Research Article

Synthesis and Antibacterial Screening of Some 1-Aroyl-3-aryl Thiourea Derivatives

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Received 15 October 2013; Accepted 17 December 2013; Published 29 January 2014

Academic Editors: A. Contini, F. A. Pasha, and Y. S. Prabhakar

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A series of 1-aryl-3-aryl thioureas derivatives were synthesized and evaluated for antibacterial activity. The results indicated that the compounds possessed higher activity against gram-negative bacteria than gram-positive bacteria. Amongst all these compounds, C18 (89.4%) exhibited the greatest antibacterial activity against gram-negative bacteria while C5 (85.6%) displayed maximum antibacterial activity against gram-positive bacteria. Preliminary study of the structure-activity relationship revealed that an electronic factor on aryl rings had a great effect on the antibacterial activity of these compounds.

1. Introduction

The increased use of antibacterial and antifungal agents has resulted in the development of drug resistant microbial pathogens which results in failure in clinical application of these agents. This highlights the incessant need for the development of new classes of antimicrobial agents and alteration of known drugs in such way that would allow them to retain their physiological action but reduce their resistance to the pathogen. Thiourea derivatives are versatile building blocks for the synthesis of a variety of heterocyclic compounds and display a wide spectrum of biological activities such as antimicrobial [1–4], antimalarial [5], antitubercular [6], anti-cancer [7], anti-HIV [8], carbonic anhydrases inhibitor [9], appetite suppressants [10], β -adrenergic receptor agonists [11], and CNS activity [12]. Therefore, their beneficial properties have prompted several groups to study these compounds. We have been interested in antimicrobial agents for a few years and have performed QSAR analysis and synthesis of antimicrobial agents [13–15]. Here in the present work we report the synthesis and screening of some 1-aryl-3-aryl thiourea derivatives for their antimicrobial potency.

2. Experimental

Synthesis of some 1-aryl-3-aryl thioureas (C1–C18) (Figure 1 and Table 1) was carried out by treating substituted benzoyl chloride with an equimolar quantity of potassium thiocyanate in acetone followed by reaction with an equimolar amount of substituted anilines to furnish the 1-aryl-3-aryl thiourea derivatives.

2.1. General Procedure for the Synthesis of 1-Aroyl-3-aryl Thioureas. A solution of substituted benzoyl chloride (10 mmol) in acetone (50 mL) was added dropwise to a suspension of potassium thiocyanate (10 mmol) in acetone (30 mL) and the reaction mixture was refluxed for 30 min. After cooling to room temperature, a solution of substituted aniline (10 mmol) in acetone (10 mL) was added and the resulting mixture refluxed for 2–3 h. The reaction was monitored by performing TLC using petroleum ether:ethyl acetate (8:2) as mobile phase. The reaction mixture was poured into cold water and the precipitated thioureas were recrystallized using aqueous ethanol [3].

The structures were confirmed by spectroscopic data and elemental analyses. All the synthesized compounds were

FIGURE 1: Synthesis of 1-aryl-3-aryl thiourea.

TABLE 1: Synthesized 1-aryl-3-aryl thiourea derivatives.

S. Number	Compound ID	R ₁	R ₂
1	C1	2-Cl	4-Br
2	C2	4-Cl	3-OMe
3	C3	4-OMe	3-OMe
4	C4	4-OMe	2-Cl
5	C5	4-Cl	2-Cl
6	C6	4-Cl	4-F
7	C7	2-Cl	3-OMe
8	C8	4-OMe	4-Br
9	C9	2-Cl	4-Cl
10	C10	4-Cl	4-Cl
11	C11	4-OMe	4-Cl
12	C12	2-Cl	2-F
13	C13	2-Cl	4-OMe
14	C14	4-Cl	4-OMe
15	C15	4-OMe	4-OMe
16	C16	4-Cl	2-F
17	C17	4-OMe	2-F
18	C18	2-Cl	2-Cl

assayed in vitro for their antibacterial activity. The antibacterial activity of compounds was determined by the paper disc diffusion method using Mueller-Hinton agar medium. Sodium Penicillin G was used as the reference antibacterial agent.

1-(2-Chlorobenzoyl)-3-(4-bromophenyl) Thiourea (C1). Yield 69%, $R_f = 0.44$, M.P. 160–165°C, IR (KBr) ν (cm⁻¹): 1539.09 (C=C), 1676.99 (C=O), 3246.94 (N-H), 1159.14 (C=S), 1159.14 (C-N), 814.87 (C-Cl). ¹H NMR (CDCl₃) δ : 12.37 (1H, s, NH), 9.276 (1H, s, NH), 7.43–7.66 (m, 4H, aroyl ring), 7.26–7.4 (m, 4H, aryl ring). DART-MS m/e (%): 369. Elemental analysis for C₁₄H₁₀N₂OSClBr (MW = 369.66) in wt% calc. C = 45.48, H = 2.73, N = 7.57, O = 4.33, S = 8.67 and found to be C = 46.01, H = 3.04, N = 7.42, O = 6.24, S = 8.16.

1-(4-Chlorobenzoyl)-3-(3-methoxyphenyl) Thiourea (C2). Yield 62%, $R_f = 0.42$, M.P. 130–135°C, IR (KBr) ν (cm⁻¹): 1532.34 (C=C), 1672.17 (C=O), 3295 (N-H), 1150.46 (C=S), 1276.79 (C-N), 850.55 (C-Cl). ¹H NMR (CDCl₃) δ : 12.52 (1H, s, NH), 9.03 (1H, s, NH), 7.47–7.85 (m, 4H, aroyl ring), 6.81–7.2 (m, 4H, aryl ring), 3.83 (3H, s, OCH₃). DART-MS m/e (%): 319.07. Elemental analysis for C₁₅H₁₃N₂O₂SCl (MW = 320.79) in wt% calc. C = 56.16, H = 4.08, N = 8.73, O = 9.97, S = 9.99 and found to be C = 56.12, H = 4.27, N = 8.59, O = 11.34, S = 9.56.

1-(4-Methoxybenzoyl)-3-(3-methoxyphenyl) Thiourea (C3). Yield 61%, $R_f = 0.3$, M.P. 80–85°C, IR (KBr) ν (cm⁻¹): 1503.41

(C=C), 1659.63 (C=O), 3517.92 (N-H), 1167.82 (C=S), 1250.75 (C-N). ¹H NMR (CDCl₃) δ : 12.69 (1H, s, NH), 9.02 (1H, s, NH), 7.2–7.87 (m, 4H, aroyl ring), 6.81–7.02 (m, 4H, aryl ring), 3.83 (3H, s, OCH₃), 3.89 (3H, s, OCH₃). DART-MS m/e (%): 315.12. Elemental analysis C₁₆H₁₆N₂O₃S (MW = 316.38) in wt% calc. C = 60.74, H = 5.09, N = 8.85, O = 15.17, S = 10.14 and found to be C = 61.78, H = 5.52, N = 8.79, O = 15.37, S = 8.43.

1-(4-Methoxybenzoyl)-3-(2-chlorophenyl) Thiourea (C4). Yield 68%, $R_f = 0.32$, M.P. 140–145°C, IR (KBr) ν (cm⁻¹): 1546.8 (C=C), 1673.81 (C=O), 3257.55 (N-H), 1178.43 (C=S), 1164.92 (C-N), 746.4 (C-Cl). ¹H NMR (CDCl₃) δ : 12.80 (1H, s, NH), 9.11 (1H, s, NH), 7.19–7.90 (m, 4H, aroyl ring), 6.99–7.36 (m, 4H, aryl ring), 3.89 (3H, s, OCH₃). DART-MS m/e (%): 321.09. Elemental analysis for C₁₅H₁₃N₂O₂SCl (MW = 320.79) in wt% calc. C = 56.16, H = 4.08, N = 8.73, O = 9.97, S = 9.99 and found to be C = 57.19, H = 4.47, N = 8.75, O = 10.13, S = 9.81.

1-(4-Chlorobenzoyl)-3-(2-chlorophenyl) Thiourea (C5). Yield 56%, $R_f = 0.45$, M.P. 162–165°C, IR (KBr) ν (cm⁻¹): 1537.16 (C=C), 1693.38 (C=O), 3331.8 (N-H), 1094.53 (C=S), 1014.49 (C-N), 687.58 (C-Cl). ¹H NMR (CDCl₃) δ : 12.65 (1H, s, NH), 9.13 (1H, s, NH), 7.53–7.88 (m, 4H, aroyl ring), 7.21–7.47 (m, 4H, aryl ring). DART-MS m/e (%): 325.048. Elemental analysis for C₁₄H₁₀N₂OSCl₂ (MW = 325.22) in wt% calc. C = 51.71, H = 3.09, N = 8.61, O = 4.91, S = 9.85 and found to be C = 52.04, H = 3.29, N = 8.18, O = 5.31, S = 9.28.

1-(4-Chlorobenzoyl)-3-(4-fluorophenyl) Thiourea (C6). Yield 71%, $R_f = 0.50$, M.P. 155–158°C, IR (KBr) ν (cm^{-1}): 1537.16 (C=C), 1666.38 (C=O), 3335.37 (N–H), 1157.21 (C=S), 1157.21 (C–N), 826.44 (C–Cl). ^1H NMR (CDCl_3) δ : 12.43 (1H, s, NH), 9.05 (1H, s, NH), 7.65–7.86 (m, 4H, aroyl ring), 7.09–7.26 (m, 4H, aryl ring). DART-MS m/e (%): 309.06. Elemental analysis for $\text{C}_{14}\text{H}_{10}\text{N}_2\text{OSClF}$ (MW = 308.76) in wt% calc. C = 54.46, H = 3.26, N = 9.07, S = 10.39 and found to be C = 54.59, H = 3.41, N = 9.13, S = 10.43.

1-(2-Chlorobenzoyl)-3-(3-methoxyphenyl) Thiourea (C7). Yield 48%, $R_f = 0.28$, M.P. 110–113°C, IR (KBr) ν (cm^{-1}): 1503.41 (C=C), 1666.38 (C=O), 3326.01 (N–H), 1148.53 (C=S), 1036.67 (C–N), 742.54 (C–Cl). ^1H NMR (CDCl_3) δ : 12.68 (1H, s, NH), 9.22 (1H, s, NH), 7.43–7.78 (m, 4H, aroyl ring), 6.83–7.22 (m, 4H, aryl ring), 3.84 (3H, s, OCH_3). DART-MS m/e (%): 321. Elemental analysis for $\text{C}_{15}\text{H}_{13}\text{N}_2\text{O}_2\text{SCl}$ (MW = 320.79) in wt% calc. C = 56.16, H = 4.09, N = 8.73, S = 9.99 and found to be C = 56.41, H = 4.43, N = 8.8, S = 9.97.

1-(4-Methoxybenzoyl)-3-(4-bromophenyl) Thiourea (C8). Yield 82%, $R_f = 0.31$, M.P. 124–128°C, IR (KBr) ν (cm^{-1}): 1503.41 (C=C), 1666.38 (C=O), 3376.16 (N–H), 1073.31 (C=S), 1024.13 (C–N). ^1H NMR (CDCl_3) δ : 12.56 (1H, s, NH), 9.01 (1H, s, NH), 7.62–7.88 (m, 4H, aroyl ring), 7.0–7.51 (m, 4H, aryl ring), 3.9 (3H, s, OCH_3). DART-MS m/e (%): 365. Elemental analysis for $\text{C}_{15}\text{H}_{13}\text{N}_2\text{O}_2\text{SBr}$ (MW = 365.25) in wt% calc. C = 49.33, H = 3.58, N = 7.67, S = 8.78 and found to be C = 49.58, H = 3.55, N = 7.82, S = 8.96.

1-(2-Chlorobenzoyl)-3-(4-chlorophenyl) Thiourea (C9). Yield 64%, $R_f = 0.38$, M.P. 188–190°C, IR (KBr) ν (cm^{-1}): 1504.37 (C=C), 1666.38 (C=O), 3267.19 (N–H), 1155.28 (C=S), 1155.28 (C–N), 831.26 (C–Cl). ^1H NMR (CDCl_3) δ : 12.93 (1H, s, NH), 9.15 (1H, s, NH), 7.63–7.74 (m, 4H, aroyl ring), 6.73–7.26 (m, 4H, aryl ring). DART-MS m/e (%): 325.66. Elemental analysis for $\text{C}_{14}\text{H}_{10}\text{N}_2\text{OSCl}_2$ (MW = 325.22) in wt% calc. C = 51.70, H = 3.09, N = 8.61, S = 9.85 and found to be C = 51.92, H = 3.20, N = 9.04, S = 9.17.

1-(4-Chlorobenzoyl)-3-(4-chlorophenyl) Thiourea (C10). Yield 57%, $R_f = 0.2$, M.P. 183–187°C, IR (KBr) ν (cm^{-1}): 1537.16 (C=C), 1686.63 (C=O), 3381.56 (N–H), 1095.49 (C=S), 1095.49 (C–N), 820.65 (C–Cl). ^1H NMR (CDCl_3) δ : 12.64 (1H, s, NH), 9.03 (1H, s, NH), 7.66–7.83 (m, 4H, aroyl ring), 7.26–7.52 (m, 4H, aryl ring). DART-MS m/e (%): 325.86. Elemental analysis for $\text{C}_{14}\text{H}_{10}\text{N}_2\text{OSCl}_2$ (MW = 325.22) in wt% calc. C = 51.70, H = 3.09, N = 8.61, S = 9.85 and found to be C = 51.93, H = 2.96, N = 8.65, S = 9.49.

1-(4-Methoxybenzoyl)-3-(4-chlorophenyl) Thiourea (C11). Yield 65%, $R_f = 0.29$, M.P. 182–187°C, IR (KBr) ν (cm^{-1}): 1537.16 (C=C), 1666.38 (C=O), 3388.7 (N–H), 1174.57 (C=S), 1250.75 (C–N), 822.58 (C–Cl). ^1H NMR (CDCl_3) δ : 12.69 (1H, s, NH), 9.05 (1H, s, NH), 7.26–7.87 (m, 4H, aroyl ring), 6.9–7.36 (m, 4H, aryl ring), 3.9 (3H, s, OCH_3). DART-MS m/e (%): 321.09. Elemental analysis for $\text{C}_{15}\text{H}_{13}\text{N}_2\text{O}_2\text{SCl}$ (MW = 320.79) in wt% calc. C = 56.16, H = 4.08, N = 8.73, S = 9.99 and found to be C = 56.53, H = 4.33, N = 8.98, S = 9.97.

1-(2-Chlorobenzoyl)-3-(2-fluorophenyl) Thiourea (C12). Yield 76%, $R_f = 0.44$, M.P. 162–170°C, IR (KBr) ν (cm^{-1}): 1536.2 (C=C), 1686.63 (C=O), 3327.65 (N–H), 1202.53 (C=S), 1163 (C–N), 753.15 (C–Cl). ^1H NMR (CDCl_3) δ : 12.46 (1H, s, NH), 9.37 (1H, s, NH), 7.43–7.78 (m, 4H, aroyl ring), 7.15–7.20 (m, 4H, aryl ring). DART-MS m/e (%): 309.08. Elemental analysis for $\text{C}_{14}\text{H}_{10}\text{N}_2\text{OSClF}$ (MW = 308.76) in wt% calc. C = 54.46, H = 3.26, N = 9.07, S = 10.39 and found to be C = 54.7, H = 3.05, N = 9.16, S = 10.42.

1-(2-Chlorobenzoyl)-3-(4-methoxyphenyl) Thiourea (C13). Yield 53%, $R_f = 0.24$, M.P. 156–162°C, IR (KBr) ν (cm^{-1}): 1537.16 (C=C), 1666.38 (C=O), 3251.11 (N–H), 1159.14 (C=S), 1026.06 (C–N), 744.47 (C–Cl). ^1H NMR (CDCl_3) δ : 12.18 (1H, s, NH), 9.28 (1H, s, NH), 7.43–7.59 (m, 4H, aroyl ring), 6.93–7.39 (m, 4H, aryl ring), 3.83 (3H, s, OCH_3). DART-MS m/e (%): 321. Elemental analysis for $\text{C}_{15}\text{H}_{13}\text{N}_2\text{O}_2\text{SCl}$ (MW = 320.79) in wt% calc. C = 56.16, H = 4.08, N = 8.73, S = 9.99 and found to be C = 56.38, H = 4.27, N = 9.07, S = 9.77.

1-(4-Chlorobenzoyl)-3-(4-methoxyphenyl) Thiourea (C14). Yield 91%, $R_f = 0.41$, M.P. 122–130°C, IR (KBr) ν (cm^{-1}): 1597.91 (C=C), 1693.38 (C=O), 3360.82 (N–H), 1094.53 (C=S), 1241.11 (C–N), 743.51 (C–Cl). ^1H NMR (CDCl_3) δ : 12.33 (1H, s, NH), 9.10 (1H, s, NH), 7.54–7.85 (m, 4H, aroyl ring), 6.93–7.50 (m, 4H, aryl ring), 3.83 (3H, s, OCH_3). DART-MS m/e (%): 321.10. Elemental analysis for $\text{C}_{15}\text{H}_{13}\text{N}_2\text{O}_2\text{SCl}$ (MW = 320.79) in wt% calc. C = 56.16, H = 4.08, N = 8.73, S = 9.99 and found to be C = 56.29, H = 4.24, N = 9.02, S = 9.98.

1-(4-Methoxybenzoyl)-3-(4-methoxyphenyl) Thiourea (C15). Yield 62%, $R_f = 0.30$, M.P. 122–128°C, IR (KBr) ν (cm^{-1}): 1504.37 (C=C), 1666.38 (C=O), 3287.44 (N–H), 1174.57 (C=S), 1245.93 (C–N). ^1H NMR (CDCl_3) δ : 12.48 (1H, s, NH), 9.07 (1H, s, NH), 7.54–7.87 (m, 4H, aroyl ring), 6.94–7.01 (m, 4H, aryl ring), 3.82 (3H, s, OCH_3), 3.88 (3H, s, OCH_3). DART-MS m/e (%): 317.15. Elemental analysis for $\text{C}_{16}\text{H}_{16}\text{N}_2\text{O}_3\text{S}$ (MW = 316.38) in wt% calc. C = 60.74, H = 5.09, N = 8.85, S = 10.14 and found to be C = 61.10, H = 5.45, N = 9.36, S = 9.36.

1-(4-Chlorobenzoyl)-3-(2-fluorophenyl) Thiourea (C16). Yield 67%, $R_f = 0.48$, M.P. 148–152°C, IR (KBr) ν (cm^{-1}): 1537.16 (C=C), 1666.38 (C=O), 3296.85 (N–H), 1201.57 (C=S), 1239.18 (C–N), 747.36 (C–Cl). ^1H NMR (CDCl_3) δ : 12.60 (1H, s, NH), 9.15 (1H, s, NH), 7.51–7.87 (m, 4H, aroyl ring), 7.15–7.2 (m, 4H, aryl ring). DART-MS m/e (%): 309.7. Elemental analysis for $\text{C}_{14}\text{H}_{10}\text{N}_2\text{OSClF}$ (MW = 308.76) in wt% calc. C = 54.46, H = 3.26, N = 9.07, S = 10.39 and found to be C = 54.60, H = 3.07, N = 9.20, S = 10.41.

1-(4-Methoxybenzoyl)-3-(2-fluorophenyl) Thiourea (C17). Yield 59%, $R_f = 0.30$, M.P. 122–126°C, IR (KBr) ν (cm^{-1}): 1504.38 (C=C), 1666.38 (C=O), 3294.19 (N–H), 1194.82 (C=S), 1028.95 (C–N). ^1H NMR (CDCl_3) δ : 12.76 (1H, s, NH), 9.11 (1H, s, NH), 7.02–7.89 (m, 4H, aroyl ring), 6.99–7.15 (m, 4H, aryl ring), 3.89 (3H, s, OCH_3). DART-MS m/e (%): 305.12. Elemental analysis for $\text{C}_{15}\text{H}_{13}\text{N}_2\text{O}_2\text{SF}$ (MW = 304.34) in wt% calc. C = 59.20, H = 4.30, N = 9.20, S = 10.55 and found to be C = 59.38, H = 4.30, N = 9.60, S = 10.83.

TABLE 2: Zone of inhibition for samples, standard, and control.

Comp. ID	<i>Escherichia coli</i>		<i>Staphylococcus aureus</i>	
	Zone of inhibition (in mm)	Relative inhibition zone diameter (in %)	Zone of inhibition (in mm)	Relative inhibition zone diameter (in %)
C1	11.7	72.7	10.9	71.2
C2	7.2	44.7	6.4	41.8
C3	10.6	65.8	9.0	58.8
C4	9.1	56.5	8.4	54.9
C5	14.2	88.2	13.1	85.6
C6	12.1	75.2	11.6	75.8
C7	8.4	52.2	7.9	51.6
C8	7.2	44.7	7.0	45.8
C9	11.5	71.4	10.4	68.0
C10	12.8	79.5	10.9	71.2
C11	7.4	46.0	7.9	51.6
C12	12.3	76.4	12.0	78.4
C13	6.4	39.8	6.0	39.2
C14	5.2	32.3	4.0	26.1
C15	5.7	35.4	4.2	27.5
C16	13.8	85.7	13.0	85.0
C17	10.6	65.8	9.4	61.4
C18	14.4	89.4	12.6	82.4
Standard	16.1	—	15.3	—
Control	Nil		Nil	

Standard: Sodium Penicillin G, Control: control (Solvent-DMSO).

1-(2-Chlorobenzoyl)-3-(2-chlorophenyl) Thiourea (C18). Yield 73%, $R_f = 0.35$, M.P. 170–174°C, IR (KBr) ν (cm^{-1}): 1537.16 (C=C), 1686.63 (C=O), 3325.30 (N–H), 1162.03 (C=S), 1162.03 (C–N), 756.04 (C–Cl). ^1H NMR (CDCl_3) δ : 12.55 (1H, s, NH), 9.39 (1H, s, NH), 7.43–7.83 (m, 4H, aroyl ring), 7.21–7.40 (m, 4H, aryl ring). DART-MS m/e (%): 325.04. Elemental analysis for $\text{C}_{14}\text{H}_{10}\text{N}_2\text{OSCl}_2$ (MW = 325.22) in wt% calc. C = 59.20, H = 4.30, N = 9.20, S = 10.55 and found to be C = 59.38, H = 4.30, N = 9.60, S = 10.83.

3. Results and Discussion

3.1. Chemistry. Synthesis of some 1-aroyle-3-aryl thioureas (C1–C18) was carried out by treating substituted benzoyl chloride with an equimolar quantity of potassium thiocyanate in acetone followed by reaction with an equimolar amount of substituted anilines to furnish the 1-aroyle-3-aryl thiourea derivatives.

The structures were confirmed by spectroscopic data and elemental analyses. FT-IR spectrum of synthesized thiourea derivatives exhibited identical trend of stretching frequency modes. Presence of peaks in the regions 3200–3250 cm^{-1} and 3320–3500 cm^{-1} indicates the existence of NH moiety and that of peaks in the regions 1665–1695 cm^{-1} and 1050–1200 indicates C=O and C=S moieties, respectively, in all the compounds. NMR spectra revealed the presence of characteristic broad singlets for HN(1) and HN(3) at 9 and 12 ppm,

respectively. Mass spectra of all the compounds displayed molecular ion peaks. Elemental analysis data are also in line with the theoretical values.

3.2. Antibacterial Activity. The synthesized compounds were assayed for their antibacterial activity against *Staphylococcus aureus* 6538 (gram-positive bacteria) and *Escherichia coli* 8739 (gram-negative bacteria) using paper disc diffusion method with Mueller-Hinton agar medium. Sodium Penicillin G was used as the reference antibacterial agent.

All the synthesized compounds inhibited the growth of bacteria with zone of inhibition ranging between 4.2 and 13.1 mm and 5.2 and 14.4 mm for gram-positive bacteria and gram-negative bacteria, respectively. These compounds were found to be more active against gram-negative bacteria as compared to gram-positive bacteria. The antibacterial activity of all the compounds observed against both microorganisms is shown in Table 2.

3.2.1. Staphylococcus aureus (Gram Positive). Amongst all these compounds, C5 (85.6%) substituted with chloro group on para position of aroyl ring and fluoro group on ortho position of aryl ring exhibits maximum percentage of relative zone of inhibition and C12 (78.4%), C16 (85%), and C18 (82.4%) also displayed significant antibacterial activity, while C14 (27.9%) containing fluoro and methoxy groups on para positions of aroyl and aryl ring, respectively, displayed the least

percentage of relative zone of inhibition as compared with the standard drug. Following is the antibacterial efficacy of synthesized compounds against *S. aureus*:

3.2.2. *E. coli* (Gram Negative). Amongst all these compounds, C18 (89.4%) carrying chloro groups on ortho positions of both aroyl and aryl rings displayed maximum antibacterial activity against *E. coli* and C5 (88.2%), C16 (85.7%), C10 (79.5%), and C12 (76.4%) exhibited significant percentage of relative zone of inhibition while C14 (32.3%) substituted with fluoro and methoxy groups on para positions of aroyl and aryl ring, respectively, displayed the least percentage of relative zone of inhibition as compared with the standard drug. Following is the antibacterial efficacy of synthesized compounds against *E. coli*:

The synthesized compounds exhibited potent inhibitory activity against the two strains compared to standard drugs at the tested concentrations. Compounds containing chloro group at ortho position on aryl ring and chloro at para and ortho positions of aroyl ring, respectively, (C5 and C18) prove to be the active against both gram-positive and gram-negative strains, while C14 (32.3%) substituted with fluoro and methoxy groups on para positions of aroyl and aryl ring, respectively, displayed the least percentage of relative zone of inhibition as compared with the standard drug against both *E. coli* and *S. aureus*. These observations suggested that presence of electron withdrawing group on aryl ring is crucial for antibacterial activity.

4. Conclusion

The title compounds were synthesized by treating substituted benzoyl chloride with an equimolar quantity of potassium thiocyanate in acetone followed by reaction with an equimolar amount of substituted anilines to furnish the 1-aroaryl-3-aryl thiourea derivatives. The synthesized thiourea derivatives were found to be more active against gram-negative bacteria as compared to gram-positive bacteria. Among the synthesized compounds, C5 and C18 exhibited maximum relative zone of inhibition against gram-positive and gram-negative strains of bacteria, respectively, as compared with the standard. These observations suggested that presence of electron withdrawing group on aryl ring is crucial for antibacterial activity.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

Acknowledgments

The authors acknowledge the Head, School of Pharmacy, and Honorable Vice-Chancellor, Devi Ahilya University, Indore, for providing facilities for the completion of this work.

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