Synthesis, characterization and antibacterial screening of novel schiff bases and thiazolidinone derivatives incorporated by triazole moiety

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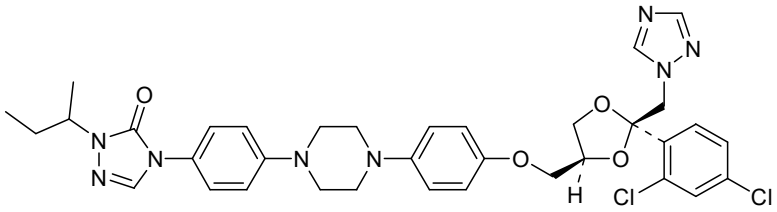
ABSTRACT

A series of novel 2-(4-(1H-1,2,4-triazol-1-yl)phenyl)-3-phenylthiazolidin-4-one derivatives have been synthesized from (Z)-N-(4-(1H-1,2,4-triazol-1- yl)benzylidene)benzenamine and thioglycollic acid in dry toluene at reflux temperature. The synthesized compounds were screened for antibacterial activity against gram +ve bacteria Staphylococcus aureus and Bacillus subtilis; and gram -ve bacteria Escherichia coli and Salmonella typhi respectively. ^{1}H NMR, IR, Mass spectral data and elemental analyses elucidated the structures of the all newly synthesized compounds. Some of the tested compounds showed significant antibacterial activity.

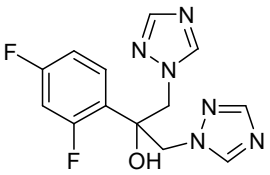
1. INTRODUCTION

Azoles are found widely in natural sources and there are several drugs available which contain azole ring as an integral part of their structure. Triazoles are important five membered heterocyclic rings containing three N atoms. The chemistry of triazole was studied in detail and discussed in literature since last 30-40 years. The major reason behind this is the activities exhibited by triazole moiety. Most of the compounds containing triazoles are potent P450 inhibitors, particularly; Itraconazole is potent inhibitor of human CYP3A4 whereas Fluconazole is known to

inhibit human CYP2C9 and CYP2C19 isoform (Fig. 1). Recently, an attention has been focused on 1*H*-1,2,4-triazole derivatives for their broad-spectrum of activities, such as fungicidal, herbicidal, anticonvulsant and plant growth regulatory activities [1-3].



1.Itraconazole.



2.Fluconazole

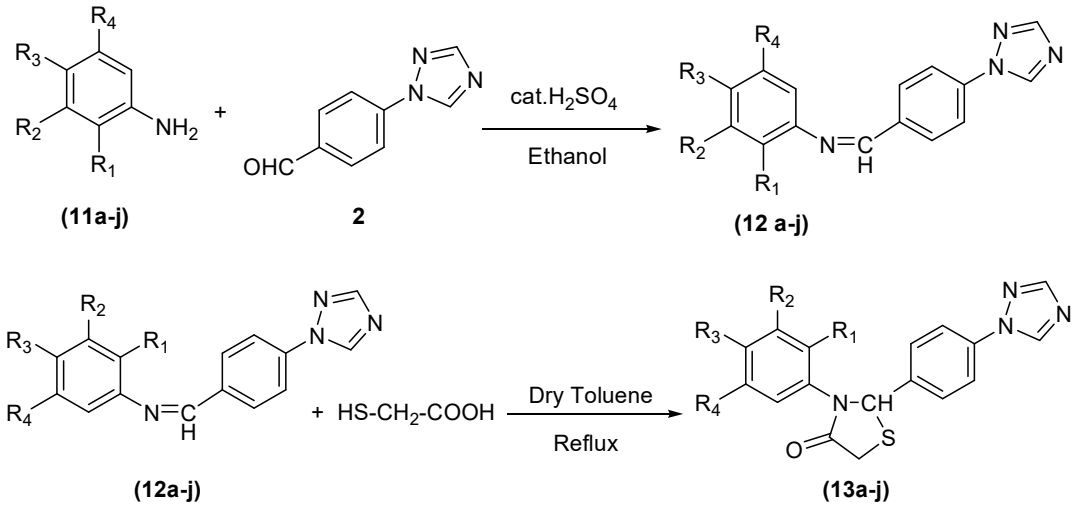
Fig.1

In medicinal and pharmaceutical field, schiff bases as well as azo compounds are biologically important compounds [4-6]. It has been suggested that the azomethine linkage might be responsible for biological activities displayed by schiff bases. In addition to this, schiff bases are precursors for the synthesis of pharmacologically important compounds like azetidinone and thiazolidinone derivatives. Furthermore, they were reported to show a variety of interesting biological properties including antibacterial [7-12], antifungal, anti-mouse hepatitis virus (MHV) [13], inhibition of herpes simplex virus type 1 (HSV-1) and adenovirus type 5 (Ad 5) [14], anti- cancer [15-19], anti-mosquito larvae [20] and herbicidal activities [21]. In agricultural chemistry, it is known that the presence of a chloro and azo functionalities in different types of azomethine compounds can exhibit pesticidal activity [22].

In 4- thiazolidinone, substituent at 2, 3 and 5 positions may be varied, but the significant and drastic difference in structure and properties is exerted by the group attached to C2. It was observed that these molecules exhibit activities ranging from anticonvulsant [23,24], anti-tubercular [25,26], anthelminitic [27,28], antibacterial [29,30] to anticancer activities [31,32]. The variations in the C3-positions are particularly popular as antimicrobial [33,34] and as cardiovascular affecting agents.

Therefore, in view of these important biological activities of the schiff bases and 4-thiazolidinone derivatives and in continuation of our research [35] we herein report the synthesis of schiff bases and 4-thiazolidinone derivatives incorporated by triazole moiety. The newly synthesized compounds were tested for the antibacterial activity against representative gram-

positive and gram-negative bacteria.



Scheme 1

2. EXPERMENTAL SECTION

CHEMISTRY

2.1 Materials and Methods

All the reagents and solvents were obtained from Sigma-Aldrich Corp. and used without further purification. The melting points of all synthesized compounds were determined in open capillary tubes and are uncorrected. The purity of all compounds was checked by silica gel TLC (Merck). IR spectra were recorded on Jasco FT-IR-4100 in KBr disc. ^{1}H NMR spectra were recorded on a Varian 400 MHz spectrometer in DMSO-d_6; chemical shifts (δ) were in ppm relative to TMS and coupling constant (*J*) were expressed in hertz (Hz) using tetrmethylsilane as internal standard. Mass spectra were recorded on a Macro mass spectrometer (Waters) by electro-spray method (ES). Elemental analysis was performed on Perkin-Elmer EAL-240 elemental analyzer.

2.2 Experimental

General procedure for the synthesis of (Z)-N-(4-(1*H*-1,2,4-triazol-1-yl)benzylidene)benzenamine (12a)

An equimolar mixture of 4-(1*H*-1,2,4-triazol-1-yl) benzaldehyde **2** (1.0gm, 5mmol) and aniline

11a (0.53ml, 5mmol) in 10ml ethanol containing few drops of sulphuric acid was refluxed for 5h. After completion of reaction (checked by TLC), the excess of solvent was removed on rotary evaporator to yield solid which was washed with petroleum ether followed by crystallization from ethanol.

The compounds (**12b-j)** were prepared by following the above procedure. Their structures have been confirmed by IR, ^{1}H NMR, mass spectra and elemental analyses.

(Z)-N-(4-(1H-1,2,4-triazol-1-yl)benzylidene)benzenamine ***(3a)****:* IR (KBr) 1604 (C-N); 1624 (C=N) cm^{-1};^{1}H NMR (400 MHz, DMSO- d_6): δ 7.25-8.44 (m, 5H, aromatic); 8.11-8.02 (dd, 4H, aromatic); 8.28 (s, 1H, imine); 8.67(s, 1H, triazole); 9.41(s, 1H, triazole); EC–MS: 249 (M^{+H}); Anal. Calcd. For $C_{15}H_{12}N_4$; C, 72.56; H, 4.87; N, 22.57; Found: C, 71.45; H, 4.12; N, 21.47.

(Z)-N-(4-(1H-1,2,4-triazol-1-yl)benzylidene)-3,4-difluorobenzenamine ***(3b):*** IR (KBr) 1600 (C-N); 1620 (C=N) cm^{-1};^{1}H NMR (400 MHz, DMSO- d_6): δ 7.153 (s, 1H, aromatic); 7.186 (d, 1H, aromatic); 7.256 (d, 1H, aromatic); 8.106-8.216 (dd, 4H, aromatic); 8.31 (s, 1H, imine); 8.51 (s,1H, triazole); 9.003 (s, 1H, triazole); EC–MS: 285 (M^{+H}); Anal. Calcd. For $C_{15}H_{10}F_2N_4$; C, 63.35; H, 3.55; F, 13.37; N, 19.71; Found: C, 62.25; H, 2.35; N, 18.67.

(Z)-N-(4-(1H-1,2,4-triazol-1-yl)benzylidene)-2,3,4-trifluorobenzenamine ***(3c):*** IR (KBr) 1610 (C-N); 1628 (C=N) cm^{-1};^{1}H NMR (400 MHz, DMSO- d_6): δ 6.7(s, 1H, aromatic); 7.3-7.68 (dd, 3H, aromatic); 8.41 (s, 1H, imine); 8.42 (s, 1H, triazole); 8.60 (s, 1H, triazole); EC–MS : 302(M^+); Anal. Calcd. For $C_{15}H_9F_3N_4$; C, 59.62; H, 3.05; F, 18.87; N, 18.54; Found: C, 60.05; H, 2.95; N, 18.71.

(Z)-N-(4-(1H-1,2,4-triazol-1-yl)benzylidene)-2,4-difluorobenzenamine ***(3d)***: IR (KBr) 1602 (C-N); 1629 (C=N) cm^{-1};^{1}H NMR (400 MHz, DMSO- d_6): δ 6.7 (m, 3H, aromatic); 7.3-7.6 (dd, 4H, aromatic); 8.42 (s, 1H, imine); 8.41 (s, 1H, triazole); 8.7 (s, 1H, triazole); EC–MS: 284(M^+); Anal. Calcd. For $C_{15}H_{10}F_2N_4$; C, 63.36; H, 3.55; F, 13.37; N, 19.71; Found: C, 63.35; H, 3.65; N,19.63.

(Z)-N-(4-(1H-1,2,4-triazol-1-yl)benzylidene)-3,4-dichlorobenzenamine ***(3e)***: IR (KBr) 1599 (C-N); 1621 (C=N) cm^{-1};^{1}H NMR (400 MHz, DMSO- d_6): δ 7.1-7.2(m, 3H, aromatic); 7.3-7.9 (dd,4H, aromatic); 8.4 (s, 1H, imine); 8.5 (s, 1H, triazole); 8.62 (s, 1H, triazole); EC–MS:

316(M^+); Anal. Calcd. For $C_{15}H_{10}Cl_2N_4$; C, 56.81; H, 3.19; Cl, 22.37; N, 17.66; Found: C, 56.85; H, 3.25; N, 17.63.

(Z)-N-(4-(1H-1,2,4-triazol-1-yl)benzylidene)-4-fluorobenzenamine ***(3f)***: IR (KBr) 1596 (C-N); 1627 (C=N) cm^{-1};^{1}H NMR (400 MHz, DMSO- d_6): δ 7.1-7.33 (m, 4H, aromatic); 7.3-7.88 (dd,4H, aromatic); 8.31 (s, 1H, imine); 8.51 (s, 1H, triazole); 8.63 (s, 1H, triazole); EC–MS: 266(M^+); Anal. Calcd. For $C_{15}H_{11}FN_4$; C, 67.66; H, 4.19; F, 7.13; N, 21.06; Found: C, 67.68; H,4.15; N, 21.16

(Z)-N-(4-(1H-1,2,4-triazol-1-yl)benzylidene)-4-nitrobenzenamine ***(3g)***: IR (KBr) 1595 (C-N); 1625 (C=N) cm^{-1};^{1}H NMR (400 MHz, DMSO- d_6): δ 7.53-8.24 (m, 5H, aromatic); 7.1-7.6 (dd,4H, aromatic); 8.41 (s, 1H, imine); 8.51 (s, 1H, triazole); 8.7(s, 1H, triazole); EC–MS: 280(M^+); Anal. Calcd. For $C_{15}H_{12}O_2N_4$; C, 61.43; H, 3.79; O, 10.91; N, 23.88; Found: C, 61.56; H, 3.65; N, 23.76

(Z)-N-(4-(1H-1,2,4-triazol-1-yl)benzylidene)-4-bromobenzenamine ***(3h)***: IR (KBr) 1598 (C-N); 1623 (C=N) cm^{-1};^{1}H NMR (400 MHz, DMSO- d_6): δ 7.21-7.42(m, 4H, aromatic); 7.3-7.63(dd, 4H, aromatic); 8.45 (s, 1H, imine); 8.41 (s, 1H, triazole); 8.7(s, 1H, triazole); EC–MS: 326(M^+); Anal. Calcd. For $C_{15}H_{11}BrN_4$; C, 55.10; H, 3.39; Br, 24.42; N, 17.12; Found: C, 55.16; H, 3.45; N, 17.27

(Z)-N-(4-(1H-1,2,4-triazol-1-yl)benzylidene)-3-nitrobenzenamine ***(3i)***: IR (KBr) 1588 (C-N); 1618 (C=N) cm^{-1};^{1}H NMR (400 MHz, DMSO- d_6): δ δ 7.5-8.54 (m, 4H, aromatic); 7.3-7.58 (dd,4H, aromatic); 8.44 (s, 1H, imine); 8.5 (s, 1H, triazole); 8.89 (s, 1H, triazole); EC–MS: 293(M^+); Anal. Calcd. For $C_{15}H_{11}O_2N_5$; C, 61.43; H, 3.78; O, 10.91; N, 23.88; Found: C, 61.46; H, 3.84; N, 23.97

(Z)-N-(4-(1H-1,2,4-triazol-1-yl)benzylidene)-4-iodobenzenamine ***(3j)***: IR (KBr) 1599 (C-N); 1619 (C=N) cm^{-1}; ^{1}H NMR (400 MHz, DMSO- d_6): δ 7.1-7.6 (m, 4H, aromatic); 7.31-7.68(dd, 4H, aromatic); 8.4 (s, 1H, imine); 8.7 (s, 1H, triazole); 9.3 (s, 1H, triazole); EC–MS: 374(M^+); Anal. Calcd. For $C_{15}H_{11}IN_4$; C, 48.15; H, 2.98; I, 33.91; N, 14.98; Found: C, 48.16; H, 2.86; N,

14.87

General procedure for the synthesis of 2-(4-(1*H*-1,2,4-triazol-1-yl)phenyl)-3-phenylthiazolidin-4-one (13a)

To a solution of imine **12a** (0.5 gm, 1.5mmol) in dry toluene was added thioglycollic acid (0.28 gm, 3mmol). The contents were refluxed for 6h until completion of the reaction. Excess solvent was removed under reduced pressure and the residue treated with saturated solution of $NaHCO_3$, extracted with ethyl acetate, dried with Na_2SO_4 and solvent distilled off. The residue on recrystallization gave 4-thiazolidinone **13a.**

The compounds **(5b-j)** were prepared by using the above procedure. Their structures have been confirmed by IR, ^{1}H NMR and Mass spectra.

2-(4-(1H-1,2,4-triazol-1-yl)phenyl)-3-phenylthiazolidin-4-one ***(5a):*** IR (KBr) 1682 (C=O); 1594 (C=N) cm^{-1}; ^{1}H NMR (400 MHz, DMSO- d_6): δ 3.893 (m, 2H, methylene protons); 6.16 (s, 1H, C_2-thiazolidinone proton); 7.157- 7.312 (m, 5H, aromatic protons); 7.462- 7.468 (d, 2H, aromatic protons); 7.612- 7.629 (d, 2H, aromatic protons); 8.077 (s, 1H, triazole proton); 8.513(s, 1H, triazole proton); EC–MS: 323 (M^{+H}); Anal. Calcd. For $C_{17}H_{14}N_4OS$; C, 63.33; H, 4.38; N, 17.38; O, 4.96; S, 9.95; Found: C, 63.53; H, 3.18; N, 17.68; S, 8.65.

2-(4-(1H-1,2,4 -triazol-1-yl)phenyl)-3-(3,4-difluorophenyl)thiazolidin -4-one ***(5b):*** IR (KBr) 1672 (C=O); 1590 (C=N) cm^{-1}; ^{1}H NMR (400 MHz, DMSO- d_6): δ 4.030 (m, 2H, methylene protons);6.26 (s, 1H, C_2-thiazolidinone proton); 6.957 (s, 1H, aromatic), 7.357- 7.531 (m, 4H, aromatic protons); 7.768 (d, 1H, aromatic protons); 7.801 (d, 1H, aromatic protons); 8.1077 (s, 1H, triazole proton); 8.613 (s, 1H, triazole proton); EC–MS: 359 (M^{+H}); Anal. Calcd. For $C_{17}H_{12}F_2N_4OS$; C, 56.98; H, 3.38; N, 15.63; S, 8.95; Found: C, 57.08; H, 2.58; N, 16.23; S, 7.55.

*2-(4-(1H-1,2,4-triazol-1-yl)phenyl)-3-(2,3,4-trifluorophenyl)thiazolidin-4-one (**5c**)*: IR (KBr) 1683 (C=O); 1591 (C=N) cm^{-1}; ^{1}H NMR (400 MHz, DMSO- d_6): δ 7.53-8.24 (m, 4H, aromatic); δ 3.95 (m, 2H, methylene protons); 5.93 (s, 1H, C_2-thiazolidinone proton); 6.7-7.2 (m, 4H, aromatic); 8.41 (s, 1H, triazole proton); 8.61 (s, 1H, triazole proton); EC–MS: 376(M^+); Anal. Calcd. For $C_{17}H_{11}F_3N_4OS$; C, 54.25; H, 2.95; N, 15.16; S, 8.52; Found: C, 57.08; H, 54.35;

N,15.23; S, 8.55.

*2-(4-(1H-1,2,4-triazol-1-yl)phenyl)-3-(2,4-difluorophenyl)thiazolidin-4-one (**5d**)*: IR (KBr) 1692 (C=O); 1597 (C=N) cm^{-1}; ^1H NMR (400 MHz, DMSO- d_6): δ 4.0 (m, 2H, methylene protons); 5.96 (s, 1H, C_2-thiazolidinone proton); 6.7-7.31 (m, 7H, aromatic protons); 8.42(s, 1H, triazole proton); 8.68 (s, 1H, triazole proton); EC–MS: 358(M^+); Anal. Calcd. For $C_{17}H_{12}F_2N_4OS$; C, 56.98; H, 3.39; F, 10.60; N, 15.63; S, 8.95; Found: C, 57.18; H, 3.37; N, 15.72; S, 8.71.

*2-(4-(1H-1,2,4-triazol-1-yl)phenyl)-3-(3,4-dichloro-2-fluorophenyl)thiazolidin-4-one (**5e**)*: IR (KBr) 1679 (C=O); 1589 (C=N) cm^{-1}; ^1H NMR (400 MHz, DMSO- d_6): δ 4.1 (m, 2H, methylene protons); 5.98 (s, 1H, C_2-thiazolidinone proton); 6.9-7.3 (m, 6H, aromatic protons); 8.47 (s, 1H, triazole proton); 8.91 (s, 1H, triazole proton); EC–MS: 408(M^+); Anal. Calcd. For$_{17}H_{11}Cl_2FN_4OS$; C, 49.89; H, 2.71; F, 4.64; N, 13.69; S, 7.83; Found: C, 49.98; H, 2.87; N, 13.72; S, 7.69

*2-(4-(1H-1,2,4-triazol-1-yl)phenyl)-3-(4-fluorophenyl)thiazolidin-4-one (**5f**)*: IR (KBr) 1687 (C=O); 1591 (C=N) cm^{-1}; ^1H NMR (400 MHz, DMSO- d_6): δ 3.92 (m, 2H, methylene protons); 6.2 (s, 1H, C_2-thiazolidinone proton); 7.0-7.31 (m, 8H, aromatic protons); 8.53 (s, 1H, triazole proton); 8.69(s, 1H, triazole proton); EC–MS: 340(M^+); Anal. Calcd. For $C_{17}H_{13}FN_4OS$; C, 59.89; H, 3.85; F, 5.58; N, 16.56; S, 9.43; Found: C, 59.78; H, 3.87; N, 16.71; S, 9.63

*2-(4-(1H-1,2,4-triazol-1-yl)phenyl)-3-(4-nitrophenyl)thiazolidin-4-one (**5g**)*: IR (KBr) 1677 (C=O); 1586 (C=N) cm^{-1}; ^1H NMR (400 MHz, DMSO- d_6): δ 3.8 (m, 2H, methylene protons); 6.1 (s, 1H, C_2-thiazolidinone proton); 7.3-8.4 (m, 8H, aromatic protons); 8.45(s, 1H, triazole proton); 8.61(s, 1H, triazole proton); EC–MS: 367(M^{+H}); Anal. Calcd. For $C_{17}H_{13}N_5O_3S$; C, 55.58; H, 3.55; N, 19.06; S, 8.73; Found: C, 55.68; H, 3.58; N, 19.17; S, 7.99

*2-(4-(1H-1,2,4-triazol-1-yl)phenyl)-3-(4-bromophenyl)thiazolidin-4-one (**5h**)*: IR (KBr) 1691 (C=O); 1588 (C=N) cm^{-1}; ^1H NMR (400 MHz, DMSO- d_6): δ 4.12 (m, 2H, methylene protons); 6.3 (s, 1H, C_2-thiazolidinone proton); 6.9-7.2 (m, 8H, aromatic protons); 8.53 (s, 1H, triazole proton); 8.81 (s, 1H, triazole proton); EC–MS: 401(M^{+H}); Anal. Calcd. For $C_{17}H_{13}BrN_4OS$; C, 50.88; H, 3.27; N, 13.96; S, 7.99; Found: C, 50.81; H, 3.28; N, 13.79; S, 7.69

2-(4-(1H-1,2,4-triazol-1-yl)phenyl)-3-(3-nitrophenyl)thiazolidin-4-one ***(5i)***: IR (KBr) 1687 (C=O); 1590 (C=N) cm^{-1}; ^1H NMR (400 MHz, DMSO- d_6): δ 4.0 (m, 2H, methylene protons); 5.96 (s, 1H, C_2-thiazolidinone proton); 7.3-8.5 (m, 8H, aromatic protons); 8.4 (s, 1H, triazole proton); 8.63 (s, 1H, triazole proton); EC–MS: 367(M^+); Anal. Calcd. For $C_{17}H_{13}N_5O_3S$; C, 55.58; H, 3.57; N, 19.06; S, 8.79; Found: C, 55.68; H, 3.58; N, 19.19; S, 8.56

2-(4-(1H-1,2,4-triazol-1-yl)phenyl)-3-(4-iodophenyl)thiazolidin-4-one ***(5j)***: IR (KBr) 1687 (C=O); 1594 (C=N) cm^{-1}; ^1H NMR (400 MHz, DMSO- d_6): δ 3.9 (m, 2H, methylene protons); 6.16 (s, 1H, C_2-thiazolidinone proton); 6.7-7.2 (m, 8H, aromatic protons); 8.45(s, 1H, triazole proton); 8.73(s, 1H, triazole proton); EC–MS: 448(M^{+H}); Anal. Calcd. For $C_{17}H_{13}IN_4OS$; C, 45.58; H, 2.92; N, 12.56; S, 7.15; Found: C, 45.67; H, 2.88; N, 12.69; S, 7.26

3. RESULT AND DISCUSSION

The synthesis of compounds Z-(4-(1*H*-1,2,4-triazol-1-yl)phenyl)-3-phenylthiazolidin-4-one 5(a-j) were accomplished in two steps as shown in **Scheme 1**. Different substituted anilines **(11a-j)** condensed with 4-(1*H*-1,2,4-triazol-1-yl) benzaldehyde **(2)** in catalytic amount of sulphuric acid and ethanol to give the schiff bases **(12a-j)**. The synthesis of 2-(4-(1*H*-1,2,4-triazol-1-yl)phenyl)-3-phenylthiazolidin-4-one derivatives **(13a-j)** from (Z)-N-(4-(1*H*-1,2,4-triazol-1- yl)benzylidene)benzenamine **(12a-j)** and thioglycollic acid (**4**) were completed in dry toluene at reflux temperature **(13a-j).** The purity of compounds was checked by TLC. Analytical and spectral data (^1H NMR, IR, Mass and elemental analysis) of the newly synthesized compounds were in full agreement with the proposed structures. The physical data of synthesized compounds is given in **Table 1**. The structure of **12a** was interpreted from spectroscopic data. IR spectra of compound **(12a)** reveals a characteristic absorption band in the region 1624 cm^{-1}corresponding to C=N stretching in schiff bases. The ^1H NMR spectra of **(12a)** exhibits two singlets at δ 8.67 and 9.40 due to triazole proton and one broad singlet at δ 8.28 assignable to imine proton. Mass spectrum was consistent with assigned structure showing (M^+) peak at 249. The IR spectra of prepared **13a** revealed the absorption band at 1682 cm^{-1} due to C=O stretching and also exhibited C=N stretching vibrations in the region 1594 cm^{-1}. In ^1H NMR spectra of compound **13a** showed multiplet at δ 3.89-4.03 due to methylene proton and one singlet at δ 6.16 due to C_2-thiazolidinone

proton. Also, two singlets at δ 8.07 and 8.51 attributed to triazole protons. Mass spectrum of 2-(4-(1*H*-1,2,4-triazol-1-yl)phenyl)-3- phenylthiazolidin-4-one showed (M^+) peak at 323.

4. BIOLOGICAL ASSAY

Some of the synthesized compounds were screened for *in vitro* antibacterial activities against gram +ve and gram –ve bacteria. In gram +ve bacteria, *Staphylococcus aureus* (*S. aureus*) and *Bacillus subtilis* (*B. subtilis*) were used and in gram –ve *Escherichia coli* (*E. coli*) and *Salmonella typhi* (*S. typhi*) were used against standard Tetracyclin and Ampicillin. The antibacterial activities were carried out on nutrient agar with standard composition and by standard procedure of paper disc method [35]. Petri dishes and necessary glasswares were sterilized in hot air oven (190 °C, 45 min). The nutrient agar and saline (0.82% NaCl) were sterilized in autoclave (121 °C, 15psi, 20min). Inoculum was prepared in sterile saline and optical density of all pathogens was adjusted to 0.10 at 625nm on Chemito Spectrscan UV 2600 Spectrophotometer which is equivalent to 0.5 McFarland standards. The nutrient agar plates were prepared by pour plate method [36]. The sensitivity of the compounds was tested by disc diffusion method (paper disc method). All the bacterial cells were cultured in nutrient plates and the compounds to be tested were dissolved in DMSO solvent and were soaked on paper discs.

The discs were placed into the plates and incubated at 37 °C for 24h. The diameter in mm of zone of inhibition around each disc was measured by scale and the observed data of antimicrobial activity of compounds and the standard drugs is given in **Table 2**. Among all the compounds screened **12a, 12c, 12e, 13a** and **13b** showed good antibacterial activity against *gram+ve* bacteria and compound **12e, 12h, 13a, 13d** and **13f** showed good activity against *gram–ve* bacteria ascomparable with that of standard drug tested. So result of all preliminary study indicated that the substituted (Z)-N-(4-(1*H*-1,2,4-triazol-1-yl)benzylidene)benzenamine **12(a-j)** and 2-(4-(1*H*-1,2,4-triazol-1-yl)phenyl)-3-phenylthiazolidin-4-one **13(a-j)** moiety represent a new class of pharmacophore for broad spectrum antimicrobial activity.

5. CONCLUSION

In summary, we have synthesized a series of triazole incorporated (Z)-N-(4-(1*H*-1,2,4-triazol-1-yl)benzylidene)benzenamine and 2-(4-(1*H*-1,2,4-triazol-1-yl)phenyl)-3-phenylthiazolidin-4-one

derivatives and their antimicrobial activities have been evaluated. All the compounds demonstrated potent inhibition against all the tested strains. The importance of such work lies in the possibility that the new compounds might be more efficacious drugs against bacteria, which could be helpful in designing more potent antibacterial agent for therapeutic use. The structure of the synthesized compound was confirmed with their spectral data.

Table 1. Physical data of the compounds **12(a-j)** and **13(a-j)**

Comp. No.	R_1	R_2	R_3	R_4	Yield (%)	M. P. (°C)
12a	H	H	H	H	80	141-143
12b	H	F	F	H	81	154-156
12c	F	F	F	H	60	126-128
12d	F	H	F	H	42	153-155
12e	F	Cl	Cl	H	82	149-151
12f	H	H	F	H	79	137-139
12g	H	H	NO_2	H	68	145-147
12h	H	H	Br	H	70	187-189
12i	H	NO_2	H	H	64	144-146
12j	H	H	I	H	65	172-174
13a	H	H	H	H	75	139-141
13b	H	F	F	H	72	150-152
13c	F	F	F	H	58	136-138
13d	F	H	F	H	44	153-157

13e	F	Cl	Cl	H	70	145-147
13f	H	H	F	H	72	138-140
13g	H	H	NO_2	H	55	155-157
13h	H	H	Br	H	69	176-178
13i	H	NO_2	H	H	61	148-150
13j	H	H	I	H	60	178-180

Table 2: Antimicrobial activity of compounds **12(a-j)** and **13(a-j)**

Entry	**Antimicrobial Activity**			
	Gram +ve		*Gram -ve*	
	Staphylococcus aureus	*Bacillus Subtilis*	*Escherichia coli*	*Salmonella typhi*
12a	21	23	20	21
12b	20	20	18	15
12c	23	21	19	18
12d	21	22	21	18
12e	25	23	22	24
12f	11	13	08	11
12g	12	10	16	09
12h	21	18	25	27
12i	10	08	11	14
12j	15	11	14	12

13a	18	21	23	27
13b	21	20	17	15
13c	18	13	11	04
13d	15	17	24	26
13e	04	06	10	05
13f	20	18	25	28
13g	06	08	09	05
13h	12	10	06	08
13i	08	11	10	12
5j	05	06	12	07
Ampicillin	**35**	**30**	**27**	**25**
Tetracyclin	**33**	**35**	**30**	**31**

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