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Synthesis and Characterization of Some New Pyrazole, Triazole, Oxadiazole, Thiazole, Thiadiazole Derivatives Bearing p-Toluenesulfonamide

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Abstract

A series of new heterocyclic derivatives A5-A15 have been synthesized using 4-(toluene-4-sulfinylamino)-benzoic acid ethyl ester A2 as a predecessor. This compound A2 was successfully used in synthesis of some new derivatives of oxadiazole, pyrazole, triazole, thiadiazole, thiazole and fused heterocyclic containing p-toluene sulfonamide moiety that supposed to have important biological activities. ^{1}H-NMR, ^{13}C-NMR and FT-IR spectroscopy were used to confirm the prepared compounds.

Keywords: Benzene sulfonamide, Oxadizole, pyrazole, Thiazole, Triazole.

Introduction

Hydrazide derivatives are considered to be important compounds that have an important role in organic and medical chemistry, where they attract a big interest by researchers through the past years because of their effective biological activities, including antimicrobials [1], anticancer [2], anti-tuberculosis [3], antivirals [4], anti HIV [5], antifungals [6], antimalarial [7], and anti-inflammatory [8].

Sulfonamides have also been used as protective agents in chemotherapy against various diseases, as many drugs that contain sulfa drugs used as antibacterial, anti-fungal [9], anti-inflammatory [10], anti-cancer [11], and an effective treatment for ulcerative colitis , alzheimer's [12], HIV [13], as well as in the treatment of infections of the urinary tract, intestines, eyes, and obesity [14].

1,3,4-oxadiazole derivatives have a broad spectrum of biological activity such as anti-inflammatory, analgesic [15], antibacterial [16], antiviral [17], blood pressure-lowering properties [18] and anticancer [19].

In addition, the other compounds have also important importance, for example 1,3,4-thiadiazole. The derivatives of 1,3,4-thiadiazole are used as antibacterial [20], antifungal [21], anticancer [22], and antiparasitic [23]. While, triazole derivatives work as antimicrobial, antioxidant, anti-urease [24], anticancer [25].

Consequently, as the important biological activity of the mentioned compounds, herein we report the newly synthesized compounds that can be effective as anticancer medicines and have biological activities, our current research plan is an extension of our magnificent efforts across design and flexible protocol toward the synthesis to prepare these important compounds such as some new pyrazole, triazole, oxadiazole, thiazole, thiadiazole derivatives

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bearing *p*-toluenesulfonamide shown in the schemes 1,2.

Materials and Methods

Melting points were achieved by using Electro-thermal SMP30- Stuart melting point apparatus ,(uncorrected). (^{1}H-NMR & ^{13}C-NMR) spectra were recorded using, Bruker Bio Spin GmbH Spectrophotometer (400 MHz by using TMS as internal standard and using DMSO-d6 as a solvent) [(s) singlet, (d) doublet, (m) multiplet]. (FT-IR) spectra were measured using a Japanese-made device (Shimadzu FT-IR-ATR) in a region confined between 400-4000 cm^{-1}.

Preparation of 4-amino benzoic Ethyl Ester A1

A mixture of *p*-amino benzoic acid (1.0 g, 0.007 mole) and H_2SO_4 (1 mL) and absolute ethanol (10 mL) was stirred at reflux for 4 hrs., then the mixture was added to crushed ice with stirring and ammonia solution was added to adjust (PH = 7), the formed precipitate was filtered off, then washed several times with water and dried.

White solid (ethanol), (0.96 g, 80 %), m.p. = 88-91°C. FT-IR ν (cm^{-1}): 3423, 3350 (NH_2), 2900 (CH_3), 1690 (C=O), 1514 (C=C aromatic).

Preparation of 4-(Toluene-4-sulfinylamino)-benzoic Acid Ethyl Ester A2

To a solution of ethyl 4-amino benzoate **A1** (0.5 g, 0.003 mole) in (5mL) of chloroform was added (6 drops) of *N*-methyl piperidine with constant stirring. A solution of *p*-toluene sulfonyl chloride (0.55 g, 0.003 mole) in (5 mL) of chloroform was added drop wise to the previous solution and the mixture was stirred for one hr. The solvent was removed under vacuum pressure. Then 2 mL of 10% sodium bicarbonate was added, and the mixture was cooled in an ice to form a pasty precipitate which was treated by adding ethanol with stirring to give a yellow precipitate, then filtered off and recrystallized with ethanol to obtain white crystals.[26]

White crystals (ethanol), (0.86 g, 89 %), m.p. = 173-175 °C. FT-IR ν (cm^{-1}): 3219 (NH), 2875 (CH_3), 1693 (C=O), 1512 (C=C aromatic), 1369, 1182 (SO_2).

Synthesis of 4-methyl-benzenesulfinic Acid (4-hydrazinocarbonyl-phenyl) Amide A3

A mixture of benzene sulfonamide ester **A2** (3.5 g, 0.011 mole) and excess of hydrazine hydrate (2.75 g, 0.055 mole) in (20 mL) of absolute ethanol was refluxed for 3 h. Then the mixture was concentrated to the half and left until the formation of the precipitate, then filtered off and recrystallized with ethanol.[27, 28]

White crystals (ethanol), (2.54 g, 76 %), m.p. = 200-203°C. FT-IR ν (cm^{-1}): 3400, 3310 (NH_2), 3200 (NH), 2873 (CH_3), 1689 (C=O), 1608 (C=C), 1345, 1172 (SO_2). ^{1}H-NMR (DMSO-d6, 400 MHz) δ (ppm): 2.33 [s, 3H, -CH_3], 4.24 [s, 2H, -NH_2], 7.22-7.24, 7.71-7.73[d-d, *J*= 8 Hz, 4H, Ar_1-H], 7.35-7.37, 7.81-7.83[d-d, *J*= 8 Hz, 4H, Ar_2-H] AB system, 10.79 [s, 1H, SO_2-NH-].^{13}C-NMR (DMSO-d6, 100 MHz) δ (ppm): 21.4, 118.5, 125.0, 127.2, 130.3, 131.0, 136.8, 142.8, 144.1, 165.6

Synthesis of Potassium *N'*-[4-(Toluene-4-sulfonylamino)-benzoyl] hydrazine-1-carbodithioate A4

A solution of KOH (1.12 g, 0.02 mole) in 20 mL of absolute EtOH was slowly added with stirring to (3.05 g, 0.01 mole) of hydrazide **A3** in (30mL) of absolute EtOH in an ice bath, followed by drop wise addition of carbon disulfide (3.6 mL, 0.04 mole). The mixture was stirred for 24 hrs. at room temperature, to produce white precipitate which was filtered off, washed with cold dry ether and dried. [27]

White solid, (3.1 g, 73%), m.p. = decomposed. FT-IR ν (cm^{-1}): 3446 (NH),3034 (=CH), 2981 (CH3), 1689 (C=O), 1600 (C=C), 1367, 1176 (SO2), 1085 (C=S).

Synthesis of *N*-[4-(5-Mercapto-[1,3,4]oxadiazol-2-yl)-phenyl]-4-methyl-benzenesulfonamide A5

This compound was prepared in two ways:

Method A:

To a solution of hydrazide **A3** (1.42 g, 0.00465 mole) in 30 mL ethanol/THF ratio (1:1) was added a

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solution of KOH (0.26 g, 0.00465 mole) in 20 mL ethanol, followed by the addition of CS2 (1.77 g., 0.0233 mole). The mixture was refluxed for 8 hrs., after that , the solvent was evaporated, then diluted HCl was added until a precipitate was formed. The precipitate was filtered, washed with water, dried and recrystallized with ethanol, (1.2 g, 74 %). [29]

Method B:

A solution of compound A4 (1 g) in 20 mL of absolute ethanol was refluxed for 10 hrs. until the removal of H_2S [identified by paper soaked with $Pb(CH_3COO)_2$]. After that, the mixture was concentrated to the half, and a small amount of water was added, after which it was acidified with HCl conc., to form precipitate which was filtered, washed with water, dried and recrystallized from ethanol.

white solid, (0.72 g, 87%), m.p= 203-205 °C. FT-IR ν (cm^{-1}): 1294, 1091 (C-O-C), 1338, 1157 (SO_2), 1606 (C=C) aromatic, 1691 (C=N), 2496 (SH), 2943 (CH_3), 3213 (NH). ^{1}H-NMR (DMSO-d6, 400 MHz) δ (ppm): 2.33 [s, 3H, -CH3], 4.24 [s, H, -SH], 7.22-7.37 [d-d, *J*= 60 Hz, 4H, Ar_1-H], 7.72-7.84 [d-d, *J*= 48 Hz, 4H, Ar_2-H] AB system, 10.81 [s, 1H, -NH]. ^{13}C-NMR (DMSO-d6, 100 MHz) δ (ppm): 21.40, 118.5, 125.0, 127.2, 130.3, 131.0, 136.8, 142.8, 144.1, 165.6.

Synthesis of *N*-[4-(3,5-Dimethyl-pyrazol-1-yl)-phenyl]-4-methyl-benzene Sulfonamide A6

A mixture of hydrazide A3 (0.244 g, 0.0008 mole) and acetyl acetone (0.1 g, 0.001 mole) in 15 mL of absolute ethanol was refluxed for 8 hrs. Then the mixture was cooled to form a precipitate which was filtered, washed with water and dried. [30]

White solid, (0.23 g, 79%), m.p= 205-207 °C. FT-IR ν (cm^{-1}): 1159, 1338 (SO_2), 1606 (C=N), 1693 (C=O), 2985 (CH), 3062 (=CH), 3219 (NH).

Synthesis of 1-4-(4-methyl phenyl sulfonamide benzoyl-N-phenyl Hydrazine Carboxide A7

A mixture of hydrazide **A3** (1.189 g, 0.0039 mole) and phenyl isothiocyanate (0.52 g, 0.0039 mole) in 15 mL of absolute ethanol was refluxed for 7 hrs., after that the mixture was cooled until a precipitate was formed. The precipitate was filtered, dried and recrystallized by aqueous ethanol 50%.[31]

white solid, (1.04 g, 61%), m.p= 207-210 °C. FT-IR ν (cm^{-1}): 1093 (C=S), 1160, 1367 (SO_2), 1608 (C=C), 1691 (C=O), 2991 (CH_3), 3062 (=CH), 3217 (NH).

Synthesis of *N*-[4-(5-Mercapto-4-phenyl-4H-[1,2,4]triazol-3-yl)-phenyl]-4-methyl-benzenesulfonamide A8

A mixture of **A7** (0.0528 g, 0.00012 mole) and 50 mL of solution of 0.2 M of sodium hydroxide was refluxed for 8 hrs. After that, the mixture was cooled and acidified with HCl to form precipitate which was filtered, washed several times with water and dried. [31]

White solid, (0.015 g, 30%), m.p = 241-243°C. FT-IR ν (cm^{-1}): 1151, 1379 (SO_2), 1606 (C=C aromatic), 2625 (SH), 2953 (CH_3), 3215 (NH).

Synthesis of 4-Methyl-N-[4-(5-phenylamino-[1,3,4]thiadiazol-2-yl)-phenyl]-benzenesulfonamide A9

To **A7** (0.0528 g, 0.00012 mole) was added drop-wise H_2SO_4 (2.5 mL) at 0 ºC with stirring. After that the ice bath was removed and the mixture was stirred for 3 hrs. at room temperature. Then after 24 hrs, the mixture was neutralize with 10% sodium hydroxide solution until the solution becomes neutral. The formed precipitate was filtered, washed with water and dried. [31]

White solid, (0.046 g, 95%), m.p = 58-60 °C. FT-IR ν (cm^{-1}): 820 (C-S), 1174, 1341(SO_2), 3220 (NH)

Synthesis of *N*-[4-(5-Mercapto-[1,3,4]thiadiazol-2-yl)-phenyl]-4-methyl-benzenesulfonamide A10

To compound A4 , (0.8 g) was added drop-wise H_2SO_4 (8 mL) with stirring. After completion of the addition, the stirring was continued for 24 hrs. After which the mixture was slowly added to the ice with stirring. The formed precipitate was filtered, washed with water and dried. [32]

White solid, (0.43 g, 62%), m.p = 239-241°C. FT-IR ν (cm^{-1}): 1091 (C=S),1155, 1342 (SO2), 1651 (C=N), 2939 (CH_3), 1608 (C=C), 3321 (NH),3315 (NH ring).

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Synthesis of 4-methyl-*N*-[4-(4amino-5-mercapto-4*H*-[1,2,4]-triazol-3-yl)phenyl)]-benzenesulfonamide A11

To a solution of potassium carbodithioate salt A4 (1.26 g, 0.003 mole) in absolute ethanol (8 mL) was added an excess of NH_2NH_2 99.5%, 7 mL with stirring, and reflux until the emanation of H_2S gas was finished [(identified by paper soaked with $Pb(CH_3COO)_2$ (~ 2.5 hrs)]. The resulting mixture was cooled to room temperature, poured on mashed ice, neutralized with CH_3COOH to give a precipitate which was filtered off, washed with water, dried ,and recrystallization from ethanol to give white precipitate.[27]

White solid (ethanol), (0.81 g, 75%), m.p. = 258-261 °C. FT-IR ν (cm^{-1}): 3319, 3215 (NH_2), 3151 (NH), 2943 (CH_3), 2519 (SH), 1649 (C=N), 1608 (C=C), 1342, 1157 (SO_2). ^{1}H-NMR (DMSO-d6, 400 MHz) δ (ppm): 2.33 [s, 3H, -CH_3], 4.48 [s, 2H, -NH_2], 7.12, 7.14-7.34, 7.36 [d-d, *J*= 8 Hz,4H, Ar_1-H] AB system, 7.66-7.72 [q, *J*= 24 Hz,4H, Ar_2-H], 9.60 [s, H, -SH], 10.59 [s, 1H, SO_2-NH-].^{13}C-NMR (DMSO-d6, 100 MHz) δ (ppm): 21.4, 118.7, 127.2, 128.6, 128.8, 130.2, 136.9, 140.8, 144.0, 165.7

Synthesis of 4-Methyl-*N*-[4-(6-oxo-5,6-dihydro-[1,2,4]triazolo[3,4-*b*] [1,3,4] thiadiazol-3-yl)-phenyl]-benzenesulfonamide A12

A mixture of compound A11 (0.361 g, 0.001 mole) and (0.78 g, 0.013 mole) of urea was heated at (180-190 °C) using sand bath for 6 hrs. Then the mixture was cooled and added to 20 mL of 5% sodium hydroxide solution. Then the mixture was acidified with diluted HCl. The formed precipitate was filtered, dried and recrystallized from ethanol. [33]

White solid, (0.33 g, 84%), m.p = 261-263°C. FT-IR ν (cm^{-1}): 1712 (C=O), 1334, 1159 (SO_2), 1608 (C=C) aromatic, 1662 (C=N), 2933 (CH_3), 3064 (=CH), 3261(NH). ^{1}H-NMR (DMSO-d6, 400 MHz) δ (ppm): 2.33 [s, 3H, -CH_3], 7.17-7.81 [m, 8H, Ar-H], 10.60 [s, 1H, SO_2-NH-], 10.66 [s, 1H, -NH-CO-].^{13}C-NMR (DMSO-d6, 100 MHz) δ (ppm): 21.4, 118.6, 126.3, 127.2, 129.2, 130.2, 131.2, 136.9, 141.0, 143.9, 156.7, 167.7.

Synthesis of *N*-(4-{5-[2-(4-Bromo-phenyl)-2-oxo-ethylsulfanyl]-[1,3,4] oxadiazol-2-yl}-phenyl)-4-methyl-benzenesulfonamide A13

To a mixture of compound **A5** (0.347 g, 0.001 mole) and *p*-bromo phencyl bromide (0.278 g, 0.001 mole) was added a solution of triethylamine (0.152 g, 0.0015 mole) in 10 mL acetonitrile at room temperature, a precipitate was formed directly. The formed precipitate was filtered, washed with water ,and recrystallized from ethanol. [29]

White solid, (0.22 g, 40%), m.p = 200-205 °C. FT-IR ν (cm^{-1}): 705 (C-Br), 1091 , 1292 (C-O-C), 1159, 1338 (SO_2), 1606 (C=C), 1651 (C=N), 2987 (CH_3), 1693 (C=O), 3219 (NH). ^{1}H-NMR (DMSO-d6, 400 MHz) δ (ppm): 2.34 [s, 3H,-CH_3], 4.26 [s, 2H, -CH_2-], 7.25-7.98 [m, 12H, Ar-H], 10.84 [s, 1H, SO_2-NH-]. ^{13}C-NMR (DMSO-d6, 100 MHz) δ (ppm): 21.3, 60.9, 118.5, 118.8, 125.0, 126.7, 127.2, 127.8, 130.2, 130.6, 131.0, 132.3, 135.7, 136.8, 142.8, 144.1, 165.6.

Synthesis of 4-Methyl-*N*-(4-thioureidocarbonyl-phenyl)-benzenesulfon Amide A14

A mixture of benzene sulfonamide ester **A2** (0.319 g, 0.001 mole) and thiourea (0.076 g, 0.001 mole) in (15 mL) of absolute ethanol was refluxed for 6 hrs. Then the mixture was cooled to form a precipitate. The formed precipitate was collected by filtration, dried ,and recrystallized from ethanol.[34]

White solid, (0.23 g, 67%), m.p = 202-204°C. FT-IR ν (cm^{-1}): 1190 (C=S), 1338 (SO_2), 1600 (C=C), 1695 (C=O), 3224 (NH), 3360, 3410 (NH_2).

Synthesis of *N*-[4-(4-Bromo-phenyl)-thiazol-2-yl]-4-(toluene-4-sulfonyl amino)-benzamide A15

Equimolar of compound **A14** and *p*-bromophencylbromide in 20 mL absolute EtOH was refluxed for 7 hrs. After which the mixture was cooled and neutralized with ammonia. The formed precipitate was filtered, washed with water, dried ,and recrystallized from ethanol. [27]

White solid, (1.19 g, 79%), m.p = 180-185°C. FT-IR ν (cm^{-1}): 700 (C-Br), 808 (C-S), 1606 (C=N), 1693 (C=O), 2953(CH_3), 3219 (NH). ^{1}H-NMR (DMSO-d6, 400 MHz) δ (ppm): 2.33 [s, 3H, -CH_3], 7.23-7.25, 7.82-7.84 [d-d, *J*= 8 Hz,4H, Ar_1-H], 7.35-7.38, 7.94-7.97 [d-d, *J*= 12 Hz, 4H, Ar_2-H], 7.72-7.74, 7.78-7.80 [d-d, *J*= 8 Hz, 4H, Ar_3-H] AB

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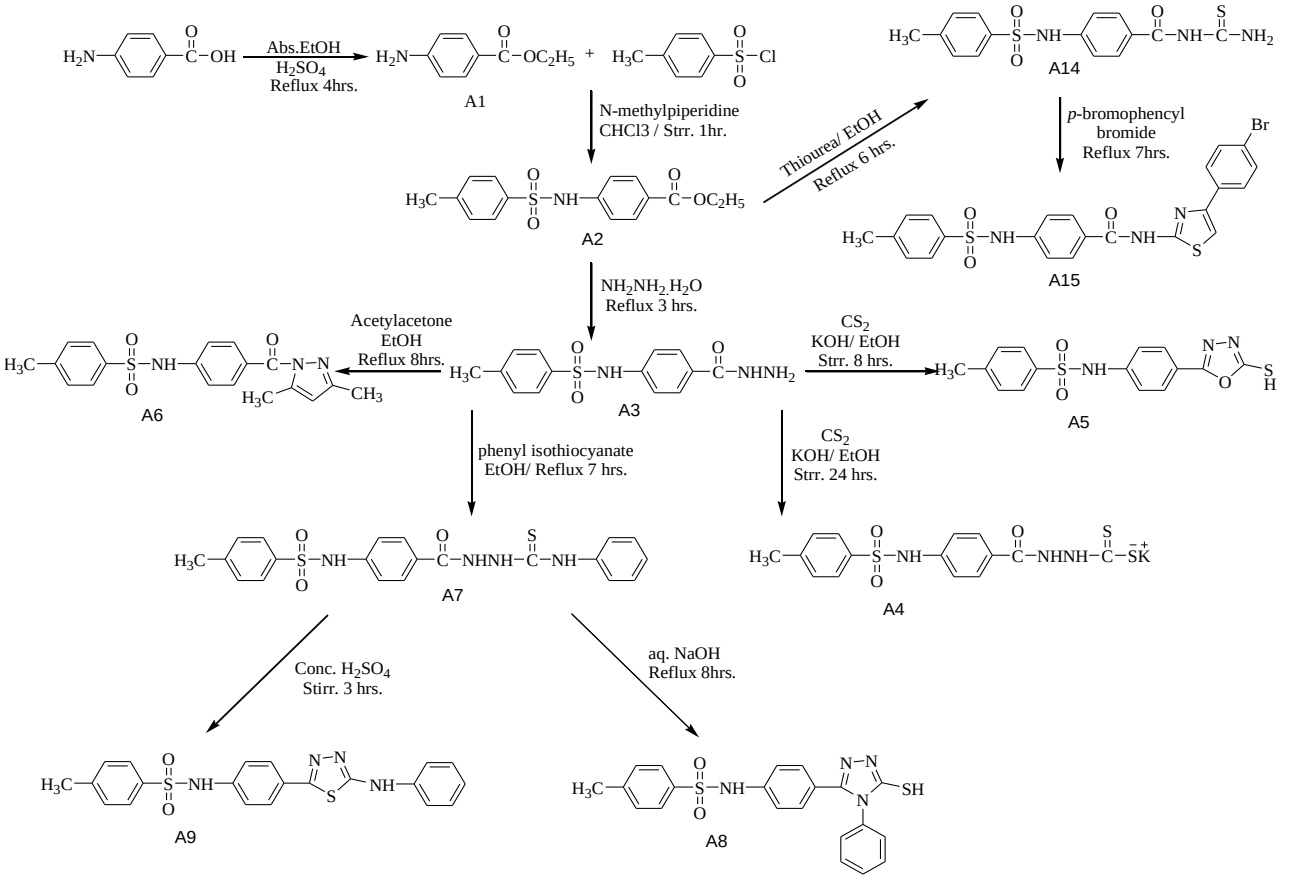
system, 8.01 [s, 1H, thiazole ring], 10.82 [s, 1H, -NH-]. ^{13}C-NMR (DMSO-d6, 100 MHz) δ (ppm): 21.4, 118.5, 125.0, 127.2, 128.5, 130.1, 130.2, 131.0, 131.1, 132.2, 132.4, 133.5, 136.8, 142.8, 144.1, 165.6, 191.5.

Results and Discussion

In the current research hydrazide derivatives A4-A15 were prepared as shown in Schemes 1, 2. The essential precursor compound used in synthesizing of compounds A4-A15. The ester A2 was synthesized from *p*-tolyl sufonyl amino benzoic acid according to the method listed previously [28]. This ester was converted to the corresponding hydrazide A3 by its reaction with $NH_2NH_2.H_2O$ according to the method stated previously [29].

Synthesis of potassium *N'*-[4-(toluene-4-sulfonylamino)-benzoyl] hydrazine-1-carbodithioate A4 was done by the reaction of the hydrazide A3 with CS_2 in presence of alcoholic KOH. The FT-IR spectrum of the salt A4 , it showed the C=S stretching at 1085 cm^{-1} and the disappearance of a NH_2 band was an evidence of the formation of the compound.

Synthesis of *N*-[4-(5-mercapto-[1,3,4]oxadiazol-2-yl)-phenyl]-4-methyl-benzenesulfonamide A5 was performed either by the refluxing of hydrazide A3 with CS_2 in presence of alcoholic potassium hydroxide, or by the refluxing of the carbodithioate salt A4 in ethanol. The IR spectrum of the compound A5 showed the bands at 1691 cm^{-1} , 2496 cm^{-1} for (C=N) and (SH), respectively. ^{1}H-NMR spectrum displayed the single signal at 4.24 ppm for proton -SH. The disappearance of C=O and NH_2 bands in IR & ^{1}H-NMR spectrum are excellent evidence of the formation of the compound A5. Whereas in its ^{13}C-NMR spectrum the following signals (δ, ppm) are shown: 21.4, 118.5, 125.0, 127.2, 130.3, 131.0, 136.8, 142.8, 144.1, 165.6.



Scheme 1. Synthesis of Compounds A1-A9, A14 and A15

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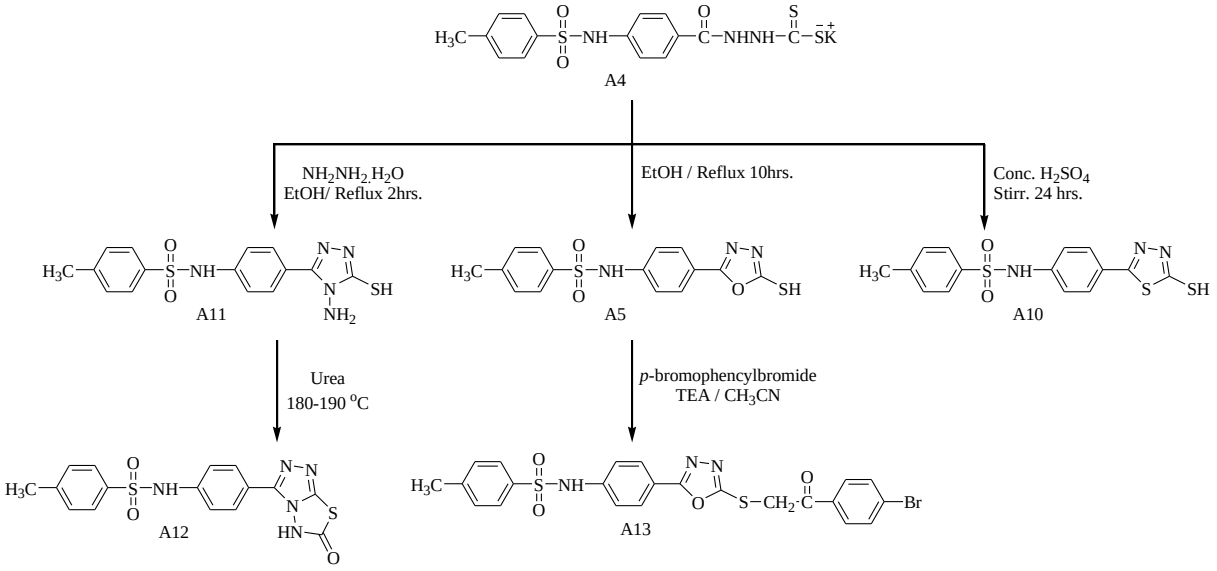
The reaction of hydraizde A3 with acetyl acetone provided compound A6. The FT-IR for compound A6 ν (cm^{-1}): 1159, 1338 for (SO_2), 1606 for (C=N), 1693 for (C=O), 2985 for (CH), 3062 for (=CH), 3219 for (NH). While the reaction of hydrazide A3 with phenyl isothiocyanate gave compound **A7**. The FT-IR for compound A7 showed the C=S stretching vibration at 1093 cm^{-1}. The disappearance of NH_2 bands in the products A6 & A7 strong evidence of the formation of the compounds A6 & A7.

The compound A7 was used to produce different heterocyclic compounds A8 & A9 via two synthetic paths. The first one includes the reaction of the compound A7 with aqueous NaOH to give compound A8. The structure of compound A8 was established according to the spectroscopy data. While, the second path includes the reaction of compound A7 and conc. H_2SO_4 to give compound A9**.** In IR spectroscopy the following bands (ν, cm^{-1}) are displayed: at 2625 for (SH) compound A8 , 820 for (C-S) compound A9 and the disappearance of C=O and C=S bands in the products A8 & A9 indicated an evidence of the formation of the compounds A8 & A9.

The potassium carbodithioate salt A4 was used to prepare different heterocyclic compounds A5, A10 – A13 via three synthetic paths as shown in Scheme 2. The first one includes the compound A4 in refluxing ethanol to give compound A5. While, the second path includes synthesis of **compounds** A10 was performed by the reaction of compound A4 with conc. H_2SO_4. The IR spectrum of the compound A10 showed the bands at 1091 cm^{-1} for (C=S), 1651 cm^{-1} for (C=N), 3315 cm^{-1} for (NH ring) and disappearance carbonyl group, this is an indication of the formation of the required compound.

Third path includes synthesis of **compounds** A11 was performed by the refluxing of the compound A4 with $NH_2NH_2.H_2O$ in ethanol. The IR spectrum compound A11 displayed the following bands (ν, cm^{-1}): at 3319, 3215 for (NH_2), 2519 for (SH), 1649 for (C=N) and disappearance of carbonyl group. While the ^{1}H-NMR spectrum of compound A11 displayed the following signals (δ, ppm): 4.48 [s, 2H, -NH_2], 9.60 [s, H, -SH], This is a strong evidence for the formation of compound A11. Moreover, ^{13}C-NMR spectrum the following signals (δ, ppm) are shown: 21.4, 118.74, 127.1, 128.6, 128.8, 130.2, 136.9, 140.8, 144.0, 165.7.



Scheme 2. Synthesis of Compounds A4, A5 AND A10-A13

In addition, the reaction of compound A11 with urea at 180-190 °C to form compound A12. The IR spectrum for compound A12 showed the disappearance of NH_2, SH groups and appearance the band at 1712 cm^{-1} for (C=O) cyclic. While the ^{1}H-NMR spectrum of compound A12 showed the signal 10.66 ppm for [s, 1H, -NH-CO-], and the disappearance the signals of protons for NH_2 and SH groups. In addition, ^{13}C-NMR spectrum the following signals (δ, ppm) are shown: 21.4, 118.6, 126.3, 127.2, 129.2, 130.2, 131.2, 136.9, 141.0, 143.9, 156.7, 167.7.

While, to synthesis of compound A13 through reaction A5 with *p*-bromophencyl bromide. The IR

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spectrum compound A13 displayed the following bands (ν, cm-1): at 705 for (C-Br), 1091, 1693 for (C=O), and the disappearance of SH group. As for the ^{1}H-NMR spectrum of compound A13 displayed the following signals (δ, ppm): 4.26 [s, 2H, -CH_2-], 7.25-7.98 [m, 12H, Ar-H] and the disappearance the signal of proton for SH group. In ^{13}C-NMR spectrum the following signals (δ, ppm) are shown: 21.3, 60.9, 118.5, 118.8, 125.0, 126.7, 127.2, 127.8, 130.2, 130.6, 131.0, 132.3, 135.7, 136.8, 142.8, 144.1, 165.6.

On the other hand, the reaction of the ester A2 with the refluxing of thiourea in ethanol to give compound A14. The IR spectrum compound A14 displayed the following bands (ν, cm^{-1}): at 1190 for (C=S), 1338 for (SO_2), 1600 for (C=C), 1695 for (C=O), 3224 for (NH), 3360, 3410 for (NH_2) and the disappearance of frequency for carbonyl ester in product.

Lastly, the reaction of the ester A14 with *p*-bromophencyl bromide to form compound A15. The IR spectrum compound A15 displayed the following bands (ν, cm^{-1}): at 700 for (C-Br), 808 for (C-S), 1606 for (C=N), 1693 for (C=O), 2953 for (CH_3), 3219 for (NH) and the disappearance of frequency for (C=S) and (NH_2) groups in product. While the ^{1}H-NMR spectrum of compound A15 displayed the following signals (δ, ppm): 2.33 [s, 3H, -CH_3], 7.23-7.25, 7.82-7.84 [d-d, *J*= 8 Hz, 4H, Ar_1-H], 7.35-7.38, 7.94-7.97 [d-d, *J*= 12 Hz, 4H, Ar_2-H], 7.72-7.74, 7.78-7.80 [d-d, *J*= 8 Hz, 4H, Ar_3-H] AB system, 8.01 [s, 1H, thiazole ring], 10.82 [s, 1H, -NH-], give a good indication that the reaction was take place and supporting the thiazole ring formation. In ^{13}C-NMR spectrum the following signals (δ, ppm) are shown: 21.4, 118.5, 125.0, 127.2, 128.5, 130.1, 130.2, 131.0, 131.1, 132.2, 132.4, 133.5, 136.8, 142.8, 144.1, 165.6, 191.5.

Conclusion

In the present study, by using simple and easy working methods, reaction conditions, we were able to prepare important heterocyclic compounds such pyrazole, triazole, oxadiazole, thiazole, thiadiazole and fused heterocyclic compound A5-A15, which are believed to have the medicinal application depending on the published literature. Therefore, his research concentrated on these derivatives.

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Authors' Declaration

- Conflicts of Interest: None.
- Ethical Clearance: The project was approved by the local ethical committee at University of Mosul.

Authors' Contribution Statement

M.A. A. contributed to implementation of the research project and interpretation of analytical data. A. H. A. contributed to the suggestion of the project idea, writing the manuscript and proofreading of research.

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تشييد وتشخيص بعض المشتقات البايرازول ، ترايازول ، اوكسادايازول ، ثايازول ، ثايادايازول الحاملة لبارا- تلوين سلفوناميد الجديدة

مها احمد حمد، عمار حسين السبعاوي

قسم الكيمياء ، كلية العلوم ، جامعة الموصل ، موصل ، العراق.

الخلاصة

تم تشييد سلسلة من المشتقات الحلقية غير المتجانسة الجديدة A15-A5 باستخدام 4- (تولوين -4- سلفينيل امينو) - حمض البنزويك إيثيل استر A2 بوصفة مادة اولية. تم استخدام هذا المركب A2 بنجاح في تخليق بعض المشتقات الجديدة من أوكساديازول ، ديازول ، تريازول ، ثاياديازول ، ثيازول و مركبات حلقية غير متجانسة الملتحمة التي تحوي على بارا-تلوين سلفوناميد في تراكيبها والذي من المفترض أن يكون له أنشطة بيولوجية مهمة. تم استخدام التحليل الطيفي البروتون و الكاربون 13 النووي المغناطيسي والاشعة تحت الحمراء لدعم تشخيص المركبات المحضرة.

الكلمات المفتاحية: بنزين سلفوناميد ، اوكسادايازول ، بايرازول ، ثايازول ، ترايازول.