the LCMNP catalyst was reused at least seven times without noticeably losing catalytic activity.

## 3. METHODS AND MATERIALS

**1. Media preparation:** Media preparation and other cell culture tasks were carried out in a laminar flow hood. All surfaces were cleaned with a 70% ethanol solution. ethanol was used to clean all glassware, pipettes, petri dishes, and test tubes.

**2. Microbial Screening:** The following organisms were chosen for the studies: bacterial varieties Staphylococcus aureus, a gram-positive bacterium (MTCC 3160) Escherichia coli, Gram-negative (MTCC 1650)

Candida albicans with Alternaria alternata (MTCC 282) (MTCC 227)

Pure cultures of the bacterial and fungal strains were obtained and kept at the Department of Botany, University of Rajasthan, Jaipur, Rajasthan, and Centre for Innovation, Research & Development (CIRD), Dr. B. Lal Institute of Biotechnology, Malviya nagar, Jaipur (Raj. ). Test strains of bacteria were cultivated on Mueller-Hinton agar for 24 hours at 370C with a pH of 7.4.

**Fluconazole, Itraconazole,** and **Streptomycin** are common medications (Controls).

At the conclusion of the incubation period, the diameter of the inhibitory zone around each well is measured and recorded. The inhibition zone diameter is used to express how active the freshly produced chemicals are.

**3. Media:** Nitrate Agar A general-purpose nutrition medium called nutrient agar is used to cultivate microorganisms that support the growth of a variety of non-fastidious organisms. Typically, it includes:

PH is set to neutral (7.4) at 25 °C with 0.5% Peptone, 0.3% beef extract/yeast extract, 1.5% agar, 0.5% NaCl, and distilled water.

AIRO JOURNALS
Free / Unpaid
Peer Reviewed
Multidisciplinary
International
ISSN: 2320-3714
Volume 1 Issue 3
March 2022
Impact Factor: 10.2
Subject Chemistry

Variations in the volume of agar poured affect the zones' diameter. Agar depths more than 4 mm may produce false-resistance results. Freshly cooked plates should either be consumed the same day or kept in the refrigerator at 2-8 0C for up to 2 weeks. To prevent medium contamination and to reduce evaporation, plates that are not used within 7 days should be wrapped in plastic. Placing plates inside the incubator at 35–37 0C for 10–30 minutes will eliminate excess moisture before usage.

### 3.1 Method of Agar Well Diffusion:

The appropriate media were autoclaved at 120 oC for 15 lb/in2 to sterilise them. For the antibacterial and antifungal assays, 30 ml of nutritional agar medium and 25 ml of potato dextrose agar medium, respectively, were introduced to 100 l of seeded broth culture containing test strains at 37 oC. These media were well combined, let to cool, and then aseptically placed onto sterile (15 cm) glass Petri dishes. After allowing the mixture to harden, 20 mm apart 7 mm diameter wells were drilled using a sterile metallic borer. Then, 1 ml of the test sample's DMSO solution containing 1 mg/ml was applied to each well. DMSO was used as a bad control. As a positive control, the common antibiotics streptomycin (1 mg/ml), fluconazole (1 mg/ml), and itraconazole (1 mg/ml) were utilised. Different concentrations of synthesised substances were added to wells. For antibacterial activity, triplicate plates of each microorganism strain were made and incubated under aerobic conditions at 37°C for 24 hours and 28°C for 48 hours, respectively.

## 4. RESULT AND DISCUSSION

### 4.1 Antimicrobial Properties of a Few Particular Compounds

For the antimicrobial investigation, some 4H-chromenes and their derivatives were chosen. Compounds I through X am shown in figure 1. These underwent in vitro evaluation for antibacterial research. Streptomycin, fluconazole, and itraconazole were employed as standard antifungal agents while fluconazole and itraconazole were utilised as standard antibacterial agents to make the solutions of each chemical. The agar well diffusion method was used to determine the synthetic chromenes' antibacterial activity and those of their derivatives.

AIRO JOURNALS
Free / Unpaid
Peer Reviewed
Multidisciplinary
International
ISSN: 2320-3714
Volume 1 Issue 3
March 2022
Impact Factor: 10.2
Subject Chemistry

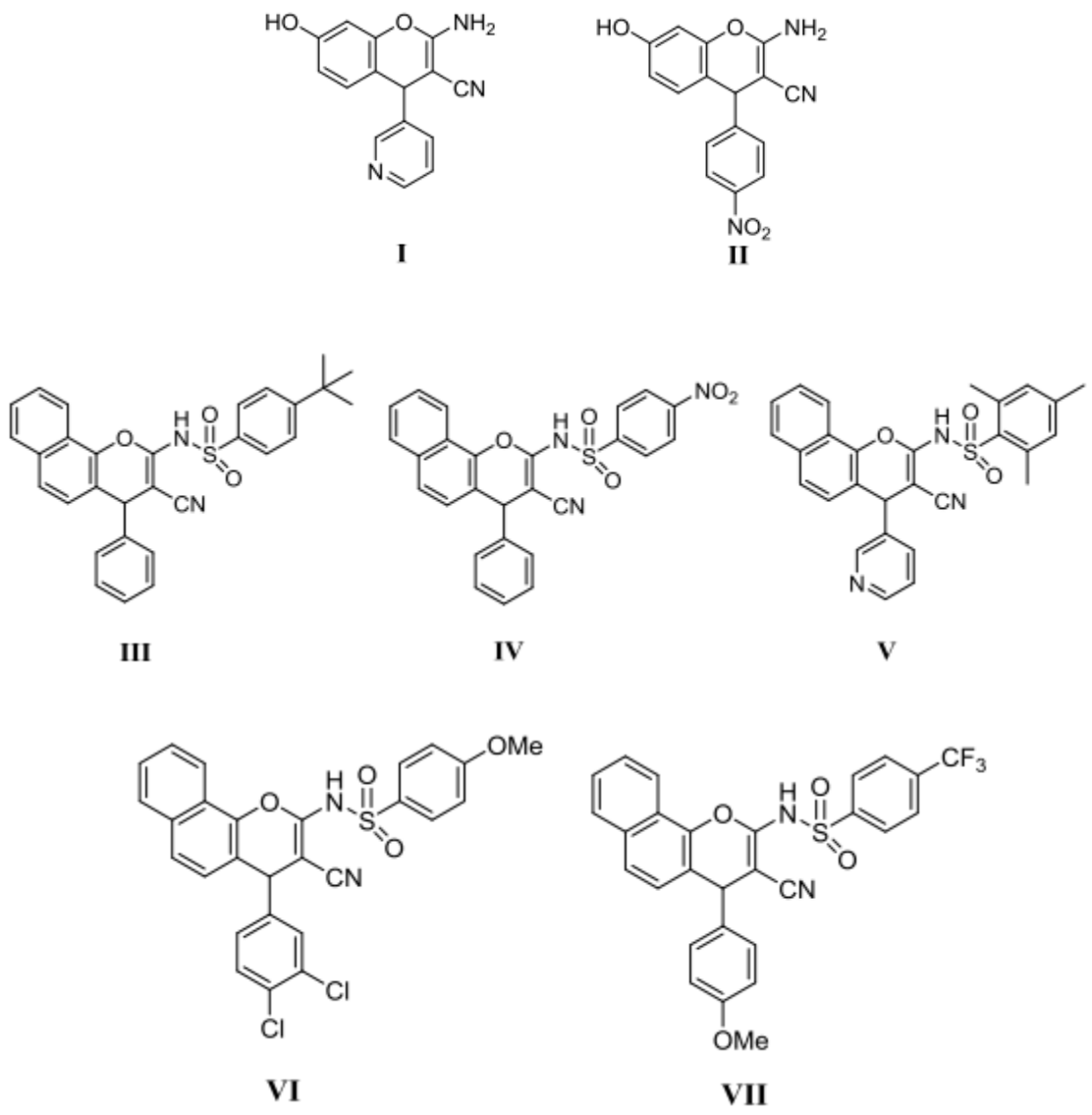



Figure 1: A Few Chosen Chemicals for Antibacterial Research

### 4.2 Fungicide Activity

Alternaria alternata (MTCC 282) and Candida albicans were used as test fungal strains for the in vitro antifungal activity of all produced compounds (MTCC 227). The fungal stock cultures were kept at 4 oC after being incubated at 37 oC for 24 hours.

AIRO JOURNALS
Free / Unpaid
Peer Reviewed
Multidisciplinary
International

ISSN: 2320-3714
Volume 1 Issue 3
March 2022
Impact Factor: 10.2
Subject Chemistry

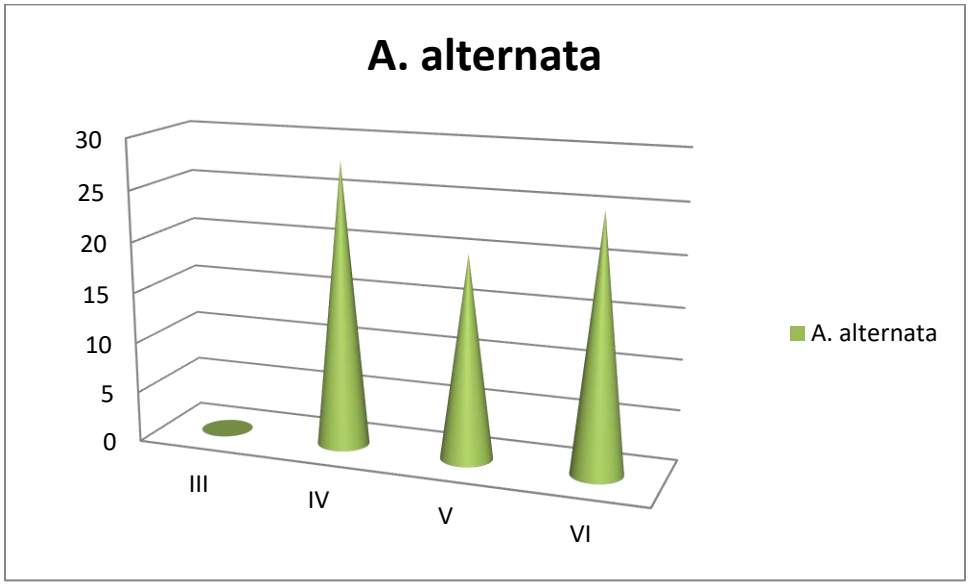
**4.3 Experimental Result**

Figure 2 depicts the fungus growth after 48–96 hours. The sizes of the inhibitory zones on the agar surface around the wells, given in figure 2 and values, were used to gauge the fungi's sensitivity to N-sulfonylchromene derivatives.

Table 1: N-sulfonylchromenes' antifungal efficacy against the fungus test organism A. alternata

| **Zone of Inhibition (mm)** | |
|---|---|
| **Sample code** | **A. alternata** |
| III | ± |
| IV | 28 |
| V | 20 |
| VI | 25 |

Figure 2 shows the graph used to analyze the effectiveness of various N-sulfonylated chromenes against fungus based on the tabulated findings.



AIRO JOURNALS
Free / Unpaid
Peer Reviewed
Multidisciplinary
International
ISSN: 2320-3714
Volume 1 Issue 3
March 2022
Impact Factor: 10.2
Subject Chemistry

Figure 2: Dimensions of the N-sulfonyl chromene derivatives' zone of inhibition against Alternaria substitute

It was discovered in this investigation that a few of the synthetic derivatives exhibit potent efficacy against the majority of the tested fungi. All of the compounds chosen in this screening effort exhibit strong antifungal activity against the fungus Alternaria alternata. Despite the fact that sample showed no discernible action against Alternaria alternata.

### 4.4 Zone of Inhibition Method Determination

The agar well diffusion method was used to examine the in vitro antibacterial properties of 4H-chromenes derivatives against two harmful bacteria (gramme positive bacteria Staphylococcus aureus and gramme negative bacteria Escherichia coli). Each chemical underwent filtering using sintered glass filters, was sterilized, and then kept at 4 degree celsius after being dissolved in dimethyl sulfoxide. Streptomycin was employed as a reference antibacterial drug to determine the zone of inhibition and to compare the results. Staphylococcus aureus and Escherichia coli, two gramme positive and gramme negative bacteria, were used as test organisms for the antibacterial activity of all the extracts. Streptomycin 50 mg/ml solution (for antibacterial activity) and 5.0 and 2.5 mg/ml solutions of each of the chosen compounds were produced in DMSO.

## 5. CONCLUSION

The 2-Amino-3-cyano-4-aryl 4H-chromenes, N-sulfonylchromene, Chromenobenzodiazepine, and Chromenobenzoxazepine that were chosen in the current study all have notable antifungal and antibacterial properties, which broaden the substrate range of the produced compounds. However, additional research is necessary to more accurately assess the potential efficacy of the synthesised compounds as antimicrobial agents, and the current investigation of new organic compounds for antimicrobial purposes increases the structural diversity of these molecules. The current findings will serve as the foundation for the creation of novel organic compounds of the relevant class for additional research in the potential identification of new bioactive scaffolds.

AIRO JOURNALS
Free / Unpaid
Peer Reviewed
Multidisciplinary
International

ISSN: 2320-3714
Volume 1 Issue 3
March 2022
Impact Factor: 10.2
Subject Chemistry

**REFERENCES**

1. Clayden, Greeves, Warren and Wothers ,"Organic Chemistry ", 1th Ed .,New York ,Oxford University, 2001.
2. Theophil Eicher and Siegfried Hanpt man, “The Chemistry of Hetero cycles”, 2th Ed., Wiley, VCH ., 2003
3. J. A. Joule and K. Mills, "Hetero Cyclic Chemistry” 5th Ed., Wiley & Sons LTD, U.K, 2010.
4. Louis D.Quin and John A. Tyrell, "Fundamentals of Hetero Cyclic Chemistry”, 9th Ed., Wiley, New York, 2010.
5. Paula Yurkanis Bruice, "Organic Chemistry" 6th Ed., United. State, p., 34, 2011
6. Issan Ahmed M. and Asniza Mustapha, Molecules, 15, P. 7498- 7508, 2010.
7. Pradnya R. Gadpayle, Sanjay P. Wate, Ashok P Mehere, Kishor P. Bhusari and Nitin B. Charbe, Medicinal Chemistry & Drug Discovery ,3(1), P. 11-19 ,2012.
8. Valery M. Dembitsky, Alexander O. Terenter, Dmitrio. Levitsky, Natural, P. 977-1006, 2013.
9. J. Heman TAhire, M.SC. Thesis School of Chemistry, University of East Anglia, Norwich, 2011
10. Michael John B., Ph. D. Thesis, University of Warwick, 2011.
11. Arvind K. Singh, Geeta M. and Kshitiz J., J. of Apple. Pharm. Sci., 1(5), P. 44-49, 2011.
12. Tanveer A., Arvind K., Nupur J. and Deepiska S., 905 Inte. Res. J. of Pharmacy, 3(3), P.70-82, 2012.
13. Yashshree P., Pramod K., Nitin K. and Ankita S., Int.J. of pharm.tech Res., 3(2), P.2980-985, 2011.
14. Rawalia,Md ,.Headaitullah and Fa-Nazz , Kh . BAL and HS. Lamba, Inte J. of Res in Pharmacy and Chemistry imidazole., 1(3) ,P.565-574, 2011 .
15. Simone Bu., Mariola ko., Agata Go., Zygmunt Ka., Henning Ei, Paololaco, Gilles Go .and Frank Se ., ARKIVOC ,(iii) ,P. 225- 250, 2009 .

AIRO JOURNALS
Free / Unpaid
Peer Reviewed
Multidisciplinary
International

ISSN: 2320-3714
Volume 1 Issue 3
March 2022
Impact Factor: 10.2
Subject Chemistry

## Author's Declaration

I as an author of the above research paper/article, hereby, declare that the content of this paper is prepared by me and if any person having copyright issue or patentor anything otherwise related to the content, I shall always be legally responsible for any issue. For the reason of invisibility of my research paper on the website/amendments/updates, I have resubmitted my paper for publication on the same date. If any data or information given by me is not correct I shall always be legally responsible. With my whole responsibility legally and formally I have intimated the publisher (Publisher) that my paper has been checked by my guide (if any) or expert to make it sure that paper is technically right and there is no unaccepted plagiarism and the entire content is genuinely mine. If any issue arise related to Plagiarism / Guide Name / Educational Qualification/ Designation/Address of my university/college/institution/Structure or Formatting/ Resubmission / Submission /Copyright / Patent/Submission for any higher degree or Job/ Primary Data/Secondary Data Issues. I will be solely/entirely responsible for any legal issues. I have been informed that the most of the data from the website is invisible or shuffled or vanished from the data base due to some technical fault or hacking and therefore the process of resubmission is there for the scholars/students who finds trouble in getting their paper on the website. At the time of resubmission of my paper I take all the legal and formal responsibilities, If I hide or do not submit the copy of my original documents (Aadhar/Driving License/Any Identity Proof and Address Proof and Photo) in spite of demand from the publisher then my paper may be rejected or removed from the website anytime and may not be consider for verification. I accept the fact that as the content of this paper and the resubmission legal responsibilities and reasons are only mine then the Publisher (Airo International Journal/Airo National Research Journal) is never responsible. I also declare that if publisher finds any complication or error or anything hidden or implemented otherwise, my paper may be removed from the website or the watermark of remark/actuality may be mentioned on my paper. Even if anything is found illegal publisher may also take legal action against me.

**Priyanka Mankar**
**Dr. Mamta Gour**