

**Research Article****CODEN: IJPNL6****SYNTHESIS AND BIOLOGICAL EVALUATION OF 1-SUBSTITUTED IMIDAZOLE DERIVATIVES**Prasanthu G^{*1}, Venkata Ramana K¹, Koti Reddy V¹, Nirmala K¹ and Ramesh Kumar N²¹Department of pharmaceutical chemistry, A.S.N Pharmacy College, Tenali, India²Department of pharmaceutical chemistry, C.L. Baid Metha College of Pharmacy, Chennai, India***Corresponding author e-mail:** prasanthugarlapati@gmail.com**ABSTRACT**

In the present study, a new series of 1-substituted imidazole derivatives were synthesized taking different anilines and sulfonamides as substitutions. The chemical structures were confirmed by means of IR, ¹H-NMR and Mass spectral data. The compounds were screened for their anticancer and antimicrobial activities. N-(3-chloro-4-fluorophenyl)-4-(1H-imidazol-1-yl)benzamide exhibited highest activity against cervical cancer. 4-(1H-imidazol-1-yl)-N-(4-(N-(5-methylisoxazol-4-yl) sulfamoyl) phenyl) benzamide showed good antifungal activity. 4-(1H-imidazol-1-yl)-N-(4-(N-thiazol-4-ylsulfamoyl) phenyl) benzamide showed good antibacterial activity.

Key words: Imidazole, Aniline, Sulfonamide, Anticancer, Antibacterial and Antifungal.**INTRODUCTION**

The imidazole moiety is known to play an important role in biological systems as a part of the histidyl residue in peptides and proteins¹. Imidazole is an important aromatic heterocycle in organic compounds because of its variable biological activities. The amino acid histidine and its decomposition product histamine have the imidazole structure, biotin as a growth factor for both humans and yeast. Imidazole derivatives pose a diverse range of pharmacological activities such as antibacterial, antifungal, antitumor, antiulcer, anticonvulsant, antiprotozoal, antitubercular, antihypertensive, analgesic, antiinflammatory, antiviral, antidepressant and anti-HIV²⁻⁶. The literature reveals that anticancer and antimicrobial properties of imidazole were associated with substitutions at 1 position^{2,5}. Therefore it was envisaged that a new series of 1-substituted imidazole derivatives with an amide group for good penetration into the BBB (Blood Brain Barrier) would result in compounds of potent biological activities. In the present study, a new series of imidazole derivatives have been synthesized

by a four step procedure. Different anilines and sulfonamides have been taken as substitutions. The chemical structures were confirmed by means of IR, ¹H NMR and Mass spectral data. The compounds were screened for acute oral toxicity, anticancer and antimicrobial activities.

MATERIALS AND METHODS

The melting points were taken in open capillary tube and are uncorrected. The IR spectra of the compounds were recorded on ABB Bomem FT-IR spectrometer MB 104 with potassium bromide pellets. The ¹H-NMR spectra of the synthesized compounds were recorded on a JOEL GSX 400 NMR spectrometer in DMSO unless otherwise stated. Mass spectra were recorded on Shimadzu GCMS QP 5000. The purity of the compounds was checked by TLC on pre-coated SiO₂ gel (HF₂₅₄ 200 mesh) aluminium plates (E-merk) using (4:1) Chloroform: Methanol as eluent and visualized by iodine vapours. The IR, ¹H-NMR and mass spectra were consistent with the assigned structure.

Synthesis of 4-(1H-Imidazol-1-yl) benzonitrile (3)^{7,8}: A mixture of imidazole(1) (0.5 mol), 4-Chlorobenzonitrile(2) (0.15 mol) and 50ml of ethanol are heated at 95°C. The conversion of 4-Chlorobenzonitrile is completed after 12 hr and then add water to the reaction mixture. The precipitate is filtered off, washed with water and dried under vacuum. The dried product is recrystallized with ethanol.

Synthesis of 4-(1H-Imidazol-1-yl) benzoic acid (4): A mixture of 4-(1H-imidazo-1-yl) benzonitrile (0.07 mol), sodium hydroxide (0.3 mol) and water (100ml) are refluxed for 5 hr. It is then cooled down to room temperature and acidify with HCl (5%) with efficient stirring (Alkali-Acid Hydrolysis). The precipitate is filtered off, washed with water and dried under vacuum.

Synthesis of 4-(1H-Imidazol-1-yl) benzoylchloride (5): A mixture of 4-(1-H-imidazol-1-yl) benzoic acid (0.05mol) and thionyl chloride (0.06mol) are refluxed on water bath for 7 hr. Excess of thionyl chloride is removed under reduced pressure and the dried product is recrystallised.

General procedure for the synthesis of compounds (P1-P14)⁹: To a well-stirred solution of 4-(1H-imidazol-1-yl)benzoyl chloride (0.01mol) and triethylamine (0.01mol) in benzene, substituted anilines (P1-P10) and sulphonamides (P11-P14) (0.01mol) in benzene was added in dropwise for about half an hour, and stirring was continued in cool condition. After the completion of reaction, it was poured into water and extracted with ether. The collected ethereal extracts were then washed well with 3% sodium bicarbonate solution, dried and then recrystallised.

Structural Data:

4-(1H-imidazol-1-yl)-N-(4-nitrophenyl)benzamide (P1): Yield 65%, mp 176-178°C, Rf value 0.55. IR (KBr) (cm⁻¹): 2975.79(Ar-H), 1593.60(C=C), 1364.65(C-N), 1474.65(C=N), 1643.63(AmideC=O), 3433.85(AmideNH), 1512.42(Ar-NO₂). ¹H NMR (δ ppm): 7-8.5 [m, 11H, Ar-H], 9.2 [s, 1H, NH]. Mass: m/z 308(5%)M⁺, (M.F: C₁₆H₁₂N₄O₃), 69(100%), 151(29%), 172(21%), 188(15%), 252(7%), 264(18%), 293(10%).

4-(1H-imidazol-1-yl)-N-(2,4-dinitrophenyl) benzamide (P2): Yield 63%, mp 180-182°C, Rf value 0.396. IR (KBr) (cm⁻¹): 3330.77(Ar-H), 1584.55(C=C), 1388.83(C-N), 1494.04(C=N), 1628.53(AmideC=O), 3445.45(AmideNH), 1520.58

(Ar-NO₂). ¹H NMR (δ ppm): 7-8.9 [m, 10H, Ar-H], 9.2 [s, 1H, NH]. Mass: m/z 353(6%) M⁺, (M.F: C₁₆H₁₁N₅O₅), 144(100%), 91(58%), 153(22%), 188(32%), 252(6%), 264(22%), 308(35%), 338(27%).

N-(3-chloro-4-fluorophenyl)-4-(1H-imidazol-1-yl) benzamide (P3): Yield 60%, mp 166-168°C, Rf value 0.477. IR (KBr) (cm⁻¹): 3094.52(Ar-H), 1592.10(C=C), 1366.64(C-N), 1492.01(C=N), 1682.6(AmideC=O), 3447.53(AmideNH), 1282.80(C-F), 761.24(C-Cl). ¹H NMR (δ ppm): 7-8 [m, 10H, Ar-H], 9.2 [s, 1H, NH]. Mass: m/z 315(8%) M⁺, (M.F: C₁₆H₁₁ClFN₃O) 128(100%), 316(7%), M+1, 66(75%), 91(61%), 144(20%), 158(43%), 171(19%), 188(15%), 252(9%), 265(17%), 281(27%).

N-(4-fluorophenyl)-4-(1H-imidazol-1-yl)benzamide (P4): Yield 50%, mp 172-174°C, Rf value 0.425. IR (KBr) (cm⁻¹): 2918.71(Ar-H), 1588.80(C=C), 1329.85(C-N), 1508.63(C=N), 1629.02(AmideC=O), 3149.61(AmideNH), 1217.31(C-F). ¹H NMR (δ ppm): 7-8 [m, 11H, Ar-H], 9.2 [s, 1H, NH]. Mass: m/z 282(4%)M⁺, (M.F: C₁₆H₁₂FN₃O), 144(100%), 68(75%), 79(34%), 96(19%), 128(15%), 171(23%), 186(12%), 252(7%), 264(17%).

N-(4-chlorophenyl)-4-(1H-imidazol-1-yl)benzamide (P5): Yield 55%, mp 168-170°C, Rf value 0.461. IR (KBr) (cm⁻¹): 3094.52(Ar-H), 1592.11(C=C), 1322(C-N), 1491.91(C=N), 1682.44(AmideC=O), 3447.53(AmideNH), 761.43(C-Cl). ¹H NMR (δ ppm): 7-8 [m, 11H, Ar-H], 9.2 [s, 1H, NH]. Mass: m/z 297(5%), M⁺ (M.F C₁₆H₁₂ClN₃O) 69(100%), 298(6%), M+1, 92(44%), 114(29%), 129(20%), 144(24%), 153(36%), 172(26%), 183(8%), 251(15%), 263(19%).

N-(2-chlorophenyl)-4-(1H-imidazol-1-yl)benzamide (P6): Yield 54%, mp 160-162°C, Rf value 0.541. IR (KBr) (cm⁻¹): 2975.79(Ar-H), 1593.60(C=C), 1364.65(C-N), 1474.65(C=N), 1643.63(Amide C=O), 3433.85(Amide NH), 763.35(C-Cl). ¹H NMR (δ ppm): 7-8 [m, 11H, Ar-H], 9.2 [s, 1H, NH]. Mass: m/z 297(8%) M⁺, (M.F C₁₆H₁₂ClN₃O), 145(100%)B, 298(5%), 90(58%), 122(23%), 128(33%), 153(35%), 173(16%), 189(10%), 252(11%), 264(18%).

4-(1H-imidazol-1-yl)-N-(4-methoxyphenyl) benzamide (P7): Yield 58%, mp 184-186°C, Rf value 0.381. IR (KBr) (cm⁻¹): 3148.53(Ar-H), 1586.57(C=C), 1385.23(C-N), 1457.63(C=N), 1654.04(Amide C=O), 3418.68(Amide NH), 1078.71(Ar-OCH₃). ¹H NMR (δ ppm): 6.8-8 [m,

11H, Ar-H], 9.2 [s, 1H, NH], 3.8 [s, 3H, CH₃]. Mass: m/z 294(5%), M⁺ (M.F C₁₇H₁₅N₃O₂), 124(100%), 91(60%), 92(10%), 110(27%), 144(13%), 153(36%), 172(23%), 188(9%), 252(6%), 263(14%), 280(25%).

4-(1H-imidazol-1-yl)-N-P-tolylbenzamide (P8): Yield 57%, mp 190-192°C, Rf value 0.521. IR (KBr) (cm⁻¹): 2918.71(Ar-H), 1588.80(C=C), 1329.85(C-N), 1508.63(C=N), 1629.02(Amide C=O), 3149.61(Amide NH), 2918.71 (Ar-CH₃). ¹H NMR (δ ppm): 7-8 [m, 11H, Ar-H], 9.2 [s, 1H, NH], 2.5 [s, 3H, CH₃]. Mass: m/z 278(5%), M⁺ (M.F C₁₇H₁₅N₃O), 68(100%), 90(56%), 108(20%), 122(23%), 144 (14%), 153(38%), 172(19%), 188(16%), 252(8%), 263(17%).

4-(1H-imidazol-1-yl)-N-(pyridin-2-yl)benzamide (P9): Yield 56%, mp 196-198°C, Rf value 0.482. IR (KBr) (cm⁻¹): 2839.95(Ar-H), 1543.05(C=C), 1325.91(C-N), 1474.76(C=N), 1667.37(Amide C=O), 3424.68(Amide NH). ¹H NMR (δ ppm): 6.4-8 [m, 11H, Ar-H], 9.2 [s, 1H, NH]. Mass: m/z 264(5%)M⁺, (M.F C₁₅H₁₂N₄O), 68(100%), 78(35%), 94(58%), 144(24%), 158(27%), 175(30%), 188(6%), 202 (10%), 215(9%), 242(7%).

N-(4-bromophenyl)-4-(1H-imidazol-1-yl)benzamide (P10): Yield 51%, mp 174-176°C, Rf value 0.465. IR (KBr) (cm⁻¹): 2975.74(Ar-H), 1591.9(C=C), 1398.56(C-N), 1474.83(C=N), 1650.85(Amide C=O), 3448.78(Amide NH), 521.87(C-Br). ¹H NMR (δ ppm): 7-8 [m, 11H, Ar-H], 9.2 [s, 1H, NH]. Mass: m/z 342(7%)M⁺, (M.F C₁₆H₁₂BrN₃O), 188(100%), 344(5%)M+2, 92(40%), 128(20%), 144(15%), 153 (36%), 171(18%), 263(16%).

4-(1H-imidazol-1-yl)-N-(4-(N-(5-methylisoxazol-4-yl)sulfamoyl) phenyl) benzamide (P11): Yield 66%, mp 302-304°C, Rf value 0.441. IR (KBr) (cm⁻¹): 3094.21(Ar-H), 1592.87(C=C), 1377.79(C-N), 1491.68(C=N), 1682.46(Amide C=O), 3476.80 (Amide NH), 1324.0(SO₂), 897.94(S-N), 2982.62(Ar-CH₃), 1015.21(C-O). ¹H NMR (δ ppm): 7-8.2 [m, 12H, Ar-H], 9.2 [s, 1H, NH], 2.5 [s, 3H, CH₃], 4 [s, 1H, S-NH]. Mass: m/z 423(4%), M⁺ (M.F C₂₀H₁₇N₅O₄S), 174(100%), 82(30%), 111(50%), 145 (35%), 156(79%), 157 (8%), 190(6%), 266(26%), 262(12%), 342(24%), 397(22%), 409(20%).

4-(1H-imidazol-1-yl)-N-(4-(N-pyrimidin-2-ylsulfamoyl)phenyl)benzamide (P12): Yield 65%, mp 296-298°C, Rf value 0.372. IR (KBr) (cm⁻¹): 3095.58(Ar-H), 1592.70(C=C), 1401.06(C-N), 1491.74(C=N), 1683.11(Amide C=O), 3430.41 (Amide NH), 1323.86(SO₂), 939.82(S-N). ¹H NMR (δ ppm): 7-8.5 [m, 14H, Ar-H], 9.2 [s, 1H, NH], 4 [s,

1H, S-NH]. Mass: m/z 420(4%), M⁺ (M.F C₂₀H₁₆N₆O₃S), 65(100%), 420(4%)M⁺, 79(25%), 111 (48%), 144(6%), 156(78%), 175(18%), 252(19%), 263(35%), 278(12%), 343(10%), 354(29%).

4-(1H-imidazol-1-yl)-N-(4-(N-thiazol-4-ylsulfamoyl) phenyl)benzamide (P13): Yield 67%, mp 308-310°C, Rf value 0.510. IR (KBr) (cm⁻¹): 3094.51(Ar-H), 1592.39(C=C), 1400.96(C-N), 1492.25(C=N), 1682.79(Amide C=O), 3470.75(Amide NH), 1321.99(SO₂), 929.53(S-N), 761.71(C-S). ¹H NMR (δ ppm): 7-8.9 [m, 13H, Ar-H], 9.2 [s, 1H, NH], 4 [s, 1H, S-NH]. Mass: m/z 425(7%)M⁺, (M.F C₁₉H₁₅N₅O₃S₂), 106(100%), 67(80%), 86(22%), 136(15%), 144(8%), 152(12%), 176(9%), 224(25%), 255(24%), 276(20%), 283(35%), 342(6%), 357 (19%), 372(23%), 416(10%).

4-(1H-imidazol-1-yl)-N-(4-(N-(5-methylpyrazin-2-yl)sulfamoyl)phenyl)benzamide (P14): Yield 64%, mp 292-294°C, Rf value 0.360. IR (KBr) (cm⁻¹): 3094.58(Ar-H), 1594.04(C=C), 1372.23(C-N), 1491.66(C=N), 1634.96(Amide C=O), 3482.17 (Amide NH), 1325.50(SO₂), 930.14(S-N), 2959.30 (Ar-CH₃). ¹H NMR (δ ppm): 7-8.2 [m, 13H, Ar-H], 9.2 [s, 1H, NH], 2.4 [s, 3H, CH₃], 4 [s, 1H, S-NH]. Mass: m/z 434(4%)M⁺, (M.F C₂₁H₁₈N₆O₃S), 121(100%), 92(22%), 111(50%), 97(5%), 172(17%), 179(8%), 227(7%), 277(20%), 343(9%), 355(19%), 368(48%), 390(42%), 401(22%), 422(21%).

Pharmacological Activity:

The synthesized compounds were evaluated for acute oral toxicity, anticancer and antimicrobial activities. Statistical analysis (ANOVA followed by Dunnet's t-test) was performed for anticancer activity to ascertain the significance of the exhibited activity. The test compounds were administered in the form of a suspension (1% carboxy methyl cellulose as vehicle). The animals used in the present study swiss albino mice weighing 20-25 g were kept in colony cages at 25±2°C, relative humidity of 45-55% under 12 hr light and dark cycle. All the animals were fed with standard animal feed and water *ad libitum*.

Acute Oral Toxicity:

In the present study the acute oral toxicity of the synthesized compounds were performed by acute toxic class method^{10,11} as per organization of economic co-operation and development (OECD) guidelines. In this methods the toxicity of the synthesized compounds were tested using a step wise procedure, each step using three mice of a single sex. The mice were fasted prior to dosing (food but not

water should be withheld) for three to four hours. Then the animals were weighed and the synthesized compounds were administered orally at a dose of 2000 mg/Kg body weight. Animals were observed individually after dosing at least once during the first 30 min; periodically during the first 24 h with special attention given during the first 4 h and daily thereafter, for a total of 14 days.

Anticancer Activity¹²:

Anticancer activity was carried out by MTT [(3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide)] assay using HELA cell lines against cervical cancer. 0.1ml of the cell suspension (containing 5×10^6 cells/100 μ l) and 0.1ml of the test solution (6.25 μ g - 100 μ g in 1% DMSO such that the final concentration of DMSO in media is less than 1%) were added to the 96 well plates and kept in 5% CO₂ incubator at 37⁰ C for 72 hours. Blank contains only cell suspension and control wells contain 1% DMSO and cell suspension. After 72 hours, 20 μ l of MTT was added and kept in carbondioxide incubator for 2 hours followed by propanol 100 μ l. The plate was covered with aluminium foil to protect it from light. Then the 96 well plates are kept in rotary shaker for 10-20 minutes. After 10-20 minutes, the 96 well plates were processed on ELISA reader for absorption at 562nm. The readings were averaged and viability of the test samples was compared with DMSO control. Anticancer activity was carried out for compounds P2, P3, P4, P6, and P7. The data was presented in Table 1.

Antimicrobial Activity¹³

The activity was carried paper disc diffusion method. The sterilized (autoclaved at 120°C for 30min) medium (40-50°C) was inoculated (1mL/100mL of medium) with the suspension (10^5 cfu mL⁻¹) of the micro-organism (matched to McFarland barium sulphate standard) and poured into a petridish to give a depth of 3-4 mm. The paper impregnated with the test compounds (25, 50 and 100 μ g mL⁻¹ in dimethyl

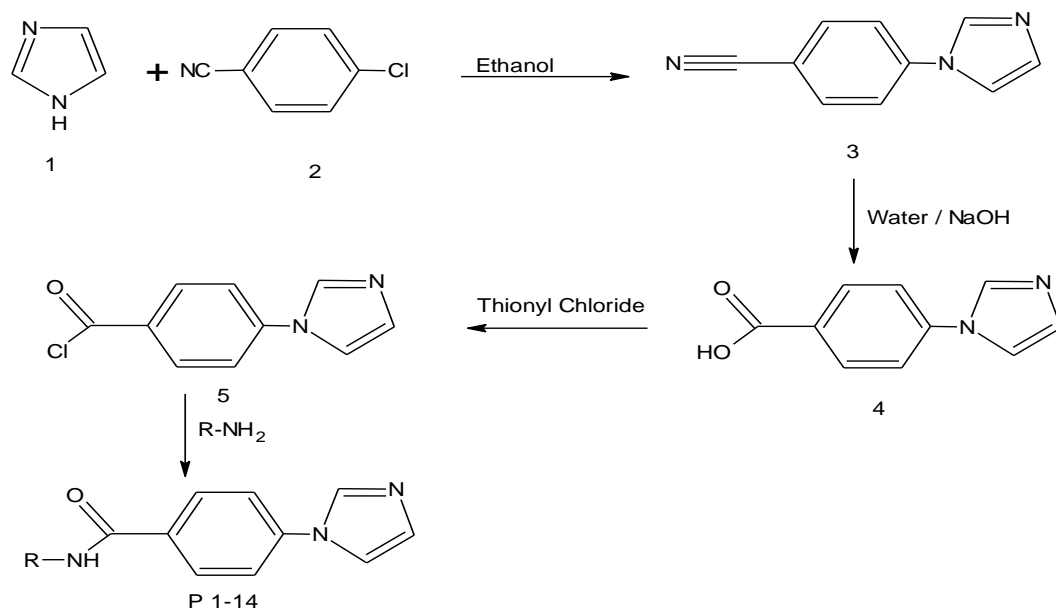
formamide) was placed on the solidified medium. The plates were pre-incubated for 1 h at RT and incubated at 37°C for 24 and 48 h for anti-bacterial and anti-fungal activities, respectively. Ciprofloxacin (100 μ g/disc) and Ketoconazole (100 μ g/disc) were used as standard for anti-bacterial and anti-fungal activities, respectively. Antibacterial activity was carried out against *Staphylococcus aureus*, *Staphylococcus epidermids*(Gram +ve), *Escherichia coli*, *Klebsiella pneumonia*(Gram -ve) organisms. Antifungal activity was tested against *Aspergillus niger*, *Candida Albicans* organisms. The zone of inhibition observed was presented in the Table 2, 3, 4, 5 and 6.

RESULTS AND DISCUSSION

Compounds P1-P14 did not cause mortality up to 2000mg/kg and were considered as safe (x-unclassified). Compound P-3 was found to exhibit good anticancer activity, the compound P-6 showed moderate activity and compounds P-2, P-4 had mild activity. Compounds P-1, P-3, P-5, P-6, P-8, P-11, were possessed good activity against Gram-positive and Gram-negative bacteria in comparison with standard (Ciprofloxacin 50 μ g/ml). Compound P-13 showed significant antibacterial activity, when compared to Ciprofloxacin. Compounds P-2, P-3, P-4, P-6, P-9, P-10, P-13 and P-14 showed good antifungal activity and Compound P-11 has showed significant antifungal activity compared to Ketaconazole. The present study reveals that introduction of sulfinyl group showed anticancer and antimicrobial activities. Therefore may serve as lead molecule for further modification to obtain therapeutically useful novel entities in this series.

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Scheme 1 : Synthesis of 1-Substituted Imidazole Derivatives

Table 1: GI₅₀ of synthesized compounds

Compounds	Hela		
	GI ₅₀ (μ m)	TGI(μ m)	LC ₅₀ (μ m)
P ₂	20.5	52.7	>100
P ₃	18.8	42.7	88.2
P ₄	21	43.6	>100
P ₆	19.5	35.4	79.2
P ₇	20.8	47.2	>100
DOXO	0.05	0.41	0.88

Table 2: Zone of Inhibition of Synthesized Compounds against Gram +Ve Bacteria

Compounds	ZONE OF INHIBITION					
	<i>S.Aureus</i>			<i>S.Epidermis</i>		
	25 μ g/ml	50 μ g/ml	100 μ g/ml	25 μ g/ml	50 μ g/ml	100 μ g/ml
P ₁	8	16	28	23	29	30
P ₂	8	15	26	21	26	28
P ₃	10	17	26	25	30	25
P ₄	10	13	25	25	28	28
P ₅	10	15	28	22	25	27
P ₆	12	16	28	24	27	32
P ₇	8	13	27	22	23	34
P ₈	8	15	26	23	25	30
P ₉	7	15	23	18	25	33
P ₁₀	10	17	25	22	26	30
P ₁₁	12	18	26	10	22	32
P ₁₂	8	17	23	10	27	28
P ₁₃	10	18	22	18	25	32
P ₁₄	8	16	27	20	26	30
Std	23	23	23	31	31	31
Control	-	-	-	-	-	-

Table 3: Zone of Inhibition of Synthesized Compounds against Gram –Ve Bacteria

Compounds	ZONE OF INHIBITION					
	<i>E.Coli</i>			<i>K.Pneumonia</i>		
	25 µg/ml	50 µg/ml	100 µg/ml	25 µg/ml	50 µg/ml	100 µg/ml
P₁	10	23	28	12	14	20
P₂	12	18	22	15	16	27
P₃	16	22	30	11	20	25
P₄	11	20	22	11	10	30
P₅	11	21	25	10	23	28
P₆	16	29	32	8	15	26
P₇	11	15	20	10	14	25
P₈	8	17	22	10	16	26
P₉	9	14	22	8	20	25
P₁₀	10	16	25	12	10	28
P₁₁	20	20	28	15	16	26
P₁₂	18	22	32	12	14	26
P₁₃	20	25	30	12	20	25
P₁₄	18	22	25	10	20	26
Std	27	27	27	24	24	24
Control	-	-	-	-	-	-

Table 4: Minimum Inhibitory Concentration of Synthesized Compounds against Gram (+) Ve and Gram (-) Ve Bacteria

Compounds	MINIMUM INHIBITORY CONCENTRATION (µg/ml)			
	<i>S.Aureus</i>	<i>S.Epidermis</i>	<i>E.Coli</i>	<i>K.Pneumonia</i>
P₁	9	7	8	10
P₂	10	6	10	9
P₃	9	6	7	9
P₄	10	7	6	6
P₅	9	6	7	10
P₆	10	6	6	6
P₇	10	8	9	7
P₈	9	6	10	7
P₉	10	8	6	10
P₁₀	9	7	10	8
P₁₁	10	9	8	7
P₁₂	9	8	7	10
P₁₃	9	9	6	10
P₁₄	10	8	7	10
Std	0.2	0.39	0.2	0.1

Table 5: Zone of Inhibition of synthesized compounds against fungi

Compounds	ZONE OF INHIBITION					
	<i>Candida Albicans</i>			<i>Aspergillus Niger</i>		
	25 µg/ml	50 µg/ml	100 µg/ml	25 µg/ml	50 µg/ml	100 µg/ml
P ₁	10	16	20	8	10	16
P ₂	15	22	25	7	12	17
P ₃	20	21	24	6	12	13
P ₄	20	24	26	8	11	15
P ₅	15	17	20	2	10	16
P ₆	20	22	25	7	8	13
P ₇	10	15	15	8	10	14
P ₈	20	22	22	5	8	16
P ₉	15	20	26	8	13	13
P ₁₀	20	20	22	6	12	16
P ₁₁	10	24	23	6	15	11
P ₁₂	20	18	20	8	13	14
P ₁₃	20	22	26	8	13	12
P ₁₄	20	20	25	6	11	10
Std	23	23	23	20	20	20
Control	-	-	-	-	-	-

Table 6: Minimum Inhibitory Concentration of Synthesized Compounds against Fungi

Compounds	MINIMUM INHIBITORY CONCENTRATION (µg/ml)	
	<i>Candida Albicans</i>	<i>Aspergillus Niger</i>
	P ₁	6
P ₂	6	9
P ₃	9	10
P ₄	6	9
P ₅	10	10
P ₆	10	10
P ₇	7	9
P ₈	7	10
P ₉	6	9
P ₁₀	7	9
P ₁₁	7	8
P ₁₂	8	9
P ₁₃	6	8
P ₁₄	6	10
Ketaconazole	1	6.1

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