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Research Article

Synthesis and Evaluation of Antibacterial and Antifungal Profile of some Newer Isoxazole Analogous

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ABSTRACT

A new series of 5-(chloromethyl)-3- (substituted phenyl) isoxazole was synthesized in the presence of sodium hydroxide, substituted aromatic aldehyde (1) combine to produce oxime (2), which are then cyclized in the presence of dichloromethane, triethylamine, and N-chlorosuccinimide to develop Compound (3) and on chlorination onward 5-(chloromethyl)-3- (substituted phenyl) isoxazole (4). By employing IR, ^{1}H-NMR, mass spectral, and elemental analyses, the chemical compositions of the generated molecules were verified. The developed molecules were tested for their antibacterial properties (*E. coli* & *S. aureus*), antifungal (*A. niger* and *C. albicans*). The new compound demonstrated considerable antibacterial and antifungal activity on level with standards set.

Introduction

Isoxazoles have a vital function in medicinal chemistry among the broad spectrum of heterocycles that had already been found to create pharmacologically relevant compounds.[1] Pharmaceuticals, agronomy, and synthetic fields all rely heavily on heterocyclic chemicals. Numerous naturally occurring chemicals include heterocyclic moieties, proving their importance in the physiological environment. These include proteins, carbs, multivitamins, co-enzymes, plasma protein, plant carotene, alkaloids, glycosides, lignin, and resins.[2] The importance and necessity of heterocyclic chemistry are hence constant. Due to its role as link between the chemical and biological sciences, heterocycles have drawn attention.[3] In several locations throughout the world, research on these compounds is now in its infancy. The evolution of bacterial resistance to current medications is a serious worry in antibacterial therapies despite the availability of powerful antimicrobials for managing diseases, necessitating ongoing exploration towards alternative types of bactericidal.[4]

Isoxazoles were seen in a range of beneficial effects, many of which are antiapoptotic,[5] antibacterial,[6] anticonvulsant,[7] antifungal,[8] antihypertensive,[9] antiprotozoal,[10] antiproliferative,[11] anti oxidant,[12] antipsychotic,[13] anti inflammatory,[14] antimicrobial,[15] analgesic,[16] antimycobacterial,[17] anti-HIV,[18] anti cancer,[19] antiviral,[20] adrenergic,[21] cytotoxic,[22] herbicidal.[23] According to a survey, the isoxazole moiety is found in several medications, including acivicin (antitumor), cloxacillin, floxacillin, and dicloxacillin (antibiotics), dimethazone (herbicide), drazoxolon (fungicide), isocarboxazid (antidepressant and anxiolytic), and valdecoxib (antiinflammatory).[24]

Due to its numerous chemical reactivities, synthetic accessibility, and biological activities, such as GABA agonist, antimicrobial, apoptotic, cytotoxic, and nicotinic receptor modulators, 3,5-disubstituted isoxazoles were

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chosen among other molecular frameworks as a potential scaffold. In order to create a novel specific molecular library that is similar to a medication, we explored the creation of 3,5-disubstituted isoxazoles as a crucial skeleton in conjunction with favored substructures.[25] Although several isoxazole synthesis procedures employ heterogeneous and homogeneous catalysts, it is widely acknowledged that 1,3-dipolar cycloaddition offers a more convenient way to produce a variety of isoxazole derivatives.[26] Numerous distinctive 3,5-di-substituted isoxazoles were created as a result of convincing 1,3-Dipolar cycloadditions of in-situ synthesized nitrile oxides by alkynes or alkene in the presence of base.[27] Furthermore, in recent decades, the microwave approach has been widely used in organic synthesis because it can quickly attain the process temperature, decrease isomer production, and shorten reaction times while increasing yield.[28] Reduced utilization of the catalyst plus organic base was important to achieve strong regioselectivity and high yield while also decreasing cost and protecting the environment.[28] A green, straightforward, practical, and effective responses technique was developed in this work. Here in some 5-(chloromethyl)-3- (substituted phenyl) isoxazole were synthesized through (scheme) from starting substituted benzaldehyde further converted to substituted aromatic oxime and then (3-(substituted phenyl) isoxazole-5yl) methanol and further through chlorination of the compound the desired formulation was achieved.

Materials And Methods

Chemistry

Compounds 4 were created using the synthetic process depicted in Scheme 1. In present work some newer 5-(chloromethyl)-3- (substituted phenyl) isoxazole derivatives (4) were in the presence of sodium hydroxide, substituted aromatic aldehydes (1) combine to produce oximes (2), which are then cyclized in the presence of dichloromethane, triethylamine, & N-chlorosuccinimide to develop (3-(substituted phenyl)isoxazol-5-yl)methanol(3)[25] and on chlorination onward 5-(chloromethyl)-3-(substituted phenyl) isoxazole derivatives 4(a-j) were synthesized. TLC was used to observe the reactions, and the resulting compounds were refined by recrystallizing them from different solvents while noting the range of their melting points.

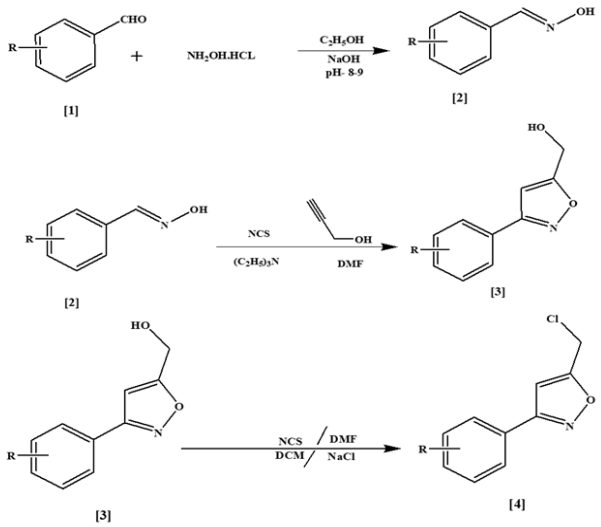
The synthesized compounds 4(a-j) were characterized by FTIR, mass Spectroscopy, ^{1}H-NMR and elemental analysis. The freshly synthesised compounds' FTIR spectra revealed the presence of distinctive absorption peaks in the region 3700–3684 cm^{-1} for -OH str., 3077–3010 cm^{-1} for aromatic C-H str., 1575–1460 cm^{-1} for C=C str., 850–550 cm^{-1} for C-Cl str., 1290–1100 cm^{-1} for C-O-C str., ~852 cm^{-1} for C-N str. of aromatic NO_2 group, and 1175-1000 cm^{-1} for aromatic C-Br str. Similarly, the ^{1}H-NMR and mass spectrum was also analyzed for the characterization of the synthesized compounds.

Experimental

On silica gel G coated glass plates, TLC was used to investigate the compounds after the melting point ranges of the experimental compounds were established using the open capillary method and melting point apparatus. On 20x5 cm TLC plates that had been well cleaned, an adsorbent silica gel G slurry was placed using a standard spreader to a thickness of around 0.3 mm. The spots were seen by exposing them to iodine fumes when the solvent system reached 3/4 of the plate length, and Rf readings were computed. Using an FTIR-8400S spectrophotometer, the IR spectra of chemicals in KBr pellets were observed (SHIMADZU). ^{k1}H-NMRsspectra of the molecules were recorded on Bruker NMR spectrophotometer indDMSO-d6 using TMS as internal standard. (Chemical Shift measured in δ ppm) and mass spectrums were observed by MS (ESI) (SHIMADZU-2010 AT, software class VP). Elemental analyses were performed on a Carlo Erba 106 and Perkin-Elmer model 240 analyzers.

General Procedure for the Synthesis of 3-(substituted phenyl isoxazol-5-yl)methanol

Substituted benzaldehyde (20 mmol) was mixed in 50 mL ethanol, and a solution of hydroxylamine was made by diluting it in 10 mL distilled water; its pH was set to 8-9 using a solution of NaOH (6 mol/mL). The prepared product was then dropped-by-drop added to the substituted benzaldehyde and ethanol solution, and the resulting mixture was refluxed until TLC confirmed the reaction's completion. After being submerged in freezing water to precipitate crystals, the resultant slurry was



Scheme 1: Synthesis of 5-(chloromethyl)-3- (substituted phenyl) isoxazole

filtered to provide 80–90% substituted benzaldoxime. The solution of benzaldehyde oxime (20 mmol) and N, N-dimethylformamide (15 mL) was prepared under the glacial bath conditions and N-chlorosuccinimide (24 mmol) was added and the resulting mixture was radiated by ultrasound until the TLC indicates the reaction end. Subsequently, propargyl alcohol (30 mmol) and triethylamine (20mmol) were added to the mixture. Following the completion of the reaction, the resultant liquid was dumped into freezing water to produce crude product. The unrefined product was then purified using column chromatography (silica gel, 200–300 mesh) to generate (3-(substituted phenyl) isoxazole-5yl) methanol with 55–89% yield.

General Procedure for the Synthesis of 5-(chloromethyl)-3-(substituted phenyl) isoxazole

Prior to adding the synthesized isoxazole (2 mmol) mixed with dichloromethane (5 mL), a solution of N-chlorosuccinimide (2 mmol) and N,N-dimethylformamide (1-mL) was first created under magnetic vortexing until the first material was consumed (about 10 minutes). The reacting mixture was stirred at room temperature for 4 to 5 hours. The product was then separated with ethyl acetate after 30 mL of saturated NaCl solution was added (3 x 30 mL). Anhydrous magnesium sulphate was used to dry the organic phase while the solvent was afterwards vaporized under reduced pressure. Crystallization with hot ethanol was used to purify the product. With a yield of 65%, the product was achieved.

- 5-(chloromethyl)-3-(4-Butylphenyl) isoxazole (4a) yield=48%, mp-182-183.5°C FTIR (KBr, cm^{-1}): - 2975,2962 cm^{-1}(C-H stretching), 1540,1498,1458 cm^{-1} (Aromatic C=C stretching), 1538 cm^{-1}(Aromatic N-O stretching), 690 cm^{-1}(C-Cl stretching)., ^{1}H-NMR ($CDCl_3$): δ- 0.99 (t,3H), 1.45 – 1.35 (sextet, 2H), 1.63 – 1.53 (m, 2H), 2.79 (td, 2H), 4.78 (d, 2H), 6.79 (t, 1H), 7.30 – 7.23 (q, 2H), 7.44 – 7.37 (m, 1H), 7.47 (dt, 1H). , MS (ESI) m/z: 249.092[M+], Anal. Calcd. for $C_{14}H_{16}ClNO$: C=67.33%; H=6.46%; N=5.61%; Cl=14.19%; O= 6.41%. found: C= 67.2%; H=6.32%; N= 5.40%; Cl= 14.03%; O= 6.29%.
- 5-(chloromethyl)-3-(4-Bromo phenyl) isoxazole (4b) yield=62%, mp-197- 199.5°C, FTIR (KBr, cm^{-1}): - 3050, 2985 cm^{-1} (C-H stretching), 1601,1528,1438 cm^{-1} (Aromatic C=C stretching), 1537 cm^{-1}(Aromatic N-O stretching), 1120 cm^{-1}(Aromatic C-Br stretching), 700 cm^{-1}(C-Cl stretching). , ^{1}H-NMR ($CDCl_3$): δ-4.78 (d, 2H), 6.79 (d, 1H), 7.59 (s, 4H). , MS (ESI) m/z: 270.940 [M+], Anal. Calcd. for $C_{10}H_7BrClNO$: C= 44.07%; H= 2.59%; N= 5.14%; Cl= 13.01%; Br= 29.32%; O= 5.87% found: C= 43.98%; H= 2.33%; N= 5.02%; Cl= 13%; Br= 29.12%; O= 5.79%.
- 5-(chloromethyl)-3-(4-Chloro phenyl) isoxazole (4c) yield= 68%, mp-167-169°C, FTIR (KBr, cm^{-1}): - 3039,2976cm^{-1} (C-H stretching), 1595,1510,1473 cm^{-1} (Aromatic C=C stretching), 1540 cm^{-1} (Aromatic N-O stretching), 1094 cm^{-1} (Aromatic C-Cl stretching), 698 cm^{-1} (C-Cl stretching). ^{1}H-NMR ($CDCl_3$): δ- 4.78 (d, 2H), 6.79 (t, 1H), 7.41 (dd, 2H), 7.61 – 7.55 (m, 2H)., MS (ESI) m/z: 226.991 [M+] Anal. Calcd. for $C_{10}H_7Cl_2NO$: C= 52.66%; H= 3.09%; N= 6.14%; Cl= 31.09%; O= 7.01%, found: C= 52.43%; H= 3%; N= 6.05%; Cl= 31%; O= 6.92%.
- 5-(chloromethyl)-3-(4-Hydroxy phenyl) isoxazole (4d) yield=58%, mp-237-238.2°C, FTIR (KBr, cm^{-1}): - 3645cm^{-1} (Aromatic OH stretching), 3040,2975 cm^{-1} (C-H stretching), 1604,1495,1478 cm^{-1} (Aromatic C=C stretching), 1530 cm^{-1} (Aromatic N-O stretching), 1231 cm^{-1} (Aromatic C-O stretching), 695 cm^{-1}(C-Cl stretching)., ^{1}H-NMR ($CDCl_3$): δ- 4.65 (d, 2H), 6.64 (t, 1H), 6.82 – 6.76 (m, 2H), 7.43 – 7.37 (m, 2H). MS (ESI) m/z: 209.024 [M+] , Anal. Calcd. for $C_{10}H_8ClNO_2$: C= 57.3%; H= 3.85%; N= 6.68%; Cl= 16.91%; O= 15.26%, found: C= 57.21%; H= 3.76%; N= 6.52%; Cl= 16.73%; O= 15.09%.
- 5-(chloromethyl)-3-(4-Fluoro phenyl) isoxazole (4e) yield=64%, mp– 138-140°C, FTIR (KBr, cm^{-1}): - 3042,2972 cm^{-1} (C-H stretching), 1596,1492,1475 cm^{-1} (Aromatic C=C stretching), 1535 cm^{-1} (Aromatic N-O stretching), 1238 cm^{-1} (Aromatic C-F stretching), 697 cm^{-1} (C-Cl stretching)., ^{1}H-NMR ($CDCl_3$): δ- 4.78 (d, 2H), 6.79 (t, 1H), 7.16 – 7.08 (m, 2H), 7.65 – 7.58 (m, 2H)., MS (ESI) m/z: 211.020 [M+], Anal. Calcd. for $C_{10}H_7ClFNO$: C= 56.76%; H= 3.33%; N= 6.62%; Cl= 16.75%; F= 8.98%; O= 7.56%, found: C= 56.6%; H= 3.25%; N= 6.49%; Cl= 16.6%; F= 8.79%; O= 7.41%.
- 5-(chloromethyl)-3-(4-Methyl phenyl) isoxazole (4f) yield= 52%, mp-149-150.7°C, FTIR (KBr, cm^{-1}): - 3048,2970,2965 cm^{-1} (C-H stretching), 1598,143,1490 cm^{-1}(Aromatic C=C stretching), 1528 cm^{-1} (Aromatic N-O stretching), 692 cm^{-1}(C-Cl stretching)., ^{1}H-NMR ($CDCl_3$): δ- 4.78 (d, 2H), 6.78 (t, 1H), 7.29 – 7.24 (m, 2H), 7.67 – 7.62 (m, 2H). , MS (ESI) m/z: 207.045 [M+], Anal. Calcd. for $C_{11}H_{10}ClNO$: C= 63.62%; H= 4.85%; N= 6.75%; Cl= 17.07%; O= 7.7%, found: C= 63.52%; H= 4.52%; N= 6.6%; Cl= 17.03%; O= 7.59%.
- 5-(chloromethyl)-3-(4-Nitro phenyl) isoxazole (4g) yield=65%, mp-158-159.5°C, FTIR (KBr, cm^{-1}): - 3045,2978 cm^{-1} (C-H stretching), 1609,1595,1486 cm^{-1} (Aromatic C=C stretching), 1532 cm^{-1} (Aromatic N-O stretching), 1529 cm^{-1} (Asymmetrical N=O Stretching), 1347cm^{-1} (Symmetrical N=O stretching), 852 cm^{-1} (Aromatic C-N stretching), 693 cm^{-1} (C-Cl stretching). , ^{1}H-NMR ($CDCl_3$): δ- 4.78 (d, 2H), 6.81 (t, 1H), 8.10 – 8.04 (m, 2H), 8.23 – 8.17 (, 2H). , MS (ESI) m/z: 238.015 [M+], Anal. Calcd. for $C_{10}H_7ClN_2O_3$: C= 50.33%; H= 2.96%; N= 11.74%; Cl= 14.86%; O= 20.11%, found: C= 50.2%; H= 2.82%; N= 11.6%; Cl= 14.73%; O= 20.09%.
- 5-(chloromethyl)-3-(2-Methoxy phenyl) isoxazole (4h) yield=51%, mp – 171-173°C, FTIR (KBr, cm^{-1}): - 3067,2980 cm^{-1} (C-H stretching), 1605,1501 cm^{-1} (Aromatic C=C stretching), 1545 cm^{-1} (Aromatic N-O stretching), 1254 cm^{-1} (Asymmetrical C-O-C stretching), 1046 cm^{-1} (Symmetrical C-O-C stretching), 696 cm^{-1} (C-Cl stretching)., ^{1}H-NMR ($CDCl_3$): δ- 3.92 (s, 2H), 4.77 (d, 2H),

6.74 (d, 1H), 6.88 (dd, 1H), 7.24 – 7.16 (m, 1H), 7.38 (td, 1H), 7.68 (dd, 1H). , MS (ESI) m/z: 223.040 [M+] , Anal. Calcd. for $C_{14}H_{16}ClNO$: C= 59.07%; H= 4.51%; N= 6.26%; Cl= 15.85%; O= 14.31%, found: C= 59.02%; H= 4.38%; N= 6.16%; Cl= 15.73%; O= 14.22%.

- 5-(chloromethyl)-3-(2-Fluoro phenyl) isoxazole (4i) yield=56%, mp - 138-139.8°C, FTIR (KBr, cm^{-1}): - 3042,2972 cm^{-1} (C-H stretching), 1600,1525,1478 cm^{-1} (Aromatic C=C stretching), 1531 cm^{-1} (Aromatic N-O stretching), 1196 cm^{-1} (Aromatic C-F stretching), 691 cm^{-1} (C-Cl stretching). , ^{1}H-NMR ($CDCl_3$): δ- 4.78 (d, 2H), 6.81 (dt, 1H), 7.16 (ddd, 1H), 7.37 – 7.30 (m, 1H), 7.41 (dddd,1H), 7.70 (ddd,1H). , MS (ESI) m/z: 211..020 [M+], Anal. Calcd. for $C_{10}H_7ClFNO$: C= 56.76%; H= 3.33%; N= 6.62%; F= 8.98%; Cl= 16.75%; O= 7.56%, found: C= 56.62%; H= 3.32%; N= 6.40%; F= 8.88%; Cl= 16.63%; O= 7.39%.
- 5-(chloromethyl)-3-(3-Methoxy phenyl) isoxazole (4j) yield=55%, mp – 170-171.3°C, FTIR (KBr, cm^{-1}): - 3061,2982 cm^{-1} (Aromatic C-H stretching), 1610,1495 cm^{-1} (Aromatic C=C stretching), 1540 cm^{-1} (Aromatic N-O stretching), 1258 cm^{-1} (Asymmetrical C-O-C stretching), 1050 cm^{-1} (Symmetrical C-O-C stretching), 699 cm^{-1} (C-Cl stretching). , ^{1}H-NMR ($CDCl_3$): δ- 3.83 (s, 3H), 4.78 (d,2H), 6.80 (t, 1H), 6.86 (dt, 1H), 7.28 (t, 1H), 7.40 – 7.33 (m, 2H). , MS (ESI) m/z: 223.040 [M+], Anal. Calcd. for $C_{14}H_{16}ClNO$: C= 59.07%; H= 4.51%; N= 6.26%; Cl= 15.85%; O= 14.31%, found: C= 59.02%; H= 4.42%; N= 6.16%; Cl= 15.73%; O= 14.29%.

Pharmacological Evaluation

Using the agar kirby - bauer disc diffusion technique and Ciprofloxacin as the reference drug for bacteria and Fluconazole as the reference medicine for fungus, respectively, the chosen compounds were examined *in-vitro*. To test the compounds' antibacterial and antifungal abilities, whatman paper discs (5 mm in diameter) were saturated with dimethylsulfoxide (DMSO), a vehicle that displayed no inhibitory zones. The inhibitory zones of the studied drugs were evaluated following incubation for bacteria for 24–28 hours at 37°C and for fungus for five days at 28°C. The inhibitory zones show that some chemicals stop bacterial growth. Three times each evaluation was conducted. Data were analysed in relation to the inhibitory zone's diameter (mm).

Antibacterial Properties

The antibacterial activity of newly generated molecules 4(a-j) was tested using nutritional agar medium and the paper disc diffusion technique against the following microorganisms: Gram+ (*Staphylococcus aureus*) and Gram- (*E. coli*). The paper disc-diffusion approach utilized paper discs impregnated with molecules dissolved in DMSO. Because of the free solubility of the test chemicals, discs impregnated with DMSO were utilized as a solvent reference for antibacterial activity.[29] Ciprofloxacin was utilized as the control medication for antibacterial activity. The findings of *in-vitro* antibacterial evaluation show that, compared to the reference antibiotic ciprofloxacin, compounds and displayed good effectiveness towards gram-positive and gram-negative bacteria. After incubation, the inhibition zone around the disc was found. The areas of inhibition show that the chemicals prevent the development of microorganisms. Each test is carried out three times. The results were analyzed in terms of the size of the inhibition zone (mm).

Antifungal Properties

The new formulations 4(a-j) were evaluated for antifungal activity on nutrient agar medium using the disc diffusion technique. Each of the developed drugs were tested *in-vitro* to compare antifungal potency. *Aspergillus niger*

Table 1: Antibacterial activity of synthesized compounds4(a-j)

Compounds	*Diameter of zone of inhibition in mm [mean ± S.D. (n=3)]*			
	S. aureus		*E. coli*	
	250 µg/mL	*500 µg/mL*	*250 µg/mL*	*500 µg/mL*
4(a)	9.3 ± 0.6	13.2 ± 0.4	12.3 ± 0.43	15 ± 0.32
4(b)	3 ± 0.2	5 ± 0.18	9 ± 0.56	12 ± 0.43
4(c)	9 ± 0.4	13 ± 0.32	3.5 ± 0.32	6.8 ± 0.54
4(d)	10.3 ± 0.23	16.3 ± 0.45	11.2 ± 0.21	18.5 ± 0.34
4(e)	13.7 ± 0.45	21 ± 0.56	12.1 ± 0.47	16.2 ± 0.46
4(f)	19.5 ± 0.32	25.3 ± 0.32	18.3 ± 0.65	22.2 ± 0.36
4(g)	9.8 ± 0.63	18.9 ± 0.45	7.5 ± 0.46	12.4 ± 0.29
4(h)	12.6 ± 0.23	19.4 ± 0.21	14.2 ± 0.52	19.8 ± 0.58
4(i)	11.5 ± 0.56	18.4 ± 0.35	12.6 ± 0.63	18.2 ± 0.34
4(j)	15.6 ± 0.29	20.7 ± 0.40	15.3 ± 0.36	17.2 ± 0.21
Ciprofloxacin	14.2 ± 0.25	-	11.2 ± 0.31	-

Data are Given as Mean S.D.(n=3); S.D. = Standard deviation.

Table 2: Antifungal activity of synthesized compounds 4(a-j)

Compounds	*Diameter of zone of inhibition in mm [mean ± S.D. (n=3)]*			
	A. niger		*C. albicans*	
	250 µg/mL	*500 µg/mL*	*250 µg/mL*	*500 µg/mL*
4(a)	8.2 ± 0.46	11.6 ± 0.29	7.6 ± 0.36	9.5 ± 0.21
4(b)	7.9 ± 0.28	11.5 ± 0.35	7.2 ± 0.4	8.5 ± 0.67
4(c)	7.4 ± 0.3	9 ± 0.21	10.1 ± 0.21	12.9 ± 0.36
4(d)	9.5 ± 0.36	10 ± 0.75	11.2 ± 0.65	13.5 ± 0.45
4(e)	11.5 ± 0.49	12.5 ± 0.42	5.9 ± 0.43	8.6 ± 0.26
4(f)	8.5 ± 0.26	12.7 ± 0.65	7 ± 0.56	10.6 ± 0.45
4(g)	8.9 ± 0.2	11.4 ± 0.36	8.3 ± 0.42	9.4 ± 0.35
4(h)	6.8 ± 0.39	10.1 ± 0.5	10.5 ± 0.5	14.06 ± 0.62
4(i)	9.5 ± 0.23	11.4 ± 0.7	9.5 ± 0.32	11.59 ± 0.36
4(j)	12.3 ± 0.2	14.2 ± 0.54	11.3 ± 0.21	13.5 ± 0.56
Fluconazole	-	12.03 ± 0.76	-	-

Data are given as mean S.D.(n=3); S.D. = Standard deviation

and *candida albicans* were employed as strains. The test fungi were cultured on Sabouraud's broth medium, and a spore suspension in a saline solution was made. Every petri dish was split into 4 equal parts across its diameter, with one disc placed in each. Fluconazole was employed as a reference medication for antifungal efficacy. The zones of inhibition demonstrate that the chemicals hinder microorganism growth.[30] Each test is performed in triplicate. The results were examined in terms of the size of the inhibitory zone (mm).

Result and Discussion

A novel series of 5-(chloromethyl)-3-(substituted phenyl) isoxazole was synthesized using the ultrasound radiation. The use of ultrasound radiation in conducted syntheses allowed to obtain products with a higher yield and in shorter time. The synthesized derivatives 4(a-j) were evaluated for antibacterial and antifungal activity.

Antibacterial Activity of the Series 4(a-j)

The synthesized compounds shown in the scheme 1 were evaluated for their antibacterial activity using the disk diffusion technique using DMSO as blank and Ciprofloxacin as the standard drug and demonstration reveals that compound 4f and 4j bearing the highest zone of inhibition and more potent comparably to standard drug Ciprofloxacin on both *Staphylococcus aureus* and *E. coli* and compound 4d, 4e and 4f showed significant antibacterial activity for *Staphylococcus aureus* and good antibacterial activity for *E. coli* at the concentration of 125 and 500 µg/mL (Table 1).

Antifungal Activity of the Series 4(a-j)

Demonstration of antifungal activity of synthesized compounds was performed using disk diffusion technique with Nutrient Agar medium for better fungal growth and Fluconazole was utilized as the standard drug and the result show that the compounds 4f and 4j was found to be most potent for the *Aspergillus niger* with the maximum Zone of inhibition compared to the reference drug Fluconazole and Compounds 4c, 4d, 4h and 4j was found to be most active against *C. albicans* with the concentration of 125 and 500 µg/mL (Table 2).

The study reveals that all the synthesized compound were found to be active as the antibacterial antifungal agents. Four out of ten compounds were found to be potent antibacterial and five out of ten compounds were as potent antifungal agents. Among all the derivatives compound 14j was found to be most potent antibacterial and antifungal agent compared to the reference drugs.

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