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Original Article

SYNTHESIS, CHARACTERIZATION AND *IN VITRO* MICROBIAL EVALUATION OF REGIOISOMERS OF ALLYL PHENYL ETHERS DERIVED 1, 2, 4-TRIAZOLES

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ABSTRACT

Objective: Synthesis and antimicrobial evaluation of regioisomers of allyl phenyl ethers derived 1, 2, 4-triazoles.

Methods: A series of new 1,2,4-triazole derivatives of allyl phenyl ethers were synthesized by reacting a mixture of regio isomers 1-(3-bromo-2-methoxypropoxy)-arene and 1-(2-bromo-3-methoxypropoxy)-arene with 1,2,4-triazole in presence of K_2CO_3 and DMF at 80^{o}C in good yields. Allyl phenyl ethers 1(a-f) were synthesized by refluxing the substituted phenols with allyl bromide in the presence of K_2CO_3 and acetone in excellent yields. The newly synthesized compounds were characterized by IR, ^{1}HNMR, Mass spectral studies and elemental analysis. These compounds were also screened for their In-vitro antibacterial and antifungal activities.

Results: Allyl phenyl ethers derived 1,2,4-triazol derivatives were synthesized in good yields.

Conclusion: Preliminary results revealed that some of the synthesized compounds were showed promising antibacterial and antifungal activity.

Keywords: 1, 2, 4-triazole, Antibacterial activity and Antifungal activity.

INTRODUCTION

Nowadays research is concentrated towards the introduction of new and safe therapeutic agents of clinical importance. The heterocyclic compounds are enjoying their importance as being the center of activity. The nitrogen containing heterocyclic compounds were found in abundance in most of the medicinal compounds. The presence of three nitrogen hetero-atoms in five membered ring systems defines an interesting class of compounds, the triazoles. 1,2,4-Triazole derivatives are known to exhibit a wide range of biological activities, such as antibacterial [1–4], antifungal [4–5], analgesic [6], anticancer [7-8], antiviral [9], antitubercular [10-11], anti-inflammatory [12], anticonvulsant [13-14], antidepressant [15] and central nervous system (CNS) [16]. Therefore, the synthesis of some new 1,2,4-triazole derivatives attracts much interest in heterocyclic chemistry. Keeping in view of the above facts and our search on biologically potent molecules, we herein report the synthesis of some new allyl phenyl ethers derived 1,2,4-triazoles and their microbial activity.

MATERIALS AND METHODS

The chemicals/reagents used were purchased from sigma-aldrich chemicals (India) and Merck Chemicals (India). Reactions were monitored by pre-coated TLC (silica gel GF 254 [E.Merck]) plates. The IR spectra were recorded by using Perkin Elmer FTIR spectrometer using a thin film on KBr pellets and frequencies were expressed in cm^{-1}. The ^{1}HNMR spectra were recorded on Brucker 300 and 400MHz spectrometer using TMS as internal standard. The Chemical shifts values were reported in ppm and given in δ units. The Mass spectra were recorded by the EI process. The elemental analysis were performed on Perkin Elmer CHNS/O analyzer 2400. The synthetic route for 1, 2, 4-triazole derivatives of allyl aryl ethers was depicted in scheme 1.The substituted Phenols were used as starting materials. The reaction of substituted phenols with allyl bromide in the presence of K_2CO_3 and acetone yielded O-allyl ethers 1(a-f) in excellent yields [17-20]. The reaction of allyl aryl ethers 1(a-f) with N-Bromosuccinimide and a catalytic amount of H_2SO_4 in methanol at reflux temperature yielded a mixture of regioisomers (Markovnikov's –anti Markovnikov's products) [21-22]. Though Markovnikov's rule predicts the major formation of isomer-A, the formation of isomer-B must be allowed due to the steric hindrance of Phenolic group. The separation of regioisomers was not achieved at this stage. The mixture of regioisomers were carried to further reaction with 1,2,4-triazole in presence of K_2CO_3 and DMF to afford 1-[3-(Aryloxy)-2-methoxypropyl]-1H-1,2,4-triazole and 1-(1-(Aryloxy)-3-methoxypropan-2-yl)-1H-1,2,4-triazole [23-25]. The positional isomers of 1,2,4-triazole derivatives were separated by NP-HPLC method using a gradient mixture of n-hexane and isopropanol as eluent.

General procedure for O-allylation

To a suspension of substituted phenols (1.0 equiv) and K_2CO_3 (2.5 equiv) in acetone (10 mL) was added allylbromide (1.05 equiv) and refluxed for 12h. After completion of the reaction, the suspension was filtered. The solvent was evaporated to dryness, quenched with water (10 mL) and extracted with ethyl acetate (3X10 mL). The combined organic layer thus obtained was washed with brine, dried over anhydrous Na_2SO_4 and evaporated in reduced pressure to afford the crude. The crude was purified by column chromatography on silica gel (60-120 mesh) using (10-15%) ethyl acetate-hexane mixture as eluent to afford the pure products **1(a-f).** The spectral data of O-allyl ethers **1**(**a-f)** were matched with literature values [18].

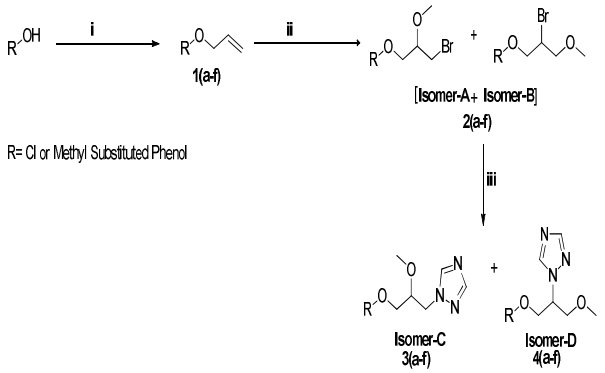
General procedure for synthesis of 1-(3-bromo-2-methoxy propoxy)-arene and 1-(2-bromo-3-methoxypropoxy)-arene 2(a-f)

To a stirred solution of **1(a-f)** (5.93 mmol) in methanol (10 mL) was added N-Bromosuccinamide (5.93 mmol) followed by catalytic amount of H_2SO_4 at 0^{0}C. Then reaction mass was refluxed for 2h. The reaction was monitored by TLC. Then, the solvent was evaporated under reduced pressure to afford crude oil. The crude was diluted with ice cold water (20 mL) and extracted with ethyl acetate (3X20 mL). The combined extracts were washed with saturated $NaHCO_3$ solution, brine, dried over Na_2SO_4 and evaporated under reduced pressure to afford a mixture of positional isomers **2(a-f**) as oils in good yields. Since these two regioisomers are not separable by Column Chromatography, the crude was used in the next step without further purification.

General procedure for synthesis of 1-[3-(aryloxy)-2-methoxy propyl]-1H-1,2,4-triazole 3(a-f) and 1-[1-(aryloxy)-3-methoxy propan-2-yl]-1H-1,2,4-triazole 4(a-f)

To a stirred solution of **2**(**a-f**) (1.78 mmol) in DMF (5 mL), was added 1,2,4-triazole (1.78 mmol) and K_2CO_3 (3.57 mmol). The reaction was stirred at 80^{o}C for 12 h. The reaction was monitored by

TLC. Then, the reaction mixture was diluted with ice cold water (10 mL) and extracted with ethyl acetate (3X10 mL). The combined extracts were washed with brine, dried over anhydrous Na_2SO_4 and concentrated under reduced pressure to afford a mixture of regioisomers (Isomer-C and Isomer-D). The regioisomers were separated by NP-Preparative HPLC method using a gradient mixture of (20-25%) 2-propanol in n-hexane as an eluent.



i) K_2CO_3 / Acetone / Allylbromide / Reflux / 12h ii) NBS / H_2SO_4/ Methanol / Reflux / 2h iii) K_2CO_3 /DMF/ 80°C / 12h

Scheme 1: Synthetic route for allyl phenyl ethers derived 1, 2, 4-triazole derivatives 3(a-f) and 4(a-f).

Spectral data

2,4-dichlorophenyl prop-2-en-1-yl ether, 1a [18]: Yield:62%; Yellow oil: BP: 116-118/8 (°C/Torr): ^{1}H NMR ($CDCl_3$, 300MHz): δ 7.4 (s, 1H), 7.20-7.18 (m, 1H), 6.9-6.8 (m, 1H), 6.2-6.1 (m, 1H), 5.5-5.4 (m, 1H), δ 5.3-5.2 (m, 1H), 4.6-4.5 (m, 2H). EI-MS (m/z): 203 ($M+H^+$)

3,4-dichlorophenyl prop-2-en-1-yl ether, 1b [18]: Yield:75%; Yellow oil: BP: 123-124/10 (°C/Torr): ^{1}H NMR ($CDCl_3$, 300MHz): δ 7.35-7.30 (m, 1H), 7.05 (s, 1H), 6.8-6.75 (m, 1H), 6.05-5.95 (m, 1H), 5.42-5.38 (m, 1H), 5.31-5.29 (m, 1H), 4.51-4.50 (m, 2H); EI-MS (m/z): 203 ($M+H^+$)

2,6-dichlorophenyl prop-2-en-1-yl ether, 1c [18]: Yield: 78%; Oil: BP: 123-124/18 (°C/Torr): ^{1}H NMR ($CDCl_3$, 300MHz): δ 7.4-7.3 (m, 2H), 7.1-6.98 (m, 1H), 6.2-6.1 (m, 1H), 5.5-5.4 (m, 1H), 5.3-5.25 (m, 1H), 4.60-4.58 (m, 2H); EI-MS (m/z): 203 ($M+H^+$)

3-chlorophenyl prop-2-en-1-yl ether, 1d [18-19]: Yield: 66%; Oil: BP: 98-99/11 (°C/Torr): ^{1}H NMR ($CDCl_3$, 300MHz): δ 7.3-7.2 (m, 1H), 7.0-6.98 (m, 1H), 6.9 (s, 1H), 6.81-6.79 (m, 1H), 6.2-6.1 (m, 1H), 5.5-5.4 (m, 1H), 5.3-5.25 (m, 1H), 4.4-4.38 (d, 2H); EI-MS (m/z): 169 ($M+H^+$)

4-chlorophenyl prop-2-en-1-yl ether, 1e [18]: Yield: 70%; Oil: BP**:** 97-98/10 **(**°C/Torr): ^{1}H NMR ($CDCl_3$, 300MHz**):** δ 7.3-7.2 (m, 2H), 6.9-6.8 (m, 2H), 6.1-5.98 (m, 1H), 5.42-5.25 (m, 2H), 4.57-4.50 (m, 2H); EI-MS (m/z): 169 ($M+H^+$)

3,5-dimethylphenyl prop-2-en-1-yl ether, 1f [18]: Yield: 70%; Oil: BP: 98-99/9(°C/Torr): ^{1}H NMR ($CDCl_3$, 300MHz): δ 6.6 (s, 1H), 6.59 (s, 2H), 6.18-6.0 (m, 1H), 5.41-5.38 (m, 1H), 5.3-5.2 (m, 1H), 4.57-4.50 (m, 2H), 2.3 (s, 6H); EI-MS (m/z): 163 ($M+H^+$)

1-(3-bromo -2-methoxypropoxy)-2,4-dichlorobenzene and 1-(2-bromo-3-methoxypropoxy)-2,4-dichlorobenzene, 2a: Oil; Yield 76%; ^{1}H NMR ($CDCl_3$, 300MHz): δ 7.39 (s, 1H), 7.20-7.19 (m, 1H), 6.91-6.85 (m, 1H), 4.39-4.22 (m, 2H), 4.2-4.1(m, 1H), 3.9-3.8 (m, 2H), 3.7-3.6 (m,1H), 3.55 (s, 1H), 3.43(s, 2H); EI-MS (m/z): 313 ($M+H^+$)

4-(3-bromo-2-methoxypropoxy)-1,2-dichlorobenzene and 4-(2-bromo-3-methoxypropoxy)-1,2-dichlorobenzene, 2b: Oil; Yield 73%; ^{1}H NMR ($CDCl_3$, 300MHz): δ 7.36-7.30 (m, 1H), 7.1(s, 1H), 6.80-6.76 (m, 1H), 4.3-4.2 (m, 2H), 4.1-4.05 (m, 1H), 3.8-3.7 (m, 2H), 3.60-3.56 (m, 1H), 3.54 (s, 1H), 3.43 (s, 2H); EI-MS (m/z): 313 ($M+H^+$)

2-(3-bromo-2-methoxypropoxy)-1,3-dichlorobenzene and 2-(2-bromo-3-methoxypropoxy)-1,3-dichlorobenzene, 2c: Oil; Yield 78%;^{1}H NMR ($CDCl_3$, 300MHz): δ 7.30-7.31(m, 2H), 7.1-7.0 (m, 1H), 4.4-4.2 (m, 2H), 4.1-4.05 (m, 1H), 3.82-3.57 (m, 6H), 3.56 (s, 1H), 3.41(s, 2H); EI-MS (m/z): 313 ($M+H^+$)

Table 1: It Represents molecular formulas and yields of final compounds.

S. No	R/(Ar-OH)	Formula of Isomer-C 3(a-f)	Formula of Isomer-D 4(a-f)	Yield (%)
1	2,4-Cl	3a/$C_{12}H_{13}Cl_2N_3O_2$	4a/$C_{12}H_{13}Cl_2N_3O_2$	75
2	3,4-Cl	3b/$C_{12}H_{13}Cl_2N_3O_2$	4b/$C_{12}H_{13}Cl_2N_3O_2$	73
3	2,6-Cl	3c/$C_{12}H_{13}Cl_2N_3O_2$	4c/$C_{12}H_{13}Cl_2N_3O_2$	80
4	3-Cl	3d/$C_{12}H_{14}ClN_3O_2$	4d /$C_{12}H_{14}ClN_3O_2$	78
5	4-Cl	3e/$C_{12}H_{14}ClN_3O_2$	4e/$C_{12}H_{14}ClN_3O_2$	85
6	3,5-CH_3	3f/$C_{14}H_{19}N_3O_2$	4f/$C_{14}H_{19}N_3O_2$	82

1-(3-bromo-2-methoxypropoxy)-3-chlorobenzene and 1-(2-bromo-3-methoxypropoxy)-3-chlorobenzene, 2d: Oil; Yield 71%**;** ^{1}H NMR ($CDCl_3$, 400MHz): δ 7.30-7.20 (m, 1H), 7.0-6.9 (m, 1H), 6.9 (s,1H), 6.80-6.78 (m, 1H), 4.4-4.3 (m, 2H), 4.2-4.1 (m, 1H), 3.9-3.8 (m, 2H), 3.7-3.6 (m, 1H), 3.58 (s, 1H), 3.41(s, 2H); EI-MS (m/z): 279 ($M+H^+$)

1-(3-bromo-2-methoxypropoxy)-4-chlorobenzene and 1-(2-bromo-3-methoxypropoxy)-4-chlorobenzene, 2e: Oil; Yield 72%**;** ^{1}H NMR ($CDCl_3$, 300MHz): δ 7.25 (m, 2H), 6.85 (m, 2H), 4.3-4.2 (m, 2H), 4.1-4.05 (m, 1H), 3.8-3.6 (m, 3H), 3.56 (s, 1H), 3.41(s, 2H); EI-MS (m/z): 279 ($M+H^+$)

1-(3-bromo-2-methoxypropoxy)-3,5-dimethylbenzene and 1-(2-bromo-3-methoxypropoxy) -3,5-dimethylbenzene, 2f: Oil; Yield 75%**;** ^{1}H NMR ($CDCl_3$, 400MHz): δ 6.75 (s, 3H), 4.4-4.3 (m, 2H), 4.2-4.1 (m, 1H), 3.9-3.8(m, 2H), 3.7-3.6 (m, 1H), 3.56 (s, 1H), 3.41(s, 2H), 2.3 (s, 6H); EI-MS (m/z): 273 ($M+H^+$)

1-[3-(2,4-dichlorophenoxy)-2-methoxypropyl]-1H-1,2,4-triazole, 3a: Semisolid; FT-IR(KBr, cm^{-1}): 3053, 2931, 1503, 1482, 1288, 1132, 1105,1012,746; ^{1}HNMR ($CDCl_3$, 300MHz): δ 8.4 (s, 1H), 8.15 (s, 1H), 7.4 (s, 1H), 7.22-7.18 (m, 1H), 6.86-6.82 (m, 1H), 4.62-4.56 (m, 1H), 4.5-4.44 (m, 1H), 4.1-3.98 (m, 3H), 3.43 (s, 3H); EI-MS (m/z): 302 ($M+H^+$, 100%), 304 (63%). Anal.Cald.for $C_{12}H_{13}Cl_2N_3O_2$: C, 47.70; H, 4.34; Cl, 23.47; N, 13.91; O, 10.59; Found: C, 47.71; H, 4.33; Cl, 23.48; N, 13.89; O, 10.58

1-[1-(2,4-dichlorophenoxy)-3-methoxypropan-2-yl]-1H-1,2,4-triazole, 4a: Semisolid, FT-IR (KBr, cm^{-1}): 3053, 2931, 1503, 1482, 1288, 1132, 1105, 1012, 746; ^{1}H NMR ($CDCl_3$, 300MHz): δ 8.7 (s, 1H), 8.15 (s, 1H), 7.35(s, 1H), 7.2-7.15 (m, 1H), 6.85-6.80 (m, 1H), 5.0-4.95 (m, 1H), 4.45-4.38 (m, 2H), 3.98-3.92 (m, 2H), 3.4 (s, 3H); EI-MS (m/z): 302 ($M+H^+$, 100%), 304 (63%); Anal.Cald.for $C_{12}H_{13}Cl_2N_3O_2$: C, 47.70; H, 4.34; Cl, 23.47; N, 13.91; O, 10.59; Found: C, 47.71; H, 4.35; Cl, 23.46; N, 13.90; O, 10.60

1-[3-(3,4-dichlorophenoxy)-2-methoxypropyl]-1H-1,2,4-triazole, 3b: Semisolid: FT-IR (KBr, cm^{-1}): 3053, 2931, 1503, 1482, 1288, 1132, 1105, 1012, 746; ^{1}H NMR ($CDCl_3$, 300MHz): δ 8.18 (s, 1H), 7.98 (s, 1H), 7.38-7.36 (m, 1H), 7.05 (s, 1H), 6.8-6.78 (m, 1H), 4.5-4.4 (m, 1H), 4.4-4.3 (m, 1H), 4.1-3.9 (m, 3H), 3.4 (s, 3H); EI-MS (m/z): 302 ($M+H^+$, 100%), 304 (63%); Anal.Cald.for $C_{12}H_{13}Cl_2N_3O_2$: C, 47.70; H, 4.34; Cl, 23.47; N, 13.91; O, 10.59; Found: C, 47.71; H, 4.34; Cl, 23.46; N, 13.90; O, 10.58

1-[1-(3,4-dichlorophenoxy)-3-methoxypropan-2-yl]-1H-1,2,4-triazole, 4b: Viscous gum: FT-IR (KBr, cm^{-1}): 3053, 2931, 1503, 1482, 1288, 1132, 1105, 1012, 746; ^1H NMR ($CDCl_3$, 300MHz): δ 8.25 (s, 1H), 7.98 (s, 1H), 7.38-7.22 (m, 1H), 7.0 (s, 1H), 6.8-6.7 (m, 1H), 4.9-4.8 (m, 1H), 4.4-4.3 (m, 2H), 3.9-3.8 (m, 2H), 3.4 (s, 3H); EI-MS (m/z): 302 ($M+H^+$, 100%), 304 (63%); Anal.Cald.for $C_{12}H_{13}Cl_2N_3O_2$: C, 47.70; H, 4.34; Cl, 23.47; N, 13.91; O, 10.59; Found: C, 47.70; H, 4.35; Cl, 23.49; N, 13.92; O, 10.60

1-[3-(2,6-dichlorophenoxy)-2-methoxypropyl]-1H-1,2,4-triazole, 3c: Semisolid; FT-IR(KBr, cm^{-1}): 3053, 2931, 1503, 1482, 1288, 1132, 1105, 1012, 746; ^1H NMR ($CDCl_3$, 300MHz): δ 8.21 (s, 1H), 7.98 (s, 1H), 7.38-7.1 (m, 2H), 7.10-7.05 (m, 1H), 4.70-4.61 (m, 1H), 4.6-4.5 (m, 1H), 4.3-4.2 (m, 1H), 4.1-3.9 (m, 2H), 3.4 (s, 3H); EI-MS (m/z): 302 ($M+H^+$,100%), 304 (63%); Anal.Cald.for $C_{12}H_{13}Cl_2N_3O_2$: C, 47.70; H, 4.34; Cl, 23.47; N, 13.91; O, 10.59; Found: C, 47.70; H, 4.33; Cl, 23.48; N, 13.92; O, 10.58.

1-[1-(2,6-dichlorophenoxy)-3-methoxypropan-2-yl]-1H-1,2,4-triazole, 4c: Gum; FT-IR(KBr, cm^{-1}): 3053, 2931, 1503, 1482, 1288, 1132, 1105, 1013, 751; ^1H NMR ($CDCl_3$, 300MHz): δ 8.5 (s, 1H), 7.98 (s, 1H), 7.38-7.22 (m, 2H), 7.1-7.0 (m, 1H), 4.9-4.8 (m, 1H), 4.4-4.3 (m, 2H), 3.9-3.8 (m, 2H), 3.4 (s, 3H); EI-MS (m/z): 302 ($M+H^+$,100%), 304 (63%); Anal.Cald.for $C_{12}H_{13}Cl_2N_3O_2$: C, 47.70; H, 4.34; Cl, 23.47; N, 13.91; O, 10.59; Found: C, 47.72; H, 4.36; Cl, 23.49; N, 13.93; O, 10.62.

1-[3-(3-chlorophenoxy)-2-methoxypropyl]-1H-1,2,4-triazole, 3d: Semisolid; FT-IR (KBr, cm^{-1}): 3051, 2930, 1504, 1488, 1282, 1133, 1106, 1012, 741; ^1H NMR ($CDCl_3$, 300MHz): δ 8.19 (s, 1H), 7.98 (s, 1H), 7.3-7.2 (m, 1H), 7.0-6.98 (m, 1H), 6.9 (s, 1H), 6.81-6.79 (m, 1H), 4.5-4.3 (m, 2H), 4.1-3.9 (m, 3H), 3.4 (s, 3H); EI-MS (m/z): 268 ($M+H^+$, 100%), 270 (32%); Anal.Cald.for: $C_{12}H_{14}ClN_3O_2$: C, 53.84; H, 5.27; Cl, 13.24; N, 15.70; O, 11.95; Found; C, 53.85; H, 5.28; Cl, 13.25; N, 15.72; O, 11.96

1-[1-(3-chlorophenoxy)-3-methoxypropan-2-yl]-1H-1,2,4-triazole, 4d: Gum; FT-IR (KBr, cm^{-1}): 3051, 2930, 1504, 1488, 1282, 1133, 1106, 1012, 741; ^1H NMR ($CDCl_3$, 300MHz): δ 8.5 (s, 1H), 7.98 (s, 1H), 7.3-7.2 (m, 1H), 7.0-6.98 (m, 1H), 6.9 (s, 1H), 6.81-6.79 (m, 1H), 4.9-4.8 (m, 1H), 4.4-4.3 (m, 2H), 3.92-3.8 (m, 2H), 3.39 (s, 3H); EI-MS (m/z): 268 ($M+H^+$, 100%), 270 (32%); Anal.Cald.for: $C_{12}H_{14}ClN_3O_2$: C, 53.84; H, 5.27; Cl, 13.24; N, 15.70; O, 11.95; Found; C, 53.86; H, 5.29; Cl, 13.23; N, 15.73; O, 11.97

1-[3-(4-chlorophenoxy)-2-methoxypropyl]-1H-1,2,4-triazole, 3e: Semisolid; FT-IR (KBr, cm^{-1}): 3051, 2930, 1504, 1488, 1282, 1133, 1106, 1012, 741; ^1H NMR ($CDCl_3$, 300MHz): δ 8.19 (s, 1H), 7.99 (s, 1H), 7.3-7.2 (m, 2H), 6.9-6.8 (m, 2H), 4.5-4.3(m, 2H), 4.1-3.9 (m, 3H), 3.39 (s, 3H); EI-MS (m/z): 268 ($M+H^+$, 100%), 270 (32%); Anal.Cald.for: $C_{12}H_{14}ClN_3O_2$: C, 53.84; H, 5.27; Cl, 13.24; N, 15.70; O, 11.95; Found; C, 53.85; H, 5.28; Cl, 13.25; N, 15.72; O, 11.96

1-[1-(4-chlorophenoxy)-3-methoxypropan-2-yl]-1H-1,2,4-triazole, 4e: Gum; FT-IR (KBr, cm^{-1}): 3051, 2930, 1504, 1488, 1282, 1133, 1106, 1012, 741; ^1H NMR ($CDCl_3$, 400MHz**):** δ 8.3 (s, 1H), 8.0 (s, 1H), 7.3-7.2 (m, 2H), 6.9-6.8 (m, 2H), 4.9-4.8 (m, 1H), 4.4-4.3 (m, 2H), 3.9-3.8 (m, 2H), 3.39 (s, 3H); EI-MS (m/z): 268 ($M+H^+$, 100%), 270 (32%); Anal.Cald.for: $C_{12}H_{14}ClN_3O_2$: C, 53.84; H, 5.27; Cl, 13.24; N, 15.70; O, 11.95; Found; C, 53.87; H, 5.28; Cl, 13.23; N, 15.71; O, 11.96

1-[3-(3,5-dimethylphenoxy)-2-methoxypropyl]-1H-1,2,4-triazole, 3f: Semisolid; FT-IR (KBr, cm^{-1}): 3056, 2929, 1506, 1486, 1278, 1136, 1107, 1013, 745; ^1H NMR (DMSO, 300MHz): δ 8.5 (s, 1H), 7.98 (s, 1H), 6.58 (s, 3H), 4.5-4.35 (m, 2H), 4.1-4.0 (m, 1H), 4.0-3.8 (m, 2H), 3.3 (s, 3H), 2.22 (s, 6H); EI-MS (m/z): 262 ($M+H^+$, 100%); Anal.Cald.for: $C_{14}H_{19}N_3O_2$; C, 64.35; H, 7.33; N, 16.08; O, 12.25; Found; C, 64.36; H, 7.35; N, 16.07; O, 12.26

1-[1-(3,5-dimethylphenoxy)-3-methoxypropan-2-yl]-1H-1,2,4-triazole, 4f: Semisolid; FT-IR (KBr, cm^{-1}): 3055, 2930, 1504, 1488, 1282, 1133, 1106, 1012, 745; ^1H NMR (DMSO**,** 300MHz): δ 8.3 (s, 1H), 8.0 (s, 1H), 6.78 (s, 3H), 4.9-4.8 (m, 1H), 4.4-4.3 (m, 2H), 3.9-3.8 (m, 2H), 3.3 (s, 3H), 2.22 (s, 6H); EI-MS (m/z): 262 ($M+H^+$, 100%); Anal.Cald.for: $C_{14}H_{19}N_3O_2$; C, 64.35; H, 7.33; N, 16.08; O, 12.25; Found; C, 64.37; H, 7.35; N, 16.08; O, 12.28

RESULTS AND DISCUSSION

Antibacterial activity

The antibacterial activity of all the synthesized compounds were examined against different Gram-positive (Bacillus subtilis and Staphylococcus aureus) and Gram-negative (Escherichia coli and Salmonella typhi) organisms by measuring zone of inhibition. The antibacterial activity was performed by Agar diffusion method at the concentration level of 100µg/ml. Ciprofloxacin (A) was used as standard drug at a concentration of 100 µg/ml. Nutrient agar was used as culture media and DMSO was used as solvent control. The results of the antibacterial activity are shown in **Table 2.**

Antifungal activity

The antifungal activity of all the synthesized compounds were examined against Aspergillus niger and Candida albicans by measuring zone of inhibition. The antifungal activity was performed by Agar diffusion method at the concentration level of 100µg/ml. Ketoconazole (B) was used as standard drug at a concentration of 100µg/ml. Sabouraud dextrose agar was used as culture media and DMSO was used as solvent control. The results of the antifungal activity are shown in **Table 2.**

Table 2: Zone of inhibition (mm) data of synthesized compounds

S. No.	Compound	B. subtilis	S. aureus	E. coli	S. typhi	A. niger	C. albicans
1	3a	13	12	14	12	15	13
2	3b	14	13	14	11	14	12
3	3c	14	13	15	12	15	13
4	3d	11	10	12	11	10	09
5	3e	12	11	10	11	10	08
6	3f	09	08	08	07	09	07
7	4a	14	13	15	12	15	14
8	4b	13	12	14	13	14	13
9	4c	14	13	15	14	15	13
10	4d	11	10	10	11	12	11
11	4e	10	11	11	12	12	11
12	4f	08	07	07	06	08	09
13	A	16	15	17	16	-	-
14	B	-	-	-	-	18	16

A=Ciprofloxacin and **B**=Ketoconazole.

CONCLUSION

It would be seen from **Table 2** that the compound **3(a-c)** and **4(a-c)** exhibit significant antibacterial activity against both Gram negative and Gram Positive organisms and the rest of the compounds show poor antibacterial activity against Gram negative and Gram Positive organisms. **Table 2** also indicates that the significant antifungal activity is exhibited by the compounds **3(a-c)** and **4(a-c)** and the

rest of the compounds showed no significant antifungal activity against both fungi. It clearly indicates that the compounds **3(a-c)** and **4(a-c**) with dichloro substitution exhibited highest microbial activity among all the rest of the compounds.

CONFLICT OF INTERESTS

Declared None

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