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Research Article

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Synthesis of (E)-2,4-Diphenyl-3-Styrylisoxazolidine-5-Carbaldehyde via 1, 3 - Dipolar Cycloaddition of A-Cinnamic– Aryl–N–Aryl Nitrone with Cinnamaldehyde and Exploration of its Bio-Activities

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Abstract
A powerful and easy single step synthesis of a new set of heterocycle known as isoxazolidines which have been synthesized right here *via* 1,3 dipolar cycloaddition using α-Cinnamic aryl-N-aryl nitrone as dipole and cinnamaldehyde as a dipolarophile in toluene by conventional as well as by Microwave irradiation methods. α-Cinnamic aryl-N-aryl nitrone and various substituted cinnamaldehydes have been employed for the synthesize of novel isoxazolidines with precise yield (85-90%). The synthesized heterocyclic compounds are characterized with the help of various spectroscopic techniques. The synthesized isoxazolidine are possessesing biologically live and specifically antibacterial activities.

Keywords: Novel isoxazolidines, reflux, microwave irradiation, Cinnamaldehyde, α-Cinnamic aryl-N-aryl nitrone, biological activities.

1. Introduction

The 1, 3-dipolar cycloaddition reactions involve dipole and dipolarophiles resulting in the formation of five-membered heterocyclic compounds namely isoxazolidines which can be used for a wide variety of applications and also have biological activities [1]. One of the most ease and elegance methods for the synthesis of heterocyclic compounds are 1,3-dipolar cycloaddition (1, 3 DC) reactions with suitable dipoles and dipolarophiles [2,3], Over the last two decades, interest in 1,3-DC has developed, and 1,3 DC reactions combining nitrones, alkenes and alkynes have found widespread uses in organic synthesis [4]. The Huisgen [5-7] reaction became one of the most significant concepts for the synthesis of heterocyclic compounds due to the detection of common reaction characteristics and their systematic extension. 1,3 DC reactions are one of the greatest pathways to built five-membered heterocyclic rings, and it has almost unique capacity to create a lot of stereochemical centres all at once. A well-known 1,3-dipoles are nitrones which are drastically developed a set of heterocycles namely isoxazolidines with suitable dipolarophiles [8-12]. Through the evolution of click chemistry, this 1,3 Dipolar Cycloaddition reactions were also used to prepare useful compounds and was involved in new, unanticipated applications in many diverse sectors of research [13-17]. The fundamental organic reaction 1,3-DC has proven extremely useful in many areas of chemistry, including the synthesis of natural products, material science, and chemical biology [18]. Different nitrones were treated with, α β-unsaturated aldehydes in a 1,3-dipolar cycloaddition reaction to produce the appropriate isoxazolidines in high yields and with remarkable stereoselectivity [19-23]. Here in the present investigation, we are interested to develop the new type of nitrones which are prepared by phenyl hydroxylamine and Cinnamaldehyde. Cinnamaldehyde is a flavonoid that offers the spice cinnamon and its flavor and odor which has many bio-activies. It is maily exhibit the biological activites like antibacterial, antifungal, anti-inflammatory

and anticancer [24]. Hence the nitrone prepared from Cinnamaldehyde and the dipolarophile also as Cinnamaldehyde plays an important role in the synthesis of new set of isoxazolidines with good bio activities. Some recent developments in 1,3-dipolar cycloadditions of nitrones are reviewed, with special emphasis on work performed in our research group, the cycloadditions of α-Cinnamic aryl-N-aryl nitrone with the so-called bio active Cinnamaldehydes by conventional method using toluene and microwave irradiation. And the synthesized compounds are characterized.

2. Materials and Methods

All of the chemicals were bought from the Nice brand and utilised without further purification. Nitrones synthesised are extremely stable over long periods of time. TLC was used to monitor each newly synthesised isoxazolidine, and ^{1}H and ^{13}C NMR spectra were obtained using Bruker 400MHz and 100MHz, respectively, with $CDCl_3$ as a solvent. Coupling constants are reported in Hertz, and chemical shifts are indicated in parts per million (δ-scale). Other approaches, such as IR and UV- vis were captured by the Jasco spectrometer and Perkin Elmer.

General procedure

Cycloaddition reaction of α-Cinnamic aryl-N-aryl nitrone with Cinnamaldehyde (E)-2,4-diphenyl-3-styrylisoxazolidine-5-carbaldehyde (3)

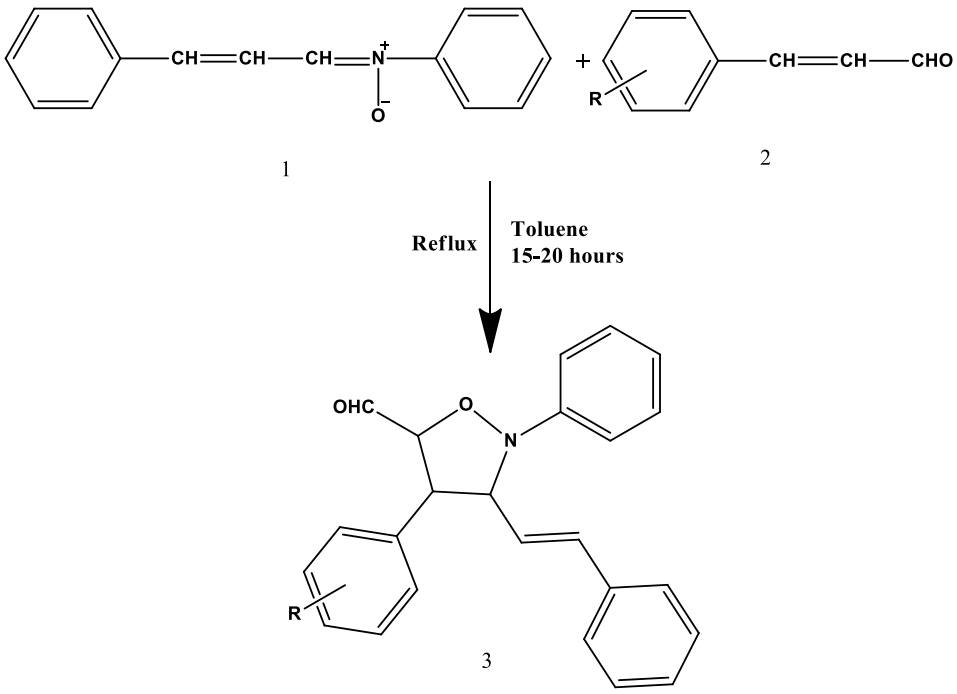
A mixture of α-Cinnamic aryl-N-aryl nitrone (**1**) and Cinnamaldehyde (**2**) was refluxed in toluene (50ml) for the time period specified in Scheme I. After completion of the reaction (as indicated by TLC), the solvent was removed under reduced pressure and the product (**3**) was recrystallized from petroleum ether. (**Scheme I**)

3. Results and Discussion

Recent research has focused on the synthesis of isoxazolidines via 1,3 dipolar cycloaddition, as well as the evaluation of their spectral and structural features of the effect of substituents on the confirmation of the central five membered isoxazolidine ring [25-27]. Similarly to this work, we planned to synthesize a new heterocycles with atleast one isoxazolidine unit. It is suggested to synthesize bisheterocycles having at least one isoxazolidine unit, as in earlier investigations (i.e) set of keto-linked bisheterocycles has been developed [28].

However, a thorough review of the literature indicated that there is no record on the cycloaddition of α-Cinnamic aryl-N-aryl nitrones with alkene [29] moiety along with the additional functional groups. This new dipolarophile Cinnamaldehyde (**2**) is a fascinating dipolarophile because it have potentially activated double bond along with the aldehyde functional group and can lead to the formation of cycloadducts with sufficient quantities of the 1,3 dipole namely α-Cinnamic-aryl-N-aryl nitrone. So, the dipole of choice for the current investigation is α-Cinnamic-aryl-N-aryl nitrone (**1**). Thus, there is more scope for additional new products in addition to normally expected regio and stereo isomers. An equimolar combination of α-Cinnamic-aryl-N-aryl nitrone [30] and Cinnamaldehyde was refluxed in toluene for 15-20 hours. After working up the reaction, it was found that only the product predominate the reaction mixture, as evidenced by TLC, and the product was separated using column chromatography. The product isolated was identified as (E)-2,4-diphenyl-3-styrylisoxazolidine-5-carbaldehyde **(3)**. From the recent literature [31], a strong indication of the regio- and stereoselectivities involved in the reaction have no other additional regio- and stereoisomer resulting from the addition and it clearly shows that the absence of another mole of the 1,3-dipole reacting one of the double bonds. Obviously, now the cycloadduct formed (**3**) has one more potential activated double bond. So, it has been planned to do a experiment with 1:2 dipolarophile and dipole for further investigation to check the Steric effect on the compound. But, only one product, (E)-2,4-diphenyl-3-styrylisoxazolidine-5-carbaldehyde **(3)**, was obtained from the reaction mixture when the process was performed.

Finally, we have chosen to investigate the cycloaddition reaction of C-aryl-N-aryl nitrone **(1)** as our initial component which reacts with the dipolarophile of cinnamaldehyde **(2)**. The systematic structure analysis for the product **3** to arrive at the exact regio and stereochemistry was carried out using ^{1}H NMR and ^{13}C NMR.



(*E*)-2,4-diphenyl-3-styrylisoxazolidine-5-carbaldehyde

Scheme I

The ^{1}H NMR spectrum shows the signal at δ 4.12 (1H, dd, *J* = 8.1, 7.1 Hz), 4.39 (1H, dd, *J* = 7.1, 4.2 Hz), 5.28 (1H, dd, *J* = 8.1, 3.8 Hz) which confirms the formation of novel isoxazolidine. And its miles feasible to attain the same product by means of microwave irradiation that is a simple and price green approach to produce new heterocycles. Strong evidence exists that the C-aryl and N-aryl groups in nitrones generated from aromatic aldehydes are arranged in a trans relationship. This uses a comparison of the UV spectra of structures with fixed cis and trans geometry as its main premise. The UV absorption at 299nm confirms the isoxazolidine ring. In FT-IR spectrum the disappearance of C=C(olefine) band at 1595.8cm^{-1} and C=N (nitrone) band disappearance at 1539.88cm^{-1} which results the formation of isoxazolidine ring system [32].

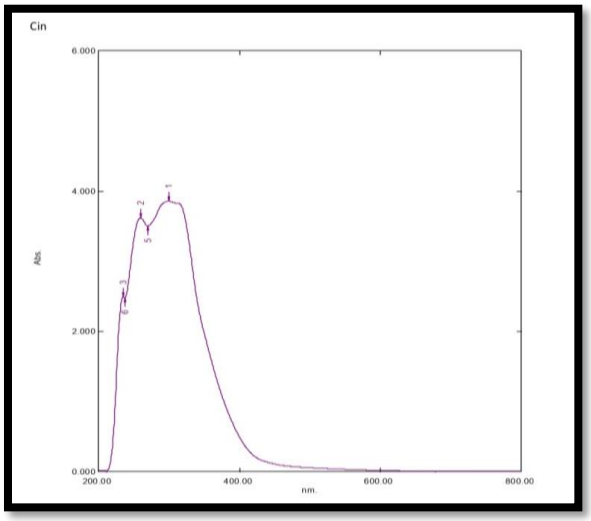


Figure 1: UV-Visible spectra of the synthesized novel isoxazolidine 3

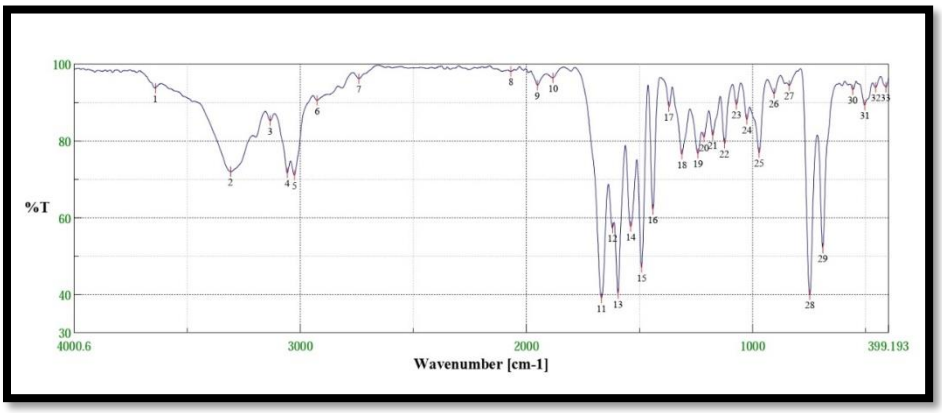
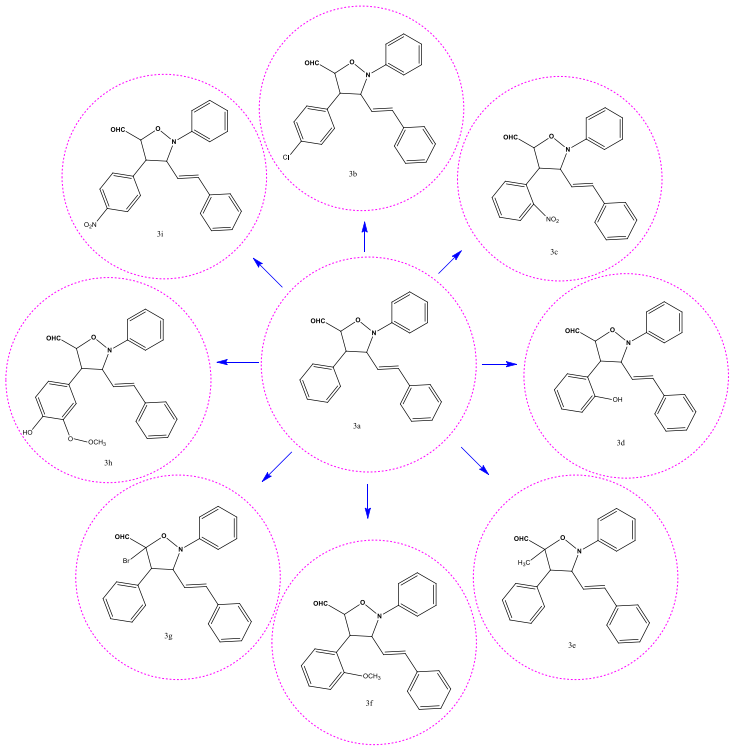


Figure 2: FT-IR spectra of the synthesized novel isoxazolidine 3

Table 1: Synthesis of novel isoxazolidines using different dipolarophiles 2

Compound	R	Time (h)	Yield (%)
3a	H	20	90%
3b	4-Cl	18	85%
3c	2-NO_2	19	87%
3d	2-OH	18	86%
3e	α-CH_3	20	85%
3f	α-OCH_3	17	86%
3g	2-Br	16	85%
3h	4-OH, 3-OCH_3	18	89%
3i	4-NO_2	20	90%

Here the substituted cinnamaldehydes reacts with the synthesized α-Cinnamic aryl-N-aryl nitrone (**1**) to give various isoxazolidine systems **(3a-3i).**



(E)-2,4-diphenyl-3-styrylisoxazolidine-5-carbaldehyde (3a)

^{1}H NMR (400 MHz, Chloroform) δ 4.12 (1H, dd, *J* = 8.1, 7.1 Hz), 4.39 (1H, dd, *J* = 7.1, 4.2 Hz), 5.28 (1H, dd, *J* = 8.1, 3.8 Hz), 6.42-6.64 (2H, 6.49 (dd, *J* = 16.8, 4.2 Hz), 6.57 (d, *J* = 16.8 Hz)), 6.99-7.46 (15H, 7.05 (tt, *J* = 8.1, 1.2 Hz), 7.08 (dtd, *J* = 8.2, 1.2, 0.5 Hz), 7.20 (tt, *J* = 7.7, 1.3 Hz), 7.21 (tt, *J* = 7.7, 1.6 Hz), 7.32 (dddd, *J* = 8.2, 8.1, 1.4, 0.5 Hz), 7.33 (dddd, *J* = 7.7, 7.6, 1.8, 0.5 Hz), 7.32 (tdd, *J* = 7.7, 1.9, 0.5 Hz), 7.36 (dtd, *J* = 7.6, 1.5, 0.5 Hz), 7.40 (dddd, *J* = 7.6, 1.8, 1.3, 0.5 Hz)), 9.71 (1H, d, *J* = 3.8 Hz).

^{13}C NMR (100 MHz) δ 40.7 (1C, s), 56.6 (1C, s), 73.9 (1C, s), 115.9 (2C, s), 127.2 (2C, s), 127.6 (2C, s), 127.8-127.8 (3C, 127.8 (s), 127.8 (s), 127.8 (s)), 128.2 (2C, s), 128.3-128.5 (4C, 128.4 (s), 128.4 (s)), 130.3 (1C, s), 134.4 (1C, s), 139.2 (1C, s), 140.5 (1C, s), 148.0 (1C, s), 201.6 (1C, s).

(E)-4-(4-chlorophenyl)-2-phenyl-3-styrylisoxazolidine-5-carbaldehyde (3b)

^{1}H NMR (400 MHz, Chloroform) δ 4.14 (1H, dd, *J* = 8.1, 7.1 Hz), 4.41 (1H, dd, *J* = 7.1, 4.3 Hz), 5.22 (1H, dd, *J* = 8.1, 3.8 Hz), 6.42-6.64 (2H, 6.49 (dd, *J* = 16.8, 4.3 Hz), 6.57 (d, *J* = 16.8 Hz)), 6.87-7.51 (14H, 6.94 (ddd, *J* = 8.2, 1.5, 0.5 Hz), 7.05 (tt, *J* = 8.1, 1.2 Hz), 7.08 (dtd, *J* = 8.2, 1.2, 0.5 Hz), 7.20 (tt, *J* = 7.7, 1.3 Hz), 7.32 (dddd, *J* = 8.2, 8.1, 1.4, 0.5 Hz), 7.33 (dddd, *J* = 7.7, 7.6, 1.8, 0.5 Hz), 7.40 (dddd, *J* = 7.6, 1.8, 1.3, 0.5 Hz), 7.45 (ddd, *J* = 8.2, 1.4, 0.5 Hz)), 9.71 (1H, d, *J* = 3.8 Hz).

^{13}C NMR (100 MHz) δ 40.7 (1C, s), 56.6 (1C, s), 73.9 (1C, s), 115.9 (2C, s), 127.2 (2C, s), 127.8-127.8 (2C, 127.8 (s), 127.8 (s)), 128.0-128.3 (4C, 128.1 (s), 128.2 (s)), 128.4 (2C, s), 128.7 (2C, s), 130.3 (1C, s), 133.7 (1C, s), 134.4 (1C, s), 139.2 (1C, s), 140.5 (1C, s), 148.0 (1C, s), 201.6 (1C, s).

(E)-4-(2-nitrophenyl)-2-phenyl-3-styrylisoxazolidine-5-carbaldehyde (3c)

^{1}H NMR (400 MHz, Chloroform) δ 4.13-4.33 (2H, 4.20 (dd, *J* = 8.1, 7.1 Hz), 4.27 (dd, *J* = 7.1, 4.4 Hz)), 5.16 (1H, dd, *J* = 8.1, 3.8 Hz), 6.42-6.64 (2H, 6.50 (dd, *J* = 16.8, 4.4 Hz), 6.57 (d, *J* = 16.8 Hz)), 6.99-7.46 (14H, 7.05 (tt, *J* = 8.1, 1.2 Hz), 7.08 (dtd, *J* = 8.2, 1.2, 0.5 Hz), 7.13 (ddd, *J* = 8.2, 1.4, 0.5 Hz), 7.20 (tt, *J* = 7.7, 1.3 Hz), 7.28 (ddd, *J* = 8.1, 1.5, 0.5 Hz), 7.32 (dddd, *J* = 8.2, 8.1, 1.4, 0.5 Hz), 7.33 (dddd, *J* = 7.7, 7.6, 1.8, 0.5 Hz), 7.37 (ddd, *J* = 8.2, 7.4, 1.5 Hz), 7.38 (ddd, *J* = 8.1, 7.4, 1.4 Hz), 7.40 (dddd, *J* = 7.6, 1.8, 1.3, 0.5 Hz)), 9.72 (1H, d, *J* = 3.8 Hz).

^{13}C NMR (100 MHz) δ 40.7 (1C, s), 56.6 (1C, s), 73.9 (1C, s), 114.8 (1C, s), 115.9 (2C, s), 124.1 (1C, s), 127.2 (2C, s), 127.3 (1C, s), 127.8-127.8 (2C, 127.8 (s), 127.8 (s)), 128.2 (2C, s), 128.3-128.5 (3C, 128.4 (s), 128.4 (s)), 129.4 (1C, s), 130.3 (1C, s), 134.4 (1C, s), 140.5 (1C, s), 148.0 (1C, s), 154.1 (1C, s), 201.6 (1C, s).

(E)-4-(2-hydroxyphenyl)-2-phenyl-3-styrylisoxazolidine-5-carbaldehyde (3d)

^{1}H NMR (400 MHz, Chloroform) δ 4.13-4.34 (2H, 4.20 (dd, *J* = 8.1, 7.1 Hz), 4.27 (dd, *J* = 7.1, 4.4 Hz)), 5.16 (1H, dd, *J* = 8.1, 3.8 Hz), 6.42-6.70 (3H, 6.50 (dd, *J* = 16.8, 4.4 Hz), 6.57 (d, *J* = 16.8 Hz), 6.64 (ddd, *J* = 8.3, 1.2, 0.5 Hz)), 6.92 (1H, ddd, *J* = 8.0, 7.5, 1.2 Hz), 6.99-7.46 (12H, 7.05 (tt, *J* = 8.1, 1.2 Hz), 7.08 (dtd, *J* = 8.2, 1.2, 0.5 Hz), 7.17 (ddd, *J* = 8.0, 1.3, 0.5 Hz), 7.20 (tt, *J* = 7.7, 1.3 Hz), 7.24 (ddd, *J* = 8.3, 7.5, 1.3 Hz), 7.32 (dddd, *J* = 8.2, 8.1, 1.4, 0.5 Hz), 7.33 (dddd, *J* = 7.7, 7.6, 1.8, 0.5 Hz), 7.40 (dddd, *J* = 7.6, 1.8, 1.3, 0.5 Hz)), 9.71 (1H, d, *J* = 3.8 Hz).

^{13}C NMR (100 MHz) δ 40.7 (1C, s), 56.6 (1C, s), 73.9 (1C, s), 115.9 (2C, s), 116.8 (1C, s), 124.1 (1C, s), 127.2 (2C, s), 127.3 (1C, s), 127.8-127.8 (2C, 127.8 (s), 127.8 (s)), 128.2 (2C, s), 128.3-128.5 (3C, 128.4 (s), 128.4 (s)), 129.4 (1C, s), 130.3 (1C, s), 134.4 (1C, s), 140.5 (1C, s), 148.0 (1C, s), 155.9 (1C, s), 201.6 (1C, s)..

(E)-5-methyl-2,4-diphenyl-3-styrylisoxazolidine-5-carbaldehyde (3e)

^{1}H NMR (400 MHz, Chloroform) δ 1.51 (3H, s), 4.15 (1H, d, *J* = 7.1 Hz), 4.49 (1H, dd, *J* = 7.1, 4.2 Hz), 6.42-6.64 (2H, 6.50 (dd, *J* = 16.8, 4.2 Hz), 6.57 (d, *J* = 16.8 Hz)), 6.99-7.46 (15H, 7.05 (tt, *J* = 8.1, 1.2 Hz), 7.08 (dtd, *J* = 8.2, 1.2, 0.5 Hz), 7.20 (tt, *J* = 7.7, 1.3 Hz), 7.21 (tt, *J* = 7.7, 1.6 Hz), 7.32 (dddd, *J* = 8.2, 8.1, 1.4, 0.5 Hz), 7.33 (dddd, *J* = 7.7, 7.6, 1.8, 0.5 Hz), 7.36 (tdd, *J* = 7.7, 1.9, 0.5 Hz), 7.37 (dtd, *J* = 7.6, 1.6, 0.5 Hz), 7.40 (dddd, *J* = 7.6, 1.8, 1.3, 0.5 Hz)), 9.71 (1H, s).

^{13}C NMR (100 MHz) δ 27.6 (1C, s), 40.7 (1C, s), 56.6 (1C, s), 79.7 (1C, s), 115.9 (2C, s), 127.2 (2C, s), 127.6 (2C, s), 127.8-127.8 (3C, 127.8 (s), 127.8 (s), 127.8 (s)), 128.2 (2C, s), 128.3-128.5 (4C, 128.4 (s), 128.4 (s)), 130.3 (1C, s), 134.4 (1C, s), 139.2 (1C, s), 140.5 (1C, s), 148.0 (1C, s), 202.2 (1C, s).

(E)-4-(2-methoxyphenyl)-2-phenyl-3-styrylisoxazolidine-5-carbaldehyde (3f)

^{1}H NMR (400 MHz, Chloroform) δ 3.80 (3H, s), 4.14-4.34 (2H, 4.21 (dd, *J* = 8.1, 7.1 Hz), 4.28 (dd, *J* = 7.1, 4.4 Hz)), 5.15 (1H, dd, *J* = 8.1, 3.8 Hz), 6.42-6.64 (2H, 6.50 (dd, *J* = 16.8, 4.4 Hz), 6.57 (d, *J* = 16.8 Hz)), 6.83-7.46 (14H, 6.90 (ddd, *J* = 8.0, 7.5, 1.3 Hz), 7.02 (ddd, *J* = 8.3, 1.3, 0.5 Hz), 7.05 (tt, *J* = 8.1, 1.2 Hz), 7.08 (dtd, *J* = 8.2, 1.2, 0.5 Hz), 7.20 (tt, *J* = 7.7, 1.3 Hz), 7.21 (ddd, *J* = 8.0, 1.3, 0.5 Hz), 7.23 (ddd, *J* = 8.3, 7.5, 1.3 Hz), 7.32 (dddd, *J* = 8.2, 8.1, 1.4, 0.5 Hz), 7.33 (dddd, *J* = 7.7, 7.6, 1.8, 0.5 Hz), 7.40 (dddd, *J* = 7.6, 1.8, 1.3, 0.5 Hz)), 9.72 (1H, d, *J* = 3.8 Hz).

^{13}C NMR (100 MHz) δ 40.7 (1C, s), 56.0 (1C, s), 56.6 (1C, s), 73.9 (1C, s), 115.8 (1C, s), 115.9 (2C, s), 124.1 (1C, s), 127.2 (2C, s), 127.3 (1C, s), 127.8-127.8 (2C, 127.8 (s), 127.8 (s)), 128.2 (2C, s), 128.3-128.5 (3C, 128.4 (s), 128.4 (s)), 129.4 (1C, s), 130.3 (1C, s), 134.4 (1C, s), 140.5 (1C, s), 148.0 (1C, s), 157.0 (1C, s), 201.6 (1C, s).

3g (E)-5-bromo-2,4-diphenyl-3-styrylisoxazolidine-5-carbaldehyde (3g)

^{1}H NMR (400 MHz, Chloroform) δ 4.34-4.56 (2H, 4.40 (d, *J* = 7.1 Hz), 4.49 (dd, *J* = 7.1, 4.2 Hz)), 6.44-6.64 (2H, 6.51 (dd, *J* = 16.8, 4.2 Hz), 6.57 (d, *J* = 16.8 Hz)), 7.00-7.14 (3H, 7.06 (tt, *J* = 8.1, 1.2 Hz), 7.08 (dtd, *J* = 8.2, 1.2, 0.5 Hz)), 7.15-7.46 (12H, 7.21 (tt, *J* = 7.7, 1.3 Hz), 7.24 (tt, *J* = 7.7, 1.8 Hz), 7.32 (dddd, *J* = 8.2, 8.1, 1.4, 0.5 Hz), 7.33 (dddd, *J* = 7.7, 7.6, 1.8, 0.5 Hz), 7.33 (tdd, *J* = 7.7, 1.9, 0.5 Hz), 7.39 (dddd, *J* = 7.6, 1.8, 1.6, 0.5 Hz), 7.40 (dddd, *J* = 7.6, 1.8, 1.3, 0.5 Hz)), 9.97 (1H, s).

^{13}C NMR (100 MHz) δ 40.7 (1C, s), 56.6 (1C, s), 89.2 (1C, s), 115.9 (2C, s), 127.2 (2C, s), 127.6 (2C, s), 127.8-127.8 (3C, 127.8 (s), 127.8 (s), 127.8 (s)), 128.2 (2C, s), 128.3-128.5 (4C, 128.4 (s), 128.4 (s)), 130.3 (1C, s), 134.4 (1C, s), 139.2 (1C, s), 140.5 (1C, s), 148.0 (1C, s), 190.9 (1C, s).

(E)-4-(4-hydroxy-3-(methylperoxy)phenyl)-2-phenyl-3-styrylisoxazolidine-5-carbaldehyde (3h)

^{1}H NMR (400 MHz, Chloroform) δ 3.79 (3H, s), 4.11 (1H, dd, *J* = 8.1, 7.1 Hz), 4.40 (1H, dd, *J* = 7.1, 4.4 Hz), 5.15 (1H, dd, *J* = 8.1, 3.8 Hz), 6.42-6.87 (5H, 6.49 (dd, *J* = 16.8, 4.4 Hz), 6.57 (d, *J* = 16.8 Hz), 6.65 (dd, *J* = 8.5, 0.5 Hz), 6.77 (dd, *J* = 8.5, 2.8 Hz), 6.81 (dd, *J* = 2.8, 0.5 Hz)), 6.99-7.46 (10H, 7.05 (tt, *J* = 8.1, 1.2 Hz), 7.08 (dtd, *J* = 8.2, 1.2, 0.5 Hz), 7.20 (tt, *J* = 7.7, 1.3 Hz), 7.32 (dddd, *J* = 8.2, 8.1, 1.4, 0.5 Hz), 7.33 (dddd, *J* = 7.7, 7.6, 1.8, 0.5 Hz), 7.40 (dddd, *J* = 7.6, 1.8, 1.3, 0.5 Hz)), 9.71 (1H, d, *J* = 3.8 Hz).

^{13}C NMR (100 MHz) δ 40.7 (1C, s), 56.0 (1C, s), 56.6 (1C, s), 73.9 (1C, s), 107.1 (1C, s), 115.8 (1C, s), 115.9 (2C, s), 127.2 (2C, s), 127.8-127.8 (2C, 127.8 (s), 127.8 (s)), 128.2 (2C, s), 128.4 (2C, s), 128.7 (1C, s), 130.3 (1C, s), 134.4 (1C, s), 139.2 (1C, s), 140.5 (1C, s), 146.7 (1C, s), 147.5 (1C, s), 148.0 (1C, s), 201.6 (1C, s)

(E)-4-(4-nitrophenyl)-2-phenyl-3-styrylisoxazolidine-5-carbaldehyde (3i)

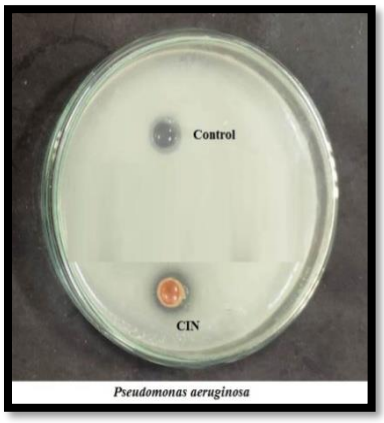
^{1}H NMR (400 MHz, Chloroform) δ 4.09 (1H, dd, *J* = 8.1, 7.1 Hz), 4.34 (1H, dd, *J* = 7.1, 4.4 Hz), 5.14 (1H, dd, *J* = 8.1, 3.8 Hz), 6.42-6.64 (2H, 6.49 (dd, *J* = 16.8, 4.4 Hz), 6.57 (d, *J* = 16.8 Hz)), 6.99-7.46 (14H, 7.05 (tt, *J* = 8.1, 1.2 Hz), 7.08 (dtd, *J* = 8.2, 1.2, 0.5 Hz), 7.20 (tt, *J* = 7.7, 1.3 Hz), 7.20 (ddd, *J* = 8.2, 1.3, 0.5 Hz), 7.27 (ddd, *J* = 8.2, 1.2, 0.5 Hz), 7.32 (dddd, *J* = 8.2, 8.1, 1.4, 0.5 Hz), 7.33 (dddd, *J* = 7.7, 7.6, 1.8, 0.5 Hz), 7.40 (dddd, *J* = 7.6, 1.8, 1.3, 0.5 Hz)), 9.71 (1H, d, *J* = 3.8 Hz).

^{13}C NMR (100 MHz) δ 40.7 (1C, s), 56.6 (1C, s), 73.9 (1C, s), 114.8 (2C, s), 115.9 (2C, s), 127.2 (2C, s), 127.8-127.8 (2C, 127.8 (s), 127.8 (s)), 128.2 (2C, s), 128.4 (2C, s), 128.7 (2C, s), 130.3 (1C, s), 134.4 (1C, s), 139.2 (1C, s), 140.5 (1C, s), 148.0 (1C, s), 164.6 (1C, s), 201.6 (1C, s).

Antibacterial activity

The disc diffusion technique is employed in this work to investigate the antibacterial activity. The approach is placing antimicrobial-soaked paper circles on a yard of bacteria grown on the outer layer of an agar medium, hatching the plate for the time being, and measuring the presence or absence of an inhibitory zone around the circles.

Isoxazolidines have been shown to have antibacterial activity [33,34]. As a result, antibacterial susceptibility test synthesized Isoxazolidine **3** was performed in the inhibitory zone diameter at a dosage of 20mg/ml of DMSO. There was no distinguishing feature among the Isoxazolidines. Compound **3** inhibits the growth of two microorganisms examined. It kills Pseudomonas aeruginosa and Bacillus marisflavi.



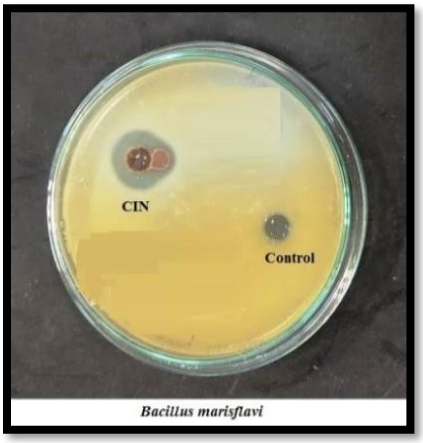


Table 2 Concentration 20mg/ml of DMSO

Organisms	Compound 3
Bacillus Marisflavi	12 mm
Pseudomonas aeruginosa	12 mm
Exiguobacterium indicum	-

4. Conclusions

Here, the heterocyclic ring system isoxazolidines were synthesised by pre-prepared stable nitrone and distinctive cinnamaldehyde as dipolarophiles. The synthesized novel isoxazolidines were confirmed by ^{1}H, ^{13}C, FT-IR and UV-Visible techniques and antibacterial activities. As a result, all of the heterocyclic compounds here have been developed successfully.

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