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# Synthesis of New Oxadiazole, Triazole and Oxazepine Derivatives of Quinazoline Moiety

FADHEL OMRAN ESSA* and KADHUM J.K. AL-HAMDANI

Department of Chemistry, College of Basic Education, University of Babylon, Hilla, Iraq

*Corresponding author: E-mail: fathel_omran61@yahoo.com

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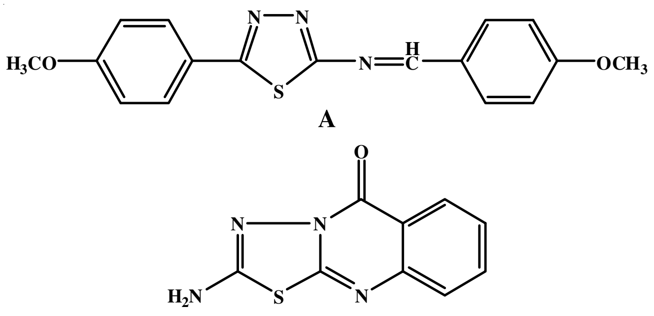
New 2-(4-oxo-2-phenylquinazolin-3(4*H*)-yl)-3-phenyl propanoic acid derivatives have been prepared by reaction of 2-phenyl-4*H*-1,3-benzoxazin-4-one with phenylalanine. The reaction of compound **1** with thionyl chloride produced 2-[4-oxo-2-phenylquinazolin-3(4*H*)-yl]-3-phenylpropanoyl chloride (**2**). Condensation of compound **2** with hydrazine hydrate afforded 2-[4-oxo-2-phenylquinazolin-3(4*H*)-yl]-3-phenyl propane hydrazide (**3**). The reaction of compound **3** with carbon disulfide and potassium hydroxide yielded 3-[1-(5-mercapto-1,3,4-oxadiazol-2-yl)-2-phenylethyl]-2-phenylquinazolin-4(3*H*)-one (**4**). Teratment of compound **4** with hydrazine hydrate gave 3-[1-(5-mercapto-4*H*-1,2,4-triazol-3-yl)-2-phenylethyl]-2-phenylquinazolin- 4(3*H*)-one (**5**). The reaction of compound **3** with phenyl isothiocyanate resulted in formation of 2-[2-(2-phenyl-4-oxoquinazolin-3(4*H*)-yl)-3-phenylpropanoyl] hydrazine carbothioamide (**6**). Treatment of compound **6** with aqueous sodium hydroxide solution produced 3-[1-(5-mercapto-4-phenyl-4*H*-1,2,4-triazol-3-yl)-2-phenylethyl]2-phenylquinazolin-4(3*H*)-one (**7**). The azomethines **8a-d** were synthesized from the reaction between the corresponding aldehydes and acid hydrazide **3**. Moreover, N-(3-methyl-1,5-dioxobenzo[e][1,3]oxazepin-4(1*H*,3*H*,5*H*)-yl-2-(4-oxo-2-phenyl quinazoline-3(4*H*)-yl)acetamide **9a-d** were synthesized from the cyclic condensation of imines with phthalic anhydride. The structure of novel synthesized compounds were suggested from IR, $^1$H NMR and and $^{13}$C NMR spectral studies.

**Keywords: Oxazines, Oxazepines, Oxadiazoles, Triazoles, Phenylquinazolines.**

## INTRODUCTION

Heterocyclic compounds that have a ring structure containing more than one type of atoms. Such as nitrogen, oxygen and sulfur in addition to the carbon atom . Due to the fact that these compounds are widespread in nature, they have received a great deal of attention from the researchers to their importance of life, they are included in the composition of chlorophyll in the plant and the hemoglobin contains four rings of pyrroles [1,2].These compounds are also involved in the structures of sugars and their derivatives and in the synthesis of most vitamins, such as vitamin C, which is in the form of five- or six-iron (pyran) rings containing one atom of oxygen [3,4]. Most members of vitamin B group have heterogeneous nitrogen-containing rings, including pyridoxine (B6), a pyridine derivative, essential for the metabolism of amino acids [4]. There are several types of life molecules that contain heterocyclic compounds systems, including nitrogenous bases such as purine and pyrimidine, which are incorporated into the synthesis of DNA and RNA and interfere with the structures of amino acids such as proline, histidine, tryptophan [3].The compound **A** was found to have a biological effect against anticancer and compound **B** has antiretroviral [5].



**A**

**B**

Structure of compound **A** and **B**

2-Substituted benzoxazinones have been the object of interest for past three decades, due to increased importance in pharmaceutical and biological field [6-12]. Oxazine derivatives are an important class of heterocyclic, which has attracted much synthetic interest due to their wide range of biological activities like sedative [13], analgesic [14], anticancer [15], antitubercular [16], antimicrobial [17], antimalarial activity [18]. Oxadiazole and triazole have a variety of potential biological activities [19-21] and utilities as technologically useful [22-24].

Oxazepine derivatives introduced in 1965 for use in relief of the psychoneuroses' characterized by anxiety and tension [25].

## EXPERIMENTAL

All the chemicals used in this research were of analytical grades. Melting points were measured using electro thermal melting point apparatus. Infrared spectra were recorded as KBr disc on SHIMADZU-FT-IR-8400 spectrometer. $^{1}$H and $^{13}$C NMR spectra were recorded on Burker 300 MHz instrument using DMSO-$d_6$ as a solvent and TMS as internal reference at Al-Albayt University, Jordan. The progress of the reaction was monitored by TLC using aluminum silica gel plates.

**2-[4-Oxo-2-phenylquinazolin-3(4*H*)-yl]-3-phenyl propanoic acid (1):** A mixture of equimolar amounts (1 mmol) of 2-phenyl-4*H*-benzo[d][1,3]oxazin-8-one and of phenylalanine (1mmol) with glacial acetic acid (15 mL) was refluxed for 5 h. The mixture was allowed to cool down to room temperature. Ice cold distilled water (25 mL) was added to the reaction mixture was recrystallized from ethanol. IR (KBr, $\nu_{max}$, $cm^{-1}$): 3420 OH, 1700 C=O acid, 1685 C=O ester, 1643 C=N, 3049 C-H benzene, 2952 $CH_2$, 2854 CH, 1587-1450 C=C benzene.

**2-[4-Oxo-2-phenylquinazolin-3(4*H*)-yl]-3-phenylpropanoylchloride (2):** A mixture of compound **1** (27 mmol) and thionyl chloride (5 mL) in dry benzene (15 mL) was refluxed for 3 h. The solution was cooled then the excess of thionyl chloride and benzene evaporated under vacuum, the product was recrystallized from ethanol. IR (KBr, $\nu_{max}$, $cm^{-1}$): 3066 C-H benzene, 2944 $CH_2$, 2832 CH, 1726 C=O acetyl chloride, 1655 C=O ester, 1612 C=N, 1598-1473 C=C benzene.

**2-[4-Oxo-2-phenylquinazolin-3(4*H*)-yl]-3-phenyl propane hydrazide (3):** (26 mmol) of compound **2** and (80 %) hydrazine hydrate (50 mmol) in dry benzene (15 mL) was refluxed for 4 h with stirring. After cooling, the benzene and excess hydrazine hydrate were removed under reduced pressure, the residue was washed well with diethyl ether, then recrystallized from ethanol to provide solid product. IR (KBr, $\nu_{max}$, $cm^{-1}$): 3307 and 3215 $H_2$, 3062 C-H benzene, 2932 $CH_2$, 2848 CH, 1660 C=O ester, 1651 C=O hydrazide, 1604 C=N and $NH_2$ bending, 1595-1448 C=C benzene.

**3-[1-(5-Mercapto-1,3,4-oxadiazol-2-yl)-2-phenylethyl]-2-phenyl quinazolin-4(3*H*)-one (4):** To a solution of compound **3** (26 mmol) in ethanol (40 mL) and KOH (26 mmol) was added, after that (5 mL) of $CS_2$ was added. The mixture was refluxed for 8 h. The solvent was evaporated under vacuums, then the product was acidified with diluted HCl. The precipitate was collected, washed with distilled water and recrystallized from ethanol. IR (KBr, $\nu_{max}$, $cm^{-1}$): 3332 NH oxadaizole, 3059 C-H benzene, 2931 $CH_2$, 2781 CH, 2532 SH, 1681 C=O ester, 1616 C=N, 1598-1494 C=C benzene, 1228 C=S. $^{1}$H NMR (DMSO-$d_6$) δ (ppm) 10 (s, SH), 8.3 (s, NH), 7.2-7.9 (ArH), 3.8 (t, CH), 3.3 (d, $CH_2$).

**3-[1-(5-Mercapto-4*H*-1,2,4-triazol-3-yl)-2-phenylethyl]-2-phenyl quinazolin- 4(3*H*)-one (5):** A mixture of substituted oxadiazole **4** (10 mmol) with hydrazine hydrate (4 mL) in ethanol (15 mL) was refluxed to 7 h, then the solvent was evaporated under reduced pressure to form precipitate which was filtered and recrystallized from ethanol. IR (KBr, $\nu_{max}$, $cm^{-1}$): 3332 NH oxadaizole, 3059 C-H benzene, 2931 $CH_2$, 2781 CH, 2532 SH, 1681 C=O ester, 1616 C=N 1598-1494 C=C benzene, 1228 C=S. $^{1}$H NMR (DMSO-$d_6$) δ (ppm) 9.7 (s, SH), 8.2 (s, NH), 6.6-7.9 (ArH), 3.6 (t, CH), 3.1 (d, $CH_2$).

**2-[2-(2-Phenyl-4-oxoquinazolin-3(4*H*)-yl)-3-phenyl propanoyl]hydrazine carbothioamide (6):** To a solution of compound **3** (1 mmol) in absolute ethanol (25 mL), phenyl isothiocyanate (1 mmol) was added with continuous stirring and the mixture was refluxed for 5 h, then the reaction mixture was cooled and the resulting solid **6** was recrystallized from ethanol. IR (KBr, $\nu_{max}$, $cm^{-1}$): 3203, 3188 and 3169 due to NH groups, 3063 C-H benzene, 2948 $CH_2$, 2845 CH, 1660 C=O ester, 1639 C=O amide and C=N, respectivaly 1597-1446 C=C benzene, 2489 SH, 1317 C=S. $^{1}$H NMR (DMSO-$d_6$) δ (ppm) 8.9 (s, NH amide), 5.2 (s, NH), 2.7 (s, NH), 6.39-7.9 (ArH), 3.8 (t, CH), 3.4 (d, $CH_2$).

**3-[1-(5-Mercapto-4-phenyl-4*H*-1,2,4-triazol-3-yl)-2-phenylethyl]2-phenylquinazolin-4(3*H*)-one (7):** Compound **6** (1 mmol) was refluxed with (10 %) aqueous sodium hydroxide solution (20 mL) for 5 h. The reaction mixture was cooled, filtered and neutralized by gradual addition with stirring of (15 %) acetic acid solution. The resulting solid was filtered and recrystallized from ethanol to give brown crystal. IR (KBr, $\nu_{max}$, $cm^{-1}$): 3184 NH, 3061 C-H benzene, 2968 $CH_2$, 2924 CH, 2537 SH, 1674 C=O ester, 1600 C=N, 1570-1450 C=C benzene, 1209 C=S. $^{1}$H NMR (DMSO-$d_6$) δ (ppm) 11.0 (s, S-H), 8.2 (s, NH), 6.6-7.9 (ArH), 4.0 (t, CH), 3.2 (d, $CH_2$).

**Synthesis of imines (8a-d):** A mixture of equimolar amounts (13 mmol) of corresponding aldehydes and compound **3** in (30 mL) of absolute ethanol. Glacial acetic acid (2 drops) was added to the mixture which was refluxed on a water bath for 7 h, then the mixture was cooled to room temperature. The products were filtered and purified from ethanol.

**2-(4-Oxo-2-phenyl-4*H*-quinazolin-3-yl)-3-phenyl-propionic acid benzylidene-hydrazide (8a):** IR (KBr, $\nu_{max}$, $cm^{-1}$): 3224 NH, 3066 C-H benzene, 2899 $CH_2$, CH, respectively, 1660 C=O ester, 1647 C=O hydrazide 1600 C=N, 1575-1494 C=C benzene). $^{1}$H NMR (DMSO-$d_6$) δ (ppm) 9.3 (s, N=CH), 8.1 (s, NH), 7.3-7.8 (ArH), 3.9 (t, CH), 3.4 (d, $CH_2$). $^{13}$C NMR (DMSO-$d_6$) 34.96 CH, 50.21 $CH_2$, (124.21-134.60) δ ppm due to aromatic carbon, (162.71) for (C=N), 154.54 C=N Schiff base, 168.25 N-C=O, 170.17 HN-C=O.

**2-(4-Oxo-2-phenyl-4*H*-quinazolin-3-yl)-3-phenyl-propionic acid (4-dimethylamino-benzylidene)-hydrazide (8b):** IR (KBr, $\nu_{max}$, $cm^{-1}$): 3203 NH, 3062 C-H benzene, 2970 $CH_3$, 2934 $CH_2$, 2890 CH, 1676 C=O ester, 1635 C=O hydrazide 1607 C=N, 1589-1519 C=C benzene. 1575-1494 C=C benzene. $^{1}$H NMR (DMSO-$d_6$) δ (ppm) 9.1 (s, N=CH), 8.0 (s, NH), 7.3-7.9 (ArH), 3.9 (t, CH), 3.1 (d, $CH_2$), 1.8 (s, $N(CH_3)_2$). $^{13}$C NMR (DMSO-$d_6$) $N(CH_3)_2$ 36.92, 34.27 CH, 49.86 $CH_2$, (124.25-135.33) ppm due to aromatic carbon, (162.13) for (C=N), 153.84 C=N Schiff base, 168.08 N- C=O, 171.80 HN-C=O.

**2-(4-Oxo-2-phenyl-4*H*-quinazolin-3-yl)-3-phenyl-propionic acid (4-hydroxy-3-methoxy-benzylidene)hydrazide (8c):** IR (KBr, $\nu_{max}$, $cm^{-1}$): 3375 OH, 3192 NH, 3062 C-H benzene, 2924 $CH_3$, 2843 $CH_2$ and CH, 1676 C=O ester, 1670

C=O hydrazide 1600 C=N, 1568-1450 C=C benzene. 1575-1494 C=C benzene). $^1$H NMR (DMSO-$d_6$) δ (ppm) 9.5 (s, N=CH), 8.0 (s, NH), 6.7-7.6 (ArH), 4.0 (t, CH), 3.4 (s, $OCH_3$), 3.2 (d, $CH_2$). $^{13}$C NMR (DMSO-$d_6$), 33.61 CH, 49.29 $CH_2$, 55.27 O-$CH_3$, (123.35-136.10) ppm due to aromatic carbon, 143.73 C-OH, (162.64) for (C=N), 153.70 C=N Schiff base, 167.90 N-C=O, 171.62 HN-C=O.

**2-(4-Oxo-2-phenyl-4*H*-quinazolin-3-yl)-3-phenyl-propionic acid (4-hydroxy-benzylidene)-hydrazide (8d):** IR (KBr, $\nu_{max}$, cm$^{-1}$): 3380 OH, 3206 NH, 3071 C-H benzene, 2843 $CH_2$ and CH, 1668 C=O ester, 1642 C=O hydrazide 1616 C=N, 1568-1450 C=C benzene. 1575-1494 C=C benzene). $^1$H NMR (DMSO-$d_6$) δ (ppm) 9.0 (s, N=CH), 8.1 (s, NH), 6.5-7.9 (ArH), 6.0 (s, OH), 3.9 (t, CH), 3.1 (d, $CH_2$). $^{13}$C NMR (DMSO-$d_6$), 34.61 CH, 48.77 $CH_2$, (121.19-138.05) ppm due to aromatic carbon, 147.03 C-OH, 164.01 for C=N, 154.06 C=N Schiff base, 167.75 N-C=O, 170.99 HN-C=O.

**Synthesis of oxazepines (9a-d):** A mixture of compounds **8a-d** (2 mmol) and phthalic anhydride (2 mmol) was dissolved in of dry benzene (15 mL) and refluxed on a water bath for 14 h. The remaining solution was treated with sodium bicarbonate to produce compounds **9a-d** as a solid precipitate and recrystallized from ethanol.

**N-(5,9-Dioxo-7-phenyl-5,9-dihydro-6-oxa-8-aza-benzocyclohepten-8-yl)-2-(4-oxo-2-phenyl-4*H*-quinazolin-3-yl)-3-phenyl-propionamide (9a):** IR (KBr, $\nu_{max}$, cm$^{-1}$): 3315 N-H, 3047 C-H, benzene, 2941 $CH_2$, 2887 (CH and C-H, oxazepine), 1726 C=O lactone, 1683 C=O lactam, 1643 C=O amid, 1610 C=N, 1583 and 1450 (C=C, benzene), $^1$H NMR (DMSO-$d_6$) δ (ppm) 8.9 (s, CH-oxazepnne), 8.3 (s, NH), 7.4-7.9 (ArH), 5.1 (t, CH), 3.09 (d, $CH_2$). $^{13}$C NMR (DMSO-$d_6$) 34.50 CH, 50.71 $CH_2$, (123.90-135.09) ppm due to aromatic carbon, (163.08) for (C=N), 167.25 N-C=O, 171.21 HN-C=O, 165.02 N-C=O oxazepine,167.83 O-C=O oxazepine.

**N-[7-(4-Dimethylamino-phenyl)-5,9-dioxo-5,9-dihydro-6-oxa-8-aza-benzocyclohepten-8-yl]-2-(4-oxo-2-phenyl-4*H*-quinazolin-3-yl)-3-phenyl-propionamide (9b):** IR (KBr, $\nu_{max}$, cm$^{-1}$): 3212 N-H, 3084 and 3027 (C-H, benzene), 2967 $CH_3$, 2861 and 2754 ($CH_2$, CH and C-H, oxazepine), 1693 C=O lactone, 1649 C=O lactam, 1627 C=O amid, 1682 C=O, 1582 and 1450 (C=C, benzene). $^1$H NMR (DMSO-$d_6$) δ (ppm) 10.8 (s, CH-oxazepnne), 10 (s, NH), 6.4-8.2 (ArH), 3.5 (t, CH), 2.9 (d, $CH_2$), 2.2 (s, $N(CH_3)_2$). $^{13}$C NMR (DMSO-$d_6$) $N(CH_3)_2$ 36.90, 34.31 CH, 50.07 $CH_2$, (124.41-135,15) ppm due to aromatic carbon, (162.13) for (C=N), 168.13 N-C=O, 172.49 HN-C=O, 165.51 N-C=O oxazepine, 167.52 O-C=O oxazepine.

**N-[7-(3-Hydroxy-4-methoxy-phenyl)-5,9-dioxo-5,9-dihydro-6-oxa-8-aza-benzo cyclo hepten-8-yl]-2-(4-oxo-2-phenyl-4*H*-quinazolin-3-yl)-3-phenyl-propionamide (9c):** IR (KBr, $\nu_{max}$, cm$^{-1}$): 3407 OH, 3338 N-H, 3007 C-H, benzene, 2900 $CH_3$, 2814 ($CH_2$, CH and C-H, oxazepine), 1743 C=O lactone, 1653 (C=O lactam and C=O amid), 1595 and 1444 C=C, benzene. $^1$H NMR (DMSO-$d_6$) δ (ppm) 10 (s, CH-oxazepnne), 8.1 (s, NH,) 6.3-7.8 (ArH), 5.3 (t, CH), 4.2 (d, $CH_2$), 3.4 (s, $OCH_3$). $^{13}$C NMR (DMSO-$d_6$), 33.60 CH, 49.50 $CH_2$, 54.99 O-$CH_3$, (122.79-136.42) ppm due to aromatic carbon, 143.59 C-OH, (163.04) for (C=N), 167.31 N-C=O, 172.02 HN-C=O, 164.94N-C=O oxazepine,167.81 O-C=O oxazepine.

**N-[7-(4-Hydroxy-phenyl)-5,9-dioxo-5,9-dihydro-6-oxa-8-aza-benzocyclohepten-8-yl]-2-(4-oxo-2-phenyl-4*H*-quinazolin-3-yl)-3-phenyl-propionamide (9d):** IR (KBr, $\nu_{max}$, cm$^{-1}$): 3309 OH, 3241 N-H, 3050 C-H, benzene, 2970 $CH_2$, 2850 CH, C-H, oxazepine), 1728 C=O lactone, 1678 C=O lactam,1637 C=O amid, 1600 C=N), 1585 and 1440 (C=C, benzene). $^1$H NMR (DMSO-$d_6$) δ (ppm) 9.8 (s, CH-oxazepnne), 8.0 (s, NH), 6.7-7.8 (ArH), 6.3 (s, OH), 5.1 (t, CH), 4.0 (d, $CH_2$). $^{13}$C NMR (DMSO-$d_6$), 34.61 CH, 48.77 $CH_2$, (122.09-138.61) ppm due to aromatic carbon, 148.00 C-OH, 164.51 for (C=N), 167.09 N-C=O, 171.70 HN-C=O, 164.51 N-C=O oxazepine, 167.49 O-C=O.

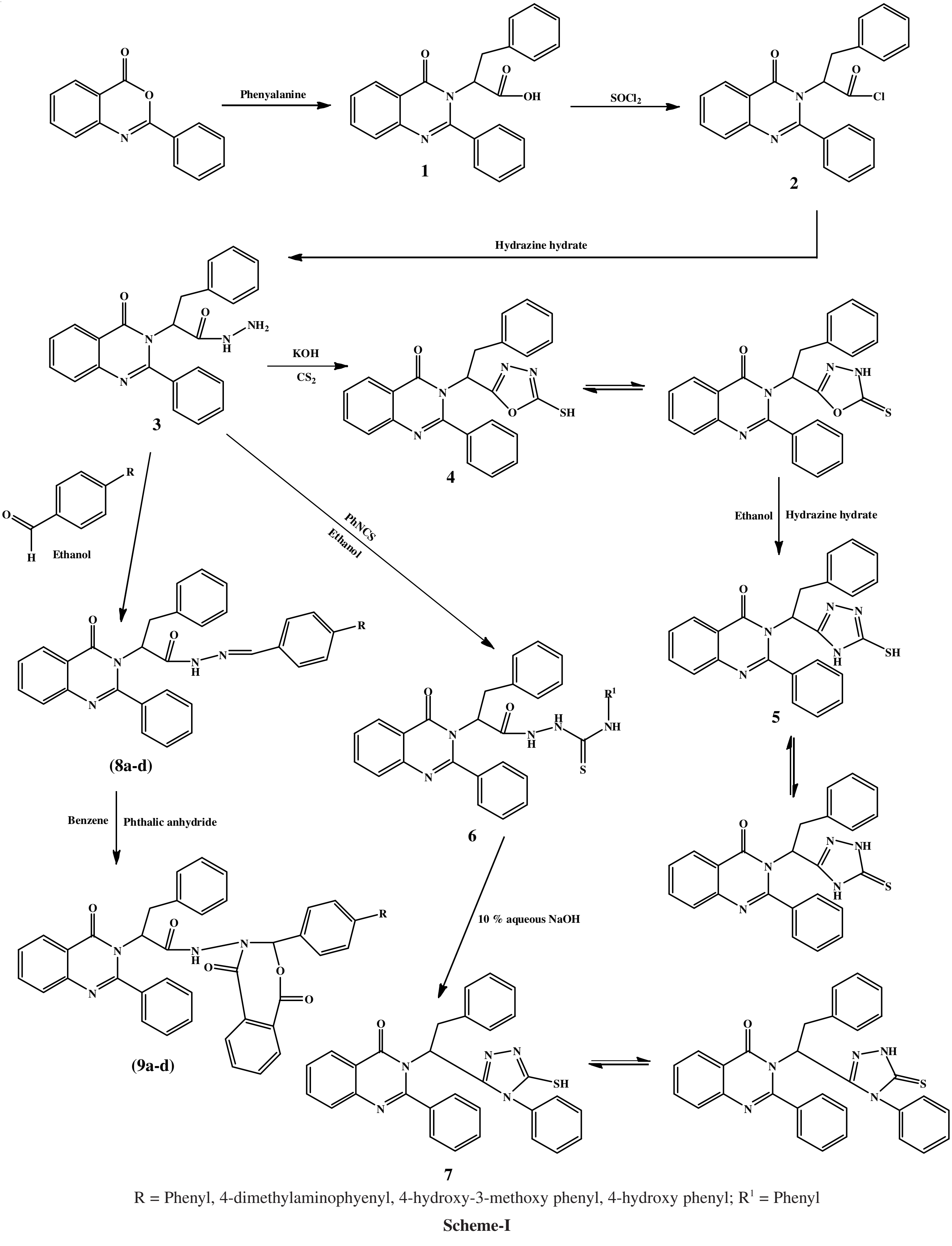
## RESULTS AND DISCUSSION

**Scheme-I** summarized the performed reactions in this work. Compound **1** reacted with $SOCl_2$ in dry benzene to give acid chloride derivative **2**, the reaction was followed by changing the absorption of carbonyl group of acid from1685 to 1760 cm$^{-1}$ for a carbonyl of acyl chloride and disappearance of stretching absorption band at 3427 cm$^{-1}$ for OH of acid.

Reaction between compound **2** and hydrazine hydrate afforded the acid hydrazide derivative **3**.The FT-IR spectrum showed the $NH_2$, NH stretching absorption near 3303 and 3215 cm$^{-1}$, the carbonyl stretching band appeared at 1661 cm$^{-1}$.

TABLE-1
PHYSICAL PROPERTIES AND SPECTRAL DATA FOR SYNTHESIZED COMPOUNDS (**1-9d**)

| Compd. No. | m.f. | m.w. (g/mol) | Colour | m.p. (°C) | Yield (%) | Purification solvent |
|---|---|---|---|---|---|---|
| **1** | $C_{23}H_{18}N_2O_3$ | 370 | Yellow | 168-171 | 73 | Ethanol |
| **2** | $C_{23}H_{17}N_2O_2$ | 388 | Dark yellow | 120-122 | 80 | Ethanol |
| **3** | $C_{23}H_{20}N_4O_2$ | 384 | Pale yellow | 178-180 | 88 | Ethanol |
| **4** | $C_{24}H_{18}N_4O_2S$ | 426 | Brown | 218-220 | 86 | Ethanol |
| **5** | $C_{24}H_{19}N_5OS$ | 425 | Dark brown | 200-202 | 81 | Ethanol |
| **6** | $C_{30}H_{25}N_5O_2S$ | 519 | Orange | Decomp. | 56 | Ethanol |
| **7** | $C_{30}H_{23}N_5OS$ | 501 | Pale orange | 271-273 | 50 | Ethanol |
| **8a** | $C_{30}H_{24}N_4O_2$ | 472 | Orange | 215-217 | 65 | Ethanol |
| **8b** | $C_{32}H_{29}N_5O_4$ | 515 | Orange | 204-206 | 80 | Ethanol |
| **8c** | $C_{31}H_{26}N_4O_4$ | 518 | Brown | 198-200 | 78 | Ethanol |
| **8d** | $C_{30}H_{24}N_4O_3$ | 488 | Brown | 240-242 | 54 | Ethanol |
| **9a** | $C_{38}H_{28}N_4O_5$ | 620 | Pale orange | 166-168 | 53 | Ethanol |
| **9b** | $C_{40}H_{33}N_5O_5$ | 663 | Red | 173-175 | 63 | Ethanol |
| **9c** | $C_{39}H_{30}N_4O_7$ | 666 | Yellow | 168-170 | 46 | Ethanol |
| **9d** | $C_{38}H_{28}N_4O_6$ | 636 | Yellow | 177-179 | 55 | Ethanol |



R = Phenyl, 4-dimethylaminophyenyl, 4-hydroxy-3-methoxy phenyl, 4-hydroxy phenyl; R$^1$ = Phenyl

Scheme-I

The treatment of compound **3** with CS$_2$ in KOH solution resulted 3-[(5-mercapto-1,3,4-oxadiazol-2-yl)methyl]-2-phenylquinazolin-4(3*H*)-one (**4**). The FT-IR spectrum of compound **4** showed a peak at 1616 cm$^{-1}$ belong to C=N of imine. The carbonyl absorption band was seen at 1660 cm$^{-1}$. Also absence of peaks in the region 3303 and 3215 cm$^{-1}$ for NH$_2$ group. In

$^1$H NMR spectrum of this compound appeared two signals related to $CH_2$ protons, CH protons, S-H proton and NH proton of thione form were observed between 3.3, 3.8, 10.0 and 8.3 ppm, respectively. The $^{13}$C NMR spectrum of compound **4**, C=S group signal at 164.30 ppm, while new signal was seen at 38.76 ppm due to C-S group.

The resulting substituted 1,3,4-oxadiazole **4** was treated with hydrazine hydrate to give 1,3,4-triazole derivative **5**. The IR spectral data showed absorptions at 3250, 1631,1622 cm$^{-1}$ assigned to NH, C=N, NH bending respectively. The band at 1228 cm$^{-1}$ due to (C=S) in thione form. In $^1$H NMR spectrum of this compound appeared signals related to NH traizole proton at 4.7 ppm.

The synthesis of compound **6** was carried out by reaction of compound **4** with phenylisothiocyanate. The FT-IR spectrum of compound **6** showed three peaks at 3203, 3180 and 3145 cm$^{-1}$ due to NH groups. The formation of this compound **6** was indicated by the presence of the azomethine (C=N), (C=S) and (C=O) stretching band at 1639,1128 and 1658 cm$^{-1}$, respectively. The $^1$H NMR spectrum provided a perfect confirmation to the structure formation in which the compound **6** showed new singlet signals 7.21-7.52 ppm for aromatic protons, while signals resonating at 8.9 ppm, 5.2 ppm and 2.7 ppm related to NH groups proton. Moreover, signal resonating at 3.4 ppm due to –$CH_2$ group.

Refluxing of compound **6** with NaOH and acidified the product afforded compound **7** containing triazole-2-yl moiety which disappearance of two bands at 1658 and 1128 cm$^{-1}$ for (C=O) group of amide and (C=S) group, respectively. In addition, a band at 2632 cm$^{-1}$ is attributed to SH stretch. In the $^1$H NMR spectrum of compound **7**, $^1$H NMR spectra show the existence of thiol SH and NH tautomeric result group in the compound 11.0 (s, S-H), and 8.2 (s, NH), respectively.

Synthesis of four various Schiff bases derivatives of compound **8** was synthesized by the reaction of compound **3** with served aromatic aldehydes in ethanol with acetic acid as a catalytic agent. The $^1$H and $^{13}$C NMR spectrum of compounds **8a-d** displayed other signals belong to the aromatic ring derived from aldehyde at aromatic region, while the signal related to $NH_2$ group of hydrazide structure did not appear. The FT-IR spectra of compounds **8a-d** showed a peak between 1616-1600 cm$^{-1}$ belonging to C=N group. The $^1$H NMR spectrum for these compounds show the new signals observed at 9.5-9.0 ppm integrating for (CH=N), N-H group of amide were observed between 8.1-8.0 and 6.5-7.9 ppm for proton of aromatic ring. The $^{13}$C NMR spectra of compounds **8a-d,** C=N signals related to individual *cis/trans* conformers were seen as two sets between 154.70-153.70 ppm, were confirmed by $^1$H NMR and IR.

The compounds **9a-d** were synthesized by the condensation reaction of compounds **8a-d** with phthalic anhydride in dry benzene. The chemical structures of compounds **9a-d** were determined by FT-IR, $^1$H NMR and $^{13}$C NMR spectroscopic techniques. The FT-IR spectrum of compounds **9a-d** showed a peak at region 1743-1683 cm$^{-1}$ belong to carbonyl of lactone. The carbonyl absorption band of lactom was observed at 1678-1643 cm$^{-1}$. The $^1$H NMR spectrum for these compounds show the new signals observed at 10.8-9.8 ppm integrating for (CH oxazepine), disappearance the signals at 9.5-9.0 ppm integrating for (CH=N) showing the characteristics chemical shifts. The $^{13}$C NMR spectrum of compound **9a-d**, appeared the carbonyl groups of lactone resonated at 167.83-167.49 ppm, while 165.54-164.51 ppm due to carbon of carbonyl of amide.

## REFERENCES

1. V. Bhardwaj, D. Gumber, V. Abbot, S. Dhiman and P. Sharma, RSC Adv., 5, 15233 (2015) https://doi.org/10.1039/C4RA15710A.
2. S.K. Mahato, A.K. Timiri, M. Mahato, A. Maity and Y.K. Walia, *J. Indian Chem. Soc*., **94**, 949 (2017).
3. R. Kaur, V. Rani, V. Abbot, Y. Kapoor, D. Konar and K. Kumar, *J. Pharm. Chem. Chem. Sci*., **1**, 17 (2017).
4. L. Mahmood, *J. Health Res. Rev*., **1**, 5 (2014); https://doi.org/10.4103/2394-2010.143318.
5. X.-P. Hui, L.-M. Zhang, Z.-Y. Zhang, Q. Wang and F. Wang, *J. Chin. Chem. Soc*., **47**, 535 (2000); https://doi.org/10.1002/jccs.200000071.
6. P.-W. Hsieh, F.-R. Chang, C.-H. Chang, P.-W. Cheng, L.-C. Chiang, F.-L. Zeng, K.-H. Lin and Y.-C. Wu, *Bioorg. Med. Chem. Lett*., **14**, 4751 (2004); https://doi.org/10.1016/j.bmcl.2004.06.083.
7. M.A. El-Hashash, M.E. Azab and J.M. Morsy, *J. Heterocycl. Chem*., **53**, 95 (2016); https://doi.org/10.1002/jhet.2389.
8. B.L. Chenard, F.S. Menniti, M.J. Pagnozzi, K.D. Shenk, F.E. Ewing and W.M. Welch, *Bioorg. Med. Chem. Lett.*, **10**, 1203 (2000); https://doi.org/10.1016/S0960-894X(00)00216-X.
9. M. Bhalla, V.K. Srivastava, T.N. Bhalla and K. Shanker, *Arzneimittelforschung*, **43**, 595 (1993).
10. M.R. Brana, J.M. Castellano, G. Keihauer, Y. Martin and C. Redondo, *Anticancer Drugs*, **9**, 527 (1994).
11. J.A. Seijas, M.P. Vázquez-Tato and M.M. Martínez, *Tetrahedron Lett.*, **41**, 2215 (2000); https://doi.org/10.1016/S0040-4039(00)00090-3.
12. H. Kai, H. Matsumoto, N. Hattori, A. Takase, T. Fujiwara and H. Sugimoto, *Med. Chem. Lett*, **11**, 1997 (2001); https://doi.org/10.1016/S0960-894X(01)00362-6.
13. R.K. Bansal, Heterocyclic Chemistry, New Age International Publisher, edn 4, pp. 501-502 (2011).
14. A.R. Katritzky and J.M. Lagowski, The Principles of Heterocyclic Chemistry, Academic Press (1968).
15. T.R. Jones, S.E. Webber, M.D. Varney, M.R. Reddy, V. Kathardekar, K.K. Lewis, H. Mazdiyasni, J. Deal, D. Nguyen, K.M. Welsh, S. Webber, A. Johnston, D.A. Matthews, W.W. Smith, C.A. Janson, R.J. Bacquet, E.F. Howland, C.L.J. Booth, S.M. Herrmann, R.W. Ward, J. White, C.A. Bartlett and C.A. Morse, *J. Med. Chem.*, **40**, 677 (1997); https://doi.org/10.1021/jm960613f.
16. M. Baumann and I.R. Baxendale, *Beilstein J. Org. Chem.*, **9**, 2265 (2013); https://doi.org/10.3762/bjoc.9.265.
17. P. Parasharya and A.R. Parkh, *Chem. Abstr.*, **121**, 108675 (1994).
18. K. Niraj, J. Alpana, R.A. Bhushan, G. Nilakshi and T. Madhulika, *Int. J. Adv. Res.*, **7**, 445 (2013).
19. Q. Li, J.M. Ren, F. Dong, Y. Feng, G.D. Gu and Z.Y. Guo, *Carbohydr. Res.*, **373**, 103 (2013); https://doi.org/10.1016/j.carres.2013.03.001.
20. R. Lesyk, O. Vladzimirska, S. Holota, L. Zaprutko and A. Gzella, *Eur. J. Med. Chem.*, **42**, 641 (2007); https://doi.org/10.1016/j.ejmech.2006.12.006.
21. V. Mathew, J. Keshavayya, V.P. Vaidya and D. Giles, *Eur. J. Med. Chem.*, **42**, 823 (2007); https://doi.org/10.1016/j.ejmech.2006.12.010.
22. Y. Tao, Q. Wang, L. Ao, C. Zhong, C. Yang, J. Qin and D. Ma, *J. Phys. Chem. C*, **114**, 601 (2009); https://doi.org/10.1021/jp908886d.
23. A.P. Kulkarni, C.J. Tonzola, A. Babel and S. A. Jenekhe, *Chem. Mater*., **16**, 4556 (2004); https://doi.org/10.1021/cm049473l.
24. J. Lee, K. Shizu, H. Tanaka, H. Nomura, T. Yasuda and C. Adachi, *J. Mater. Chem. C*, **1**, 4599 (2013); https://doi.org/10.1039/C3TC30699B.
25. S.J. Wadher, M.P. Puranik, N.A. Karande and P.G. Yeole, *Int. J. PharmTech Res.*, **1**, 22 (2009).