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Synthesis and Characterization of Some Novel Chalcones containing 1,3,4-Oxadiazole as antibacterial agents

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Abstract: *A series of novel 3-(4-(5-amino-1,3,4-oxadiazol-2-yl)phenyl)-1-arylprop-2-en-1-one (chalcones) were obtained by treatment of 4-formyl benzoic acid with different substituted acetophenone followed by reaction with semicarbazide hydrochloride in presence of phosphorous oxychloride. The structures of isolated compounds were confirmed by 1H NMR, IR, LC-MS and elemental analyses. All the derivatives of chalcones were tested for their antibacterial activities against gram negative bacteria Escherichia coli and gram positive bacteria Bacillus subtilis, , Micrococcus luteus, Staphylococcus aureus.*

Keywords : *antibacterial activities, chalcones, oxadiazoles*

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I. Introduction

Chalcones are bichromophoric molecules separated by a keto-vinyl chain and constitute an important class of naturally occurring flavonoids exhibiting a wide spectrum of biological activities like antifungal[1], antibacterial[2] ,antituberculosis[3,4], antihypertensive[5], anticancer[6], anti-inflammatory[7], antihepatotoxic[8], antimalarial[9], hypoglycemic[10]. The presence of a reactive α,β-unsaturated keto functional group in chalcone is found to be responsible for their broad spectrum activity, which may be altered depending on the type and position of substituents on the aromatic rings.

Oxadiazoles are an important class of five-membered heterocyclic compounds and were found to have potential antimicrobial[11,12], anti-inflammatory[13,14], antipyretic[15], anticancer[16], antiviral[17], antidiabetic[18], antihypertensive[19] activity. The clinically effective drug[20] available in market having oxadiazole moiety are Raltegravir, Zibotintan, Furamizole, Tidazosin and Nesapidil have showed in Fig.1. On the basis of above observations, it was thought of interest to synthesize some new chalcones having oxadiazole moiety starting from chalcones and semicarbazide hydrochloride in presence of phosphorous oxychloride. The antibacterial activity of these newly synthesized compounds against gram negative bacteria *Escherichia coli*, and gram positive bacteria *Bacillus subtilis, Micrococcus luteus* and *Staphylococcus aureus* has been discussed in present work.

II. Experimental

Melting points were determined on Jindal SM capillary melting point apparatus. IR spectra in KBr were recorded using potassium bromide disks on a Perkin-Elmer Spectrum (SAIF CDRI) and ^{1}H NMR spectra in DMSO-d6 on 400 MHz spectrometer. The purity of the compounds was checked by thin layer chromatography (TLC) on Merck aluminum-packed silica gel plates. All solvents like ethanol (for synthesis), DMSO (for antibacterial activity) and hexane, ethyl acetate, acetone (for mobile phase of TLC) were of the highest purity and anhydrous. 4-formyl benzoic acid, Phosphorous oxychloride and all acetophenones were purchased from Sigma aldrich.

All chalcones were screened for their in vitro antibacterial activity against the standard strains of one Gram-negative bacteria: *Escherichia coli* (NCIM 5346), and three Gram-positive bacteria: *Bacillus subtilis* (NCIM 2920), *Micrococcus luteuzs* (NCIM 5262) and *Staphylococcus aureus* (NCIM 5345). Respective minimum inhibitory concentration (MICs) value was determined by well-diffusion method[21].

2.1 General Procedure: 4-(3-oxo-3-arylprop-1-enyl) benzoic acid (1a-j):

A solution of 4-formyl benzoic acid (0.01 mole) and substituted acetophenones (0.01 mole) in ethanol (20 mL) was cooled to 5-10^0 C in an ice bath. The cooled solution was treated with aqueous solution of sodium hydroxide (0.02 mole). The reaction mixture was stirred on magnetic stirrer for 30 min in cooling then left

overnight at room temperature. The resulting dark orange solution was diluted with ice water then acidified with diluted hydrochloric acid. The precipitate thus obtained were filtered, washed with water and then recrystallized with ethanol.

4-(3-oxo-3-phenylprop-1-enyl)benzoic acid (1a): Yield: 89%; mp: 150°C; IR (KBr,cm^{-1}): 1685 (C=O), 1605 (C=C), 3021 (OH), 2920 (Ar–CH); ^{1}H NMR (400 MHz, DMSO-d_6) δ ppm: 8.19 (d, 1H, =CH-Ar), 7.59 (d, 1H, -CO-CH=), 7.57-8.08 (m, 9H, Ar-H); ESI: ($M+H^+$) 253, Anal. Cald. For $C_{16}H_{12}O_3$: C: 76.18, H: 4.79. Found: C: 76.16, H: 4.76.

4-(3-oxo-3-p-tolylprop-1-enyl)benzoic acid (1b): Yield: 86%; mp: 225°C; IR (KBr,cm^{-1}): 1683 (C=O), 1602 (C=C), 3021 (OH), 2923 (Ar–CH); ^{1}H NMR (400 MHz, DMSO-d_6) δ ppm: 2.40 (s, 3H, CH_3), 8.15 (d, 1H, =CH-Ar), 7.96 (d, 1H, -CO-CH=), 7.25-7.96 (m, 8H, Ar-H); ESI: ($M+H^+$) 267; Anal. Cald. For $C_{17}H_{14}O_3$: C: 76.68, H: 5.30. Found: C: 76.65, H: 5.26.

4-(3-(4-bromophenyl)-3-oxoprop-1-enyl)benzoic acid (1c): Yield: 76%; mp: 190°C; IR (KBr,cm^{-1}): 1685 (C=O), 1607 (C=C), 3026 (OH), 2925 (Ar–CH); ^{1}H NMR (400 MHz, DMSO-d_6) δ ppm: 8.13 (d, 1H, =CH-Ar), 7.57 (d, 1H, -CO-CH=), 7.10-7.99 (m, 8H, Ar-H); ESI: ($M+H^+$) 331, Anal. Cald. For $C_{16}H_{11}BrO_3$: C: 58.03, H: 3.35. Found: C: 58.01, H: 3.34.

4-(3-(4-chlorophenyl)-3-oxoprop-1-enyl)benzoic acid (1d): Yield: 74%; mp: 220°C; IR (KBr,cm^{-1}): 1682 (C=O), 1610 (C=C), 3026 (OH), 2926 (Ar–CH); ^{1}H NMR (400 MHz, DMSO-d_6) δ ppm: 8.12 (d, 1H, =CH-Ar), 7.62 (d, 1H, -CO-CH=), 7.39-7.89 (m, 8H, Ar-H); ESI: ($M+H^+$) 287, Anal. Cald. For $C_{16}H_{11}ClO_3$: C: 67.03, H: 3.87. Found: C: 67.00, H: 3.84.

4-(3-(4-fluorophenyl)-3-oxoprop-1-enyl)benzoic acid (1e): Yield: 81%; mp: 270°C; IR (KBr,cm^{-1}): 1682 (C=O), 1605 (C=C), 3022 (OH), 2923 (Ar–CH); ^{1}H NMR (400 MHz, DMSO-d_6) δ ppm: 8.13 (d, 1H, =CH-Ar), 7.62 (d, 1H, -CO-CH=), 7.41-7.91 (m, 8H, Ar-H); ESI: ($M+H^+$) 271, Anal. Cald. For $C_{16}H_{11}FO_3$: C: 71.11, H: 4.10. Found: C: 71.08, H: 4.06.

4-(3-(3-nitrophenyl)-3-oxoprop-1-enyl)benzoic acid (1f): Yield: 85%; mp: 195°C; IR (KBr,cm^{-1}): 1683 (C=O), 1609 (C=C), 3025 (OH), 2922 (Ar–CH); ^{1}H NMR (400 MHz, DMSO-d_6) δ ppm: 8.13 (d, 1H, =CH-Ar), 7.59 (d, 1H, -CO-CH=), 7.52-8.61 (m, 8H, Ar-H); ESI: ($M+H^+$) 298, Anal. Cald. For $C_{16}H_{11}NO_5$: C: 64.65, H: 3.73, N: 4.71. Found: C: 64.62, H: 3.70, N: 4.69.

4-(3-(4-methyl-3-nitrophenyl)-3-oxoprop-1-enyl)benzoic acid (1g): Yield: 75%; mp: 252°C; IR (KBr,cm^{-1}): 1685 (C=O), 1605 (C=C), 3025 (OH), 2926 (Ar–CH); ^{1}H NMR (400 MHz, DMSO-d_6) δ ppm: 2.39 (s, 3H, CH_3), 8.10 (d, 1H, =CH-Ar), 7.60 (d, 1H, -CO-CH=), 7.50-8.39 (m, 7H, Ar-H);. ESI: ($M+H^+$) 312, Anal. Cald. For $C_{17}H_{13}NO_5$: C: 65.59, H: 4.21, N: 4.50. Found: C: 65.57, H: 4.19, N: 4.46.

4-(3-(4-bromo-3-nitrophenyl)-3-oxoprop-1-enyl)benzoic acid (1h): Yield: 71%; mp: 212°C; IR (KBr,cm^{-1}): 1683 (C=O), 1610 (C=C), 3022 (OH), 2922 (Ar–CH); ^{1}H NMR (400 MHz, DMSO-d_6) δ ppm: 8.13 (d, 1H, =CH-Ar), 7.62 (d, 1H, -CO-CH=), 7.50-8.51 (m, 7H, Ar-H); ESI: ($M+H^+$) 376, Anal. Cald. For $C_{16}H_{10}BrNO_5$: C: 51.09, H: 2.68, N: 3.72. Found: C: 51.02, H: 2.65, N: 3.68.

4-(3-(4-chloro-3-nitrophenyl)-3-oxoprop-1-enyl)benzoic acid (1i): Yield: 73%; mp: 242°C; IR (KBr,cm^{-1}): 1686 (C=O), 1609 (C=C), 3023 (OH), 2924 (Ar–CH); ^{1}H NMR (400 MHz, DMSO-d_6) δ ppm: 8.10 (d, 1H, =CH-Ar), 7.60 (d, 1H, -CO-CH=), 7.55-8.69 (m, 7H, Ar-H); ESI: ($M+H^+$) 332, Anal. Cald. For $C_{16}H_{10}ClNO_5$: C: 57.93, H: 3.04, N: 4.22. Found: C: 57.91, H: 3.01, N: 4.22.

4-(3-(4-fluoro-3-nitrophenyl)-3-oxoprop-1-enyl)benzoic acid (1j): Yield: 75%; mp: 251°C; IR (KBr,cm^{-1}): 1682 (C=O), 1609 (C=C), 3023 (OH), 2922 (Ar–CH); ^{1}H NMR (400 MHz, DMSO-d_6) δ ppm: 8.09 (d, 1H, =CH-Ar), 7.60 (d, 1H, -CO-CH=), 7.55-8.69 (m, 7H, Ar-H); ESI: ($M+H^+$) 316, Anal. Cald. For $C_{16}H_{10}FNO_5$: C: 60.96, H: 3.20, N: 4.44. Found: C: 60.92, H: 3.19, N: 4.42.

2.2 General Preocedure: 3-(4-(5-amino-1,3,4-oxadiazol-2-yl)phenyl)-1-arylprop-2-en-1-one (2a-j)

A stirring mixture of 4-(3-oxo-3-phenylprop-1-enyl) benzoic acid (0.003 mol), semicarbazide (0.003 mol) and phosphorus oxychloride (10 ml) was heated at 75 °-80°C for 45 h. After cooling to room temperature, water was added and the reaction mixture was further refluxed for 4-5 h. After cooling, the mixture was neutralized by the addition of potassium hydroxide solution under stirring. Thus obtained precipitate was filtered then dissolved in ethyl acetate, washed with saturated solution of sodium bicarbonate followed by water. Organic layer was distilled and solid obtained was recrystallized with ethanol.

3-(4-(5-amino-1,3,4-oxadiazol-2-yl)phenyl)-1-phenylprop-2-en-1-one (2a): Yield: 75%; mp: 120°C; IR (KBr,cm^{-1}) 3348, 3268 (NH_2), 1662 (C=O), 1601 (C=C), 1508 (C=N), 1068 (C-O-C); ^{1}H NMR (400 MHz, DMSO-d_6) δ ppm: 8.04 (d, 1H, =CH-Ar), 7.56 (d, 1H, -CO-CH=), 7.33-7.97 (m, 9H, Ar-H) ESI: ($M+H^+$) 292, Anal. Cald. For $C_{17}H_{13}N_3O_2$: C: 70.09, H: 4.50, N: 14.42. Found: C: 70.07, H: 4.46, N: 14.40.

3-(4-(5-amino-1,3,4-oxadiazol-2-yl)phenyl)-1-p-tolylprop-2-en-1-one (2b): Yield: 76%; mp: 218°C; IR (KBr,cm^{-1}): 3583, 3019 (NH_2), 1659 (C=O), 1601 (C=C), 1508 (C=N), 1073 (C-O-C); ^{1}H NMR (400 MHz, DMSO-d_6) δ ppm: 2.40 (s, 3H, CH_3), 8.15 (d, 1H, =CH-Ar), 7.96 (d, 1H, -CO-CH=), 7.29-7.96 (m, 8H, Ar-H);

ESI: ($M+H^+$) 306, Anal. Cald. For $C_{18}H_{15}N_3O_2$: C: 70.81, H: 4.95, N: 13.76. Found: C: 70.79, H: 4.91, N: 13.75.

3-(4-(5-amino-1,3,4-oxadiazol-2-yl)phenyl)-1-(4-bromophenyl)prop-2-en-1-one (2c): Yield: 78%; mp: 230°C; IR (KBr,cm^{-1}): 3413 (NH_2), 1651 (C=O), 1601 (C=C), 1593 (C=N), 1027 (C-O-C); ^{1}H NMR (400 MHz, DMSO-d_6) δ ppm: 8.13 (d, 1H, =CH-Ar), 7.57 (d, 1H, -CO-CH=), 7.10-7.99 (m, 8H, Ar-H); ESI: ($M+H^+$) 370, Anal. Cald. For $C_{17}H_{12}BrN_3O_2$: C: 55.15, H: 3.27, N: 11.35. Found: C: 55.12, H: 3.26, N: 11.31.

3-(4-(5-amino-1,3,4-oxadiazol-2-yl)phenyl)-1-(4-chlorophenyl)prop-2-en-1-one (2d): Yield: 78%; mp: 230°C; IR (KBr,cm^{-1}): 3420 (NH_2), 1652 (C=O), 1602 (C=C), 1595 (C=N), 1029 (C-O-C); ^{1}H NMR (400 MHz, DMSO-d_6) δ ppm: 8.12 (d, 1H, =CH-Ar), 7.62 (d, 1H, -CO-CH=), 7.39-7.89 (m, 8H, Ar-H); ESI: ($M+H^+$) 326, Anal. Cald. For $C_{17}H_{12}ClN_3O_2$ C: 62.68, H: 3.71, N: 12.90. Found: C: 62.65, H: 3.69, N: 12.86.

3-(4-(5-amino-1,3,4-oxadiazol-2-yl)phenyl)-1-(4-fluorophenyl)prop-2-en-1-one (2e): Yield: 71%; mp: 210°C; IR (KBr,cm^{-1}): 3410 (NH_2), 1655 (C=O), 1601 (C=C), 1591 (C=N), 1029 (C-O-C); ^{1}H NMR (400 MHz, DMSO-d_6) δ ppm: 8.13 (d, 1H, =CH-Ar), 7.62 (d, 1H, -CO-CH=), 7.41-7.91 (m, 8H, Ar-H); ESI: ($M+H^+$) 310, Anal. Cald. For $C_{17}H_{12}FN_3O_2$ C: 66.02, H: 3.91, N: 13.59. Found: C: 66.01, H: 3.86, N: 13.57.

3-(4-(5-amino-1,3,4-oxadiazol-2-yl)phenyl)-1-(3-nitrophenyl)prop-2-en-1-one (2f): Yield: 75%; mp: 215°C; IR (KBr,cm^{-1}): 3348, 3268 (NH_2), 1662 (C=O), 1602 (C=C), 1508 (C=N), 1068 (C-O-C); ^{1}H NMR (400 MHz, DMSO-d_6) δ ppm: 8.13 (d, 1H, =CH-Ar), 7.59 (d, 1H, -CO-CH=), 7.52-8.61 (m, 8H, Ar-H); ESI: ($M+H^+$) 337, Anal. Cald. For $C_{17}H_{12}N_4O_4$ C: 60.71, H: 3.60, N: 16.66. Found: C: 60.69, H: 3.60, N: 16.62.

3-(4-(5-amino-1,3,4-oxadiazol-2-yl)phenyl)-1-(4-methyl-3-nitrophenyl)prop-2-en-1-one (2g): Yield: 72%; mp: 225°C; IR (KBr,cm^{-1}): 3410 (NH_2), 1655 (C=O), 1601 (C=C), 1591 (C=N), 1029 (C-O-C); ^{1}H NMR (400 MHz, DMSO-d_6) δ ppm: 2.39 (s, 3H, CH_3), 8.10 (d, 1H, =CH-Ar), 7.60 (d, 1H, -CO-CH=), 7.50-8.39 (m, 7H, Ar-H); ESI: ($M+H^+$) 351, Anal. Cald. For $C_{18}H_{14}N_4O_4$ C: 61.71, H: 4.03, N: 15.99. Found: C: 61.68, H: 4.02, N: 15.97.

3-(4-(5-amino-1,3,4-oxadiazol-2-yl)phenyl)-1-(4-bromo-3-nitrophenyl)prop-2-en-1-one (2h): Yield: 74%; mp: 228°C; IR (KBr,cm^{-1}): 3420 (NH_2), 1652 (C=O), 1601 (C=C), 1595 (C=N), 1029 (C-O-C); ^{1}H NMR (400 MHz, DMSO-d_6) δ ppm: 8.13 (d, 1H, =CH-Ar), 7.62 (d, 1H, -CO-CH=), 7.50-8.51 (m, 7H, Ar-H); ESI: ($M+H^+$) 416, Anal. Cald. For $C_{17}H_{11}BrN_4O_4$ C: 49.18, H: 2.67, N: 13.49. Found: C: 49.14, H: 2.63, N: 13.46.

3-(4-(5-amino-1,3,4-oxadiazol-2-yl)phenyl)-1-(4-chloro-3-nitrophenyl)prop-2-en-1-one (2i): Yield: 76%; mp: 201°C; IR (KBr,cm^{-1}): 3413 (NH_2), 1651 (C=O), 1602 (C=C), 1593 (C=N), 1027 (C-O-C); ^{1}H NMR (400 MHz, DMSO-d_6) δ ppm: 8.10 (d, 1H, =CH-Ar), 7.60 (d, 1H, -CO-CH=), 7.55-8.69 (m, 7H, Ar-H); ESI: ($M+H^+$) 371, Anal. Cald. For $C_{17}H_{11}ClN_4O_4$ C: 55.07, H: 2.99, N: 15.11. Found: C: 55.06, H: 2.96, N: 15.10.

3-(4-(5-amino-1,3,4-oxadiazol-2-yl)phenyl)-1-(4-fluoro-3-nitrophenyl)prop-2-en-1-one (2j): Yield: 72%; mp: 211°C; IR (KBr,cm^{-1}): 3410 (NH_2), 1655 (C=O), 1601 (C=C), 1591 (C=N), 1029 (C-O-C); ^{1}H NMR (400 MHz, DMSO-d_6) δ ppm: 8.09 (d, 1H, =CH-Ar), 7.60 (d, 1H, -CO-CH=), 7.55-8.69 (m, 7H, Ar-H); ESI: ($M+H^+$) 355, Anal. Cald. For $C_{17}H_{11}FN_4O_4$ C: 57.63, H: 3.13, N: 15.81. Found: C: 57.62, H: 3.10, N: 15.79.

2.3 Antibacterial Activity

All the synthesized compounds were tested against four different microorganisms; *Escherichia coli, Bacillus subtilis, Micrococcus luteus, Staphylococcus aureus*. The agar well-diffusion method[21] was applied for the determination of inhibition zones and minimum inhibitory concentrations (MICs). 7.0 gm nutrient agar medium were mixed with 250 mL double distilled water and autoclaved then poured into a 90 mm sterile Petri plate. The medium was allowed to solidify, and 8 mm wells were dug with a sterile metallic borer. Then DMSO solution of the test sample (5 mg/mL, 2.5 mg/mL, 1.25 mg/mL, 0.62 mg/mL, 0.31 mg/mL, and 0.15 mg/mL) was added to the respective wells. Ciprofloxacin was used as a standard drug. Each bacterial strain was prepared in triplicates plates and were incubated at 37 °C for 24 h. The minimum concentration at which compound showed inhibition zone were recorded as minimum inhibitory concentration .The activity was determined by measuring the diameter of zone showing complete inhibition (mm), thereby, the zones were precisely measured with the aid of a Vernier Caliper (precision 0.1 mm). The growth inhibition was calculated with reference to the positive control.

III. Results And Discussion

The synthetic routes of syntesized compounds are depicted in Scheme 1. The starting chalcones 1a-j were prepared in good yields by conventional Claisen-Schmidt condensation by reacting 4-formyl benzoic acid and substituted acetophenones in the presence of a base. In this paper, we reported that reaction of chalcones 1a-j with semicarbazide hydrochloride in presence of phosphorous oxychloride gave the corresponding oxadiazoles 2a-j. The structures of the isolated compounds were determined by LC-MS, IR and 1H-NMR spectra.

1.4 IR Spectra

The IR band of (1a-j) revealed characteristic bands for -CH=CH- at 1,602-1,610 cm^{-1} and OH of COOH at 3,021-3,025 cm^{-1}. 1a-j also revealed the C=O band at 1,682-1,685 cm^{-1}, Ar-CH band at 2,920-2,926 cm^{-1}. The IR of the 2a-j revealed characteristic bands for -CH=CH- at 1,601-1,602 cm^{-1}, C=N at 1,508–1,595 cm^{-1},

C=O at 1,651–1,662, primary amines at 3,583-3,348 cm−1. Peak of COOH in starting material chalcones appeared at 3,021-3,025 cm^{-1} which was disappeared in products, clearly indicate that COOH has converted into oxadiazoles moiety. Several new peaks of C-O-C at 1,027-1,073 cm^{-1} also supports the formation of product.

1.5 1H NMR Spectra

The 1H-NMR spectra of 1a-j showed the multiplet at δ = 7.10- 8.39 ppm characteristic for the aromatic protons and a doublet at δ = 8.09- 8.19 ppm , δ = 7.57- 7.96 ppm for (=CH-Ar) and (-CO-CH=) respectively. Some derivatives like 1b and 1g showed singlet at 2.40 and 2.39 respectively for CH_3 group. The 1H-NMR spectra of 2a-j showed the multiplet at δ = 7.10–8.69 ppm characteristic for the aromatic protons and a doublet at δ = 8.09 - 8.15 ppm, δ = 7.56- 7.96 ppm for (=CH-Ar) and (-CO-CH=) respectively. Some derivatives like 2b and 2g showed singlet at 2.40 and 2.39 respectively for CH_3 group.

2.6 Mass Spectra

The mass spectra of all compounds showed a fragment ion peak at their m/z value, which is consistent with the expected protonated ion ($M+H^+$).

2.7 Antibacterial activity

The in vitro antibacterial activities of chalcones (1a-j) and their correspondind oxadiazoles (2a-j) were tested against four test organisms *Escherichia coli, Bacillus subtilis, Micrococcus luteus, Staphylococcus aureus* following the agar well-diffusion method and using ciprofloxacin as standard drugs. The tested compounds showed significant effect against all tested bacteria (Fig. 2.).

Compounds showed moderate to good inhibition zone against all tested bacteria (Fig. 3.) The maximum activity (++++++; MIC = 0.15 mg/mL) was indicated for compounds 2c, 2d, 2e, 2f, 2g, 2h, 2i and 2j against all tested bacterial strain. These results suggest that electron-withdrawing groups (X =Br, Cl, F and NO_2) in the oxadiazoles compounds play an important role in enhancing the activity. While the compounds 1c, 1d, 1e, 1f and 1g showed moderate activity (++++; MIC= 0.62 mg/mL) against *Bacillus subtilis* and *Micrococcus luteus*. These compounds are also active against *Escherechia coli* and *Staphylococcus aureus* (+++; MIC=1.25 mg/mL). These findings clearly indicate that presence of oxadiazole moieties with chalcones increases the activity upto some extent. Compounds 1a and 1b towards all tested bacteria while 2a towards *Bacillus subtilis* and and 2a, 2b towards *Micrococcus luteus* showed slight activity. Compound 2a for *Escherechia coli* and *Staphylococcus aureus* and 2b towards *Bacillus subtilis*, *Escherechia coli* and *Staphylococcus aureus* showed moderate activity (+++; MIC= 1.25 mg/mL).

IV. Figures And Tables

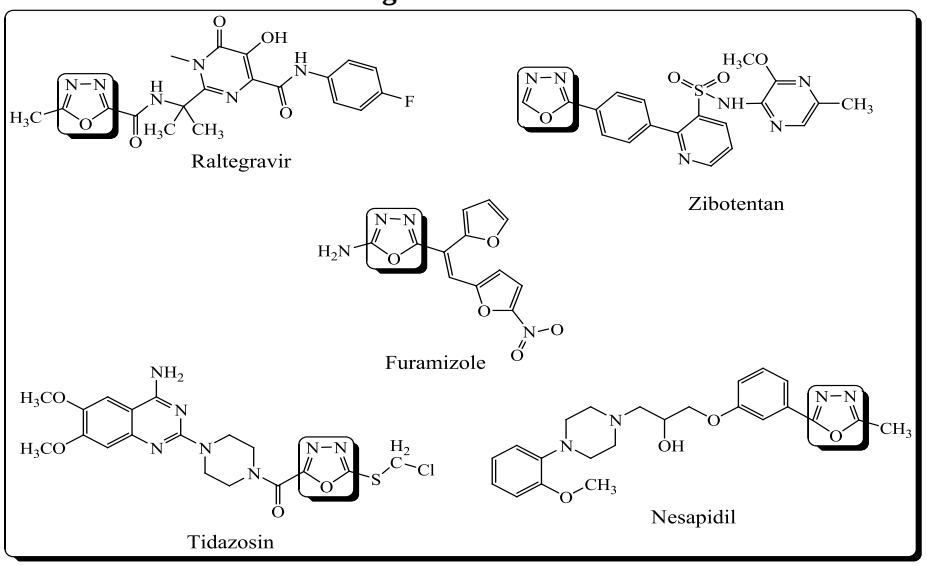


Fig. 1: Clinically effective drug having oxadiazole moiety.

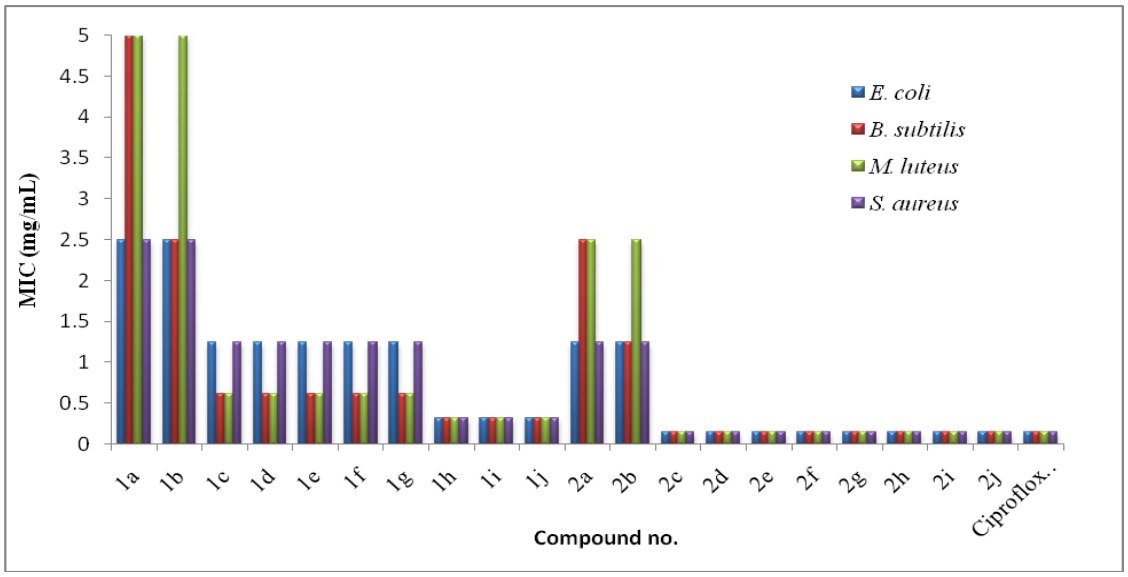


Fig. 2. Antibacterial activities of synthesized compounds 1a-j and 2a-j

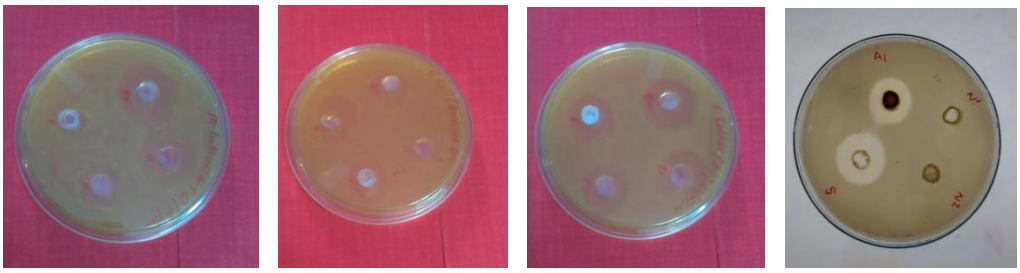
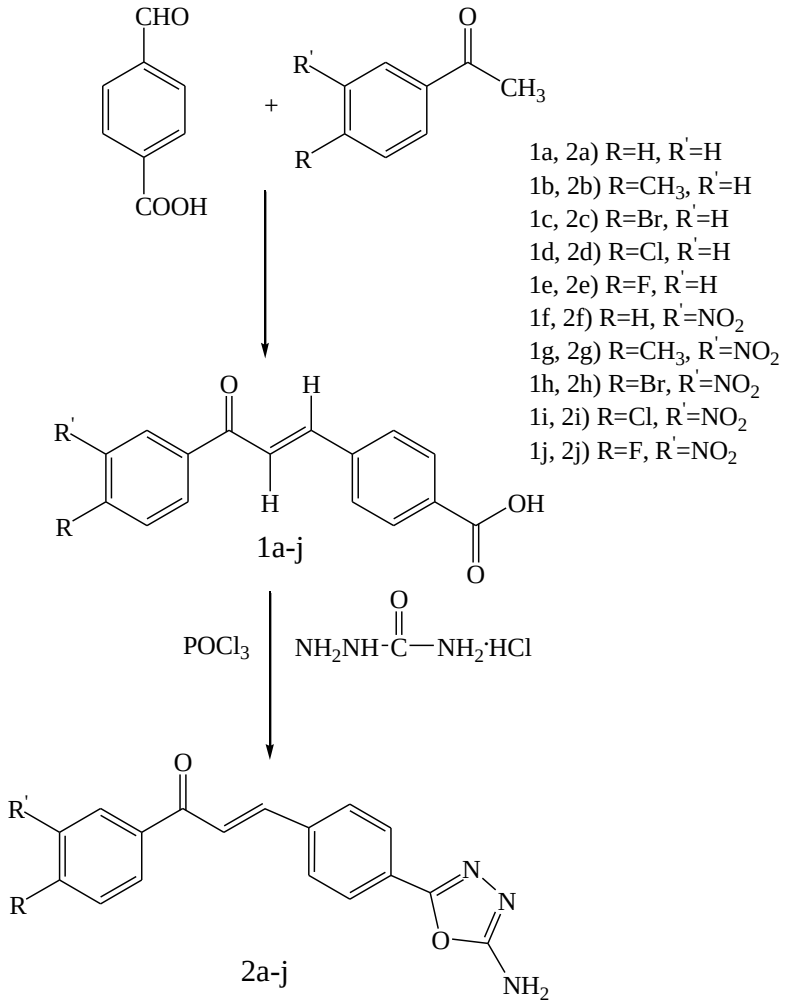


Fig. 3. Plate showing inhibition zone against all tested bacteria

Table 1. Antibacterial activities of synthesized compounds 1a-j and 2a-j

Compound	R	R`	*Gram negative*	*Gram positive*		
			E.coli	*B.subtilis*	*M.luteus*	*S.aureus*
1a	H	H	+ +	+	+	+ +
1b	CH_3	H	+ +	+ +	+	+ +
1c	Br	H	+ + +	+ + + +	+ + + +	+ + +
1d	Cl	H	+ + +	+ + + +	+ + + +	+ + +
1e	F	H	+ + +	+ + + +	+ + + +	+ + +
1f	H	NO_2	+ + +	+ + + +	+ + + +	+ + +
1g	CH_3	NO_2	+ + +	+ + + +	+ + + +	+ + +
1h	Br	NO_2	+ + + + +	+ + + + +	+ + + + +	+ + + + +
1i	Cl	NO_2	+ + + + +	+ + + + +	+ + + + +	+ + + + +
1j	F	NO_2	+ + + + +	+ + + + +	+ + + + +	+ + + + +
2a	H	H	+ + +	++	+ +	+ + +
2b	CH_3	H	+ + +	+ + +	+ +	+ + +
2c	Br	H	+ + + + + +	+ + + + + +	+ + + + + +	+ + + + + +
2d	Cl	H	+ + + + + +	+ + + + + +	+ + + + + +	+ + + + + +
2e	F	H	+ + + + + +	+ + + + + +	+ + + + + +	+ + + + + +
2f	H	NO_2	+ + + + + +	+ + + + + +	+ + + + + +	+ + + + + +
2g	CH_3	NO_2	+ + + + + +	+ + + + + +	+ + + + + +	+ + + + + +
2h	Br	NO_2	+ + + + + +	+ + + + + +	+ + + + + +	+ + + + + +
2i	Cl	NO_2	+ + + + + +	+ + + + + +	+ + + + + +	+ + + + + +
2j	F	NO_2	+ + + + + +	+ + + + + +	+ + + + + +	+ + + + + +
Ciprofloxacin			+ + + + + +	+ + + + + +	+ + + + + +	+ + + + + +

++++++ (MIC = 0.15mg /mL) and +++++ (MIC = 0.32 mg/mL) for high activity; ++++ (MIC = 0.62 mg/mL) and +++ (MIC = 1.25 mg/mL) for moderate activity; ++ (MIC = 2.5 mg/mL) and + (MIC = 5.0 mg/mL) for slight activity.



Scheme 1.

V. Conclusion

A series of novel 3-(4-(5-amino-1,3,4-oxadiazol-2-yl)phenyl)-1-arylprop-2-en-1-one (chalcones) were synthesiszed. The structures of isolated compounds were confirmed by several spectral techniques (1H NMR, IR, LC-MS and elemental analyses). The preparation of novel chalcones involved one pot synthesis which is time saving. All the derivatives of chalcones which were tested for their antibacterial activities against several microorganism and showed moderate to good activities. The presence of keto ethylinic group and oxadiazole core together increased the activity of compounds which is clear from MICs value.

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