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# MICROWAVE-ASSISTED SYNTHESIS OF 1,3,4 –OXADIAZOLES CONTAINING PYRAZOLONES

***L.K.Ravindranath, E.V.Suresh Kumar, K.Srikanth Y.N.Spoorthi, and P.Phebe**

*Professor in Chemistry S.K.University Anantapur, Andrapradesh, India*
*Author to whom correspondence should be addressed -lkravindranath@gmail.com*

**Abstract:** The key intermediate acetohydrazide **6** cyclization with aryl substituted acids **7 a-g** in presence of phosphorous oxy chloride ($POCl_3$) under microwave irradiation resulted in the formation of the 2-(5-oxo-4-(2-phenylhydrazono)-3-(trichloromethyl)-4,5-dihydro-1H-pyrazol-1-yl)-N-(1-(5-phenyl-2,3-dihydro-1,3,4-oxadiazol-2-yl)ethyl)acetamide **(8a-h)** in excellent yields, also under microwave irradiation and in the presence of dry phosphorous oxy chloride as cyclizing agent. The results obtained indicate that, unlike classical heating, microwave irradiation results in higher yields, shorter reaction times (5-15 min.) and cleaner reactions.

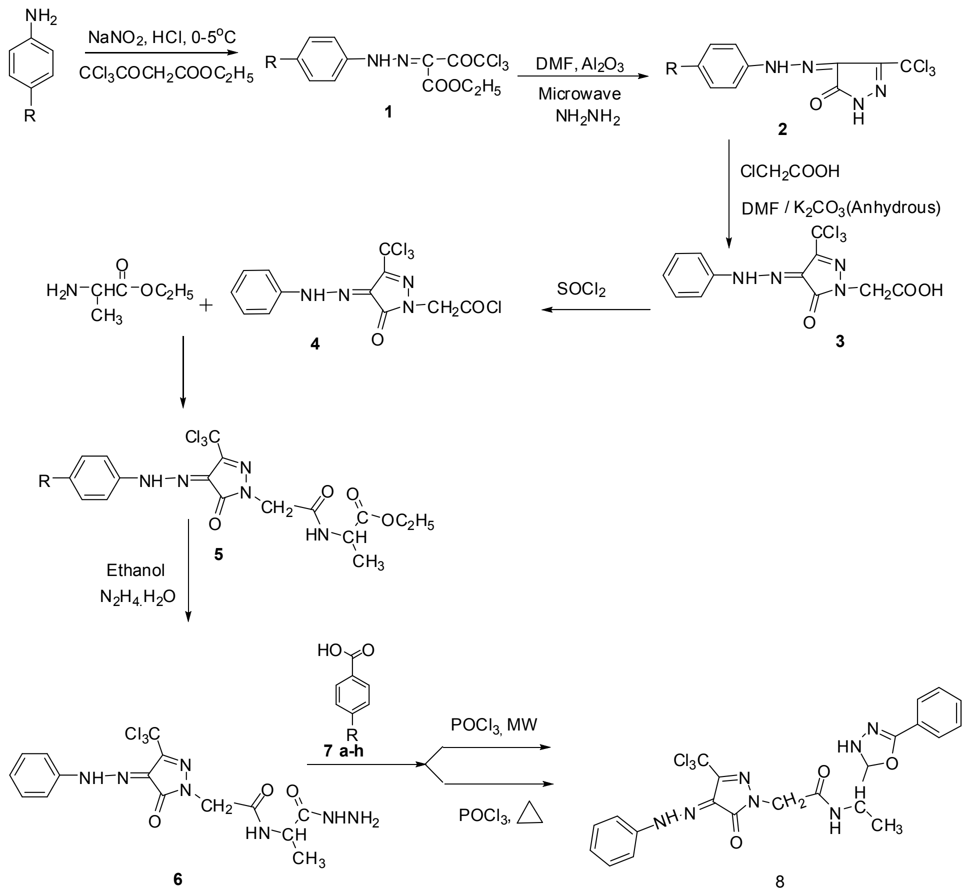
**Keywords:**, Pyrazolones derivatives, Microwave irradiation.

## Introduction

Over a last decade, microwave-assisted chemistry has matured into a highly useful technique and provides an interesting alternative for heating chemical reactions. Microwave techniques in synthetic chemistry often elicit a dramatic increase of the reaction rate, is suited to increased demands of industry. The combination of solvent-free conditions and microwave irradiation, leads to reductions in reaction times, enhancement in conversions and sometimes[1-2], in selectivity with several advantages of eco-friendly approach. A number of reviews[2-9] and monographs[10] have advocated the use of microwave technology in chemical synthesis.

Variously substituted pyrazolines and their derivatives are important biological agents and a significant amount of research activity has been directed towards this class. In particular, they are used as antitumor[11], antibacterial, antifungal, antiviral, antiparasitic, anti-tubercular and insecticidal agents[12-20]. Some of these compounds have also anti-inflammatory, anti-diabetic, anesthetic and analgesic properties[21-24]. Moreover, pyrazolines have played a crucial part in the development of theory in heterocyclic chemistry and also used extensively as useful synthons in organic synthesis[25-28]

**Scheme-1**




## Results and discussion

As a result of our studies related to development of synthetic protocols using microwave irradiation, we now report a novel and easy procedure for Some 1,3,4-Oxadiazoles containing Pyrazolones. In this paper cyclization in presence of phosphorous oxy chloride 5a under microwave irradiation at 160W for about 5 minutes to yield 1,3,4-Oxadiazole substituted Pyrazolones quantitatively in 5-12 minutes . The heterocyclic product was characterized on the basis of their $^{1}$H-NMR, $^{13}$C-NMR, IR and MS spectral and elemental analysis.

## Conclusion

In summary, this work demonstrates a rapid, efficient and environmentally friendly method of synthesis of 1,3,4-Oxadiazole substituted pyrazolones under microwave heating, and the results obtained confirm the superiority of the microwave irradiation method over the classical heating one.

## Experimental

All the chemicals were used as received without further purification. Reactions were carried out using household micro oven (power consumption 1200 W, microwave frequency 2450 MHz) and monitored by thin layer chromatography (TLC) on silica gel plates (60 F254) visualizing with ultraviolet light or iodine spray. Melting points were determined in open capillary tubes in Buchi 530 circulating oil apparatus and are not corrected. $^{1}$H NMR spectra were determined in DMSO-$d_6$ solution on JOEL AL300 spectrometers.

**General procedure:**

**Ethyl 4,4,4-trichloro-3-oxo-2-(2-phenyl hydrazono) butanoate (1)** was prepared by the procedure described by H.M.W.Alborsky, M.E.Baum[29]

**4-(2-subtituted aryl hydrazono)-5-trichloromethyl-2, 4-dihydro-pyrazol-3-one (2)**

Mixtures of **(1)** and hydrazine hydrate and DMF (10 drops) were subjected to microwave irradiation at 150W intermittently at 30 sec intervals for 2 minutes. After complete conversion as indicated by TLC, the reaction mixture was cooled and treated with cold water. The precipitate 3-methyl 4-(4'-substituted aryl hydrazono) pyrazoline-5-one **(2)** was filtered and recrystallized from ethanol. m.p. $180^0$C, yield 87%.

**2-(5-oxo-4-(2-phenylhydrazono)-3-(trichloromethyl)-4,5-dihydro-1H-pyrazol-1-yl)acetic acid (3)**

A mixture of **(2)**, 2-chloroacetic acid, anhydrous $K_2CO_3$ and DMF was stirred at room temperature for 8 hours. The reaction mixture was diluted with ice cold water. The separated solid was identified as 2-(5-oxo-4-(2-phenylhydrazono)-3-(trichloromethyl)-4,5-dihydro-1H-pyrazol-1-yl)acetic acid **(3)**. Yield 71%, m.p.: $181^0$C; $^{1}$H-NMR (400 MHz,DMSO-$d_6$ $\delta$ ppm): 3.65(s,2H,N $CH_2$CO), 10.56 (s, H, Ar-NH), 12.68 (s,1H,COOH) 6.81 -7.88 (m, 5H, for $C_6H_5$ phenyl group);; $^{13}$C-NMR (400 MHz,DMSO-$d_6\delta$ ppm): 51.7 ($CH_2$), 116-144 ( Ar-C ), 132 ( NH-N=C ), 153 ( pyrazole C=O), 91 ( $CCl_3$ ), 145 ($CCl_3$ - C), 168.4 (Acid C=O); IR (KBr): $\overline{\nu}$ = 1600, 3120,2967,1682,1617 cm$^{-1}$ and these are due to C = N, NH, acid carbonyl and cyclic carbonyl in five membered hetero cyclic ring respectively *Anal*. Calcd. for $C_{12}H_9Cl_3N_4O_3$ (363.58); C, 39.64; H, 2.50; N, 15.41; found (%); C: 38.23, H: 3.13, N: 22.31.

**2-(5-oxo-4-(2-phenylhydrazono)-3-(trichloromethyl)-4,5-dihydro-1H-pyrazol-1-yl)acetyl chloride (4)**

To a solution of 2-(5-oxo-4-(2-phenylhydrazono)-3-(trichloromethyl)-4,5-dihydro-1H-pyrazol-1-yl)acetic acid (3). (900 mg) in toluene (30 mL) was added thionyl chloride (0.90 mL) at room temperatures. The resulting solution was heated to reflux for 2 h. Then, it was cooled to room temperature and the excess thionyl chloride and toluene was removed under vacuum. The residue was dissolved one time in toluene and removed again under vacuum to afford 2-(5-oxo-4-(2-phenylhydrazono)-3-(trichloromethyl)-4,5-dihydro-1H-pyrazol-1-yl)acetyl chloride **(4)**. Yield 58%, m.p.: $173^0$C; $^{1}$H-NMR (400 MHz,DMSO-$d_6$ 3.81(s,2H,N $CH_2$CO), 10.70 (s, H, Ar-NH), 6.78 -7.88 (m, 5H, for $C_6H_5$ phenyl group) ; $^{1}$H-NMR (400 MHz,DMSO-$d_6$ $\delta$ ppm): 3.81(s,2H,N $CH_2$CO), 10.70 (s, H, Ar-NH), 6.78 -7.88 (m, 5H, for $C_6H_5$ phenyl group) ; $^{13}$C-NMR (400 MHz,DMSO-$d_6$ $\delta$ ppm): 64.5 ($CH_2$), 116-144 ( Ar-C ), 132 ( NH-N=C ), 153 ( pyrazole C=O), 91 ( $CCl_3$ ), 145 ($CCl_3$ - C), 173.5 (Acid Chloride C=O) IR (KBr): $\overline{\nu}$ = 3180,1696,1617,1651 cm$^{-1}$ and these are due to NH, cyclic carbonyl in five membered hetero cyclic ring exo > C = N, acid chloride respectively *Anal*. Calcd. for $C_{12}H_8Cl_4N_4O_2$ (382.03); C, 37.73; H, 2.11; N, 14.67; found (%); C: 38.23, H: 3.13, N: 22.31.

**Ethyl2-(2-(5-oxo-4-(2-phenylhydrazono)-3-(trichloromethyl)-4,5-dihydro-1H-pyrazol-1-yl)acetamido) propanoate (5)**

A solution of acid chloride **(4a-f)** (2.47 mmol) in dichloromethane (30 mL) were added DL-Alanine ethyl ester hydrochloride (735 mg, 2.5 mmol) and diisopropylethylamine (1.3 mL, 7.5 mmol) at 0°C. Then, the solution warmed to room temperature and it was stirred overnight.

Then, it was diluted with water (50 mL) and dichloromethane (50 mL). The two layers were separated and the aqueous layer was extracted with dichloromethane (50 mL). The combined organic layer was washed with brine solution and dried over anhydrous magnesium sulfate. Filtration of the drying agent and concentration of the solvent gave the crude residue which was purified by using column chromatography to give ethyl 2-(2-(5-oxo-4-(2-phenylhydrazono)-3-(trichloromethyl)-4,5-dihydro-1H-pyrazol-1-yl) acetamido) propanoate (5a-f) (1.5 g) as a colorless oil. Yield 65%, m.p.: $184^0$C; $^1$H-NMR (400 MHz,DMSO-$d_6$ δ ppm) : 1.25-1.28 (d,3H, $CH_2CH_3$), 2.12-2.15(t,3H,$CHCH_3$), 3.51(s,2H, $NCH_2$),4.22-4.27(q,2H $OCH_2$) 5.18-5.25(q,1H,CH $CH_3$), 10.72 (s, H, CONH), 12.58 (s, H, Ar-NH), 6.82 -7.94 (m, 5H, for $C_6H_5$ of phenyl group); $^{13}$C-NMR (400 MHz,DMSO-$d_6$ δ ppm): 64.5 ($CH_2$), 116-144 ( Ar-C ), 132 ( NH-N=C ), 153 ( pyrazole C=O), 91 ( $CCl_3$ ), 145 ($CCl_3$ - C), 171 (C=ONHN$H_2$), 168 (C=ONH), 49(CHC=O), 17.3($CH_3$CH), 65($CH_2$C=O) 14($CH_2CH_3$); IR (KBr): $\bar{\nu}$ = 3164, 3120, 1592, 1617, 1689, 1732 $cm^{-1}$ and these are due to >NH, CO-NH exo > C = N, cyclic carbonyl in five membered heterocyclic ring, carbonyl group, ester carbonyl group respectively. *Anal*. Calcd. for $C_{17}H_{18}Cl_3N_5O_4$ (462.71); C, 44.13; H, 3.92; N, 15.14; found (%); C: 44.20, H: 4.21, N: 22.31.

**(N-(1-hydrazinyl-1-oxopropan-2-yl)-2-(5-oxo-4-(2-phenylhydrazono)-3-(trichloromethyl)-4,5-dihydro-1H-pyrazol-1-yl)acetamide (6)**

A solution of **(5)** (0.01M) and hydrazine hydrate (0.015M) in ethanol 20 mL was refluxed for 5 hours. The reaction mixture was cooled and poured on to ice cold water with stirring. The separated solid was filtered, washed with water and recrystallized from ethanol to afford **(6)** Yield 64%, m.p. $132^0$C; $^1$H-NMR (400 MHz,DMSO-$d_6$ δ ppm): 2.08-2.10 (d,3H, $CHCH_3$), 3.78(s,2H, $NCH_2$CO), 4.31(s, 2H, $NH_2$),4.77-4.82(q, H $CH_3$ CH), 9.72 (s, H, CONH), 11.16 (s, H, NH), 10.75(s, H, Ar-NH), 6.82 -7.98 (m, 5H, for $C_6H_5$ of phenyl group); $^{13}$C-NMR (400 MHz,DMSO-$d_6$ δ ppm): 64.5 ($CH_2$), 116-144 ( Ar-C ), 132 ( NH-N=C ), 153 ( pyrazole C=O), 91 ( $CCl_3$ ), 145 ($CCl_3$ - C), 171 (C=ONHNH2) 168 (C=ONH) 49(CHC=O); IR (KBr): $\bar{\nu}$ = 3420, 3380, 3198, 3132, 3108, 1720, 1680, 1615 and these are due to – $NH_2$, CO–NH, >NH, Ar-NH exo > C = N, cyclic carbonyl in five membered hetero cyclic ring respectively, *Anal*. Calcd. for $C_{15}H_{16}Cl_3N_7O_3$ (448.69); C: 40.15, H: 3.59, N: 21.85 found (%); C: 40.17, H: 3.62, N: 21.88.

**General procedure for microwave-assisted preparation of ((**2-(5-oxo-4-(2-phenylhydrazono)-3-(trichloromethyl)-4,5-dihydro-1H-pyrazol-1-yl)-N-(1-(5-phenyl-2,3-dihydro-1,3,4-oxadiazol-2-yl)ethyl)acetamide **8a-h**

A mixture of **6** (0.01mol), and corresponding benzoic acid **7 a-h** (0.01 mol) and 5 drops of phosphorous oxy chloride under microwave irradiation for few min at (160 W) . After completion of the reaction as indicated by TLC, the reaction mixture was cooled and poured in to crushed ice. Finally, it was neutralized by 5% NaHCO3. After usual workup (2-(5-oxo-4-(2-phenylhydrazono)-3-(trichloromethyl)-4,5-dihydro-1H-pyrazol-1-yl)-N-(1-(5-phenyl-2,3-dihydro-1,3,4-oxadiazol-2-yl)ethyl)acetamide **8a** was obtained in 59% yield.

The above reaction was found to be general one and proceeded smoothly with other substituted aromatic acids R = phenyl, p-tolyl, p-anisyl, p-chloro phenyl, o-tolyl, nicotinyl, 2-furyl, p-nitro phenyl, giving various 1,3,4-Oxadiazoles **8 b – h**

**2-(5-oxo-4-(2-phenylhydrazono)-3-(trichloromethyl)-4,5-dihydro-1H-pyrazol-1-yl)-N-(1-(5-phenyl-2,3-dihydro-1,3,4-oxadiazol-2-yl)ethyl)acetamide 8a :** Yield 59%, M.P.:$176^0$C; $^1$H-

NMR (400 MHz, DMSO-$d_6$ δ ppm 1.59-1.61 (d, 3H, $CH_3$), 3.45(s,2H, $NCH_2CO$), 4.13-4.18(q,1H $CH_3CH$),4.64-4.66 (d, HN-CH) 11.15 (s, H, CONH), 6.38 (s, H, N -NH), 13.16 (s, H, Ar-NH), 6.36 -8.18 (m, 10H, for $C_6H_5$ and $C_6H_4$ of two phenyl groups).; $^{13}$C-NMR (400 MHz, DMSO-$d_6$ δ ppm): 53 ($CH_2$), 116-143 ( Ar-C ), 128 ( NH-N=C ), 153 ( pyrazole C=O), 91 ( $CCl_3$ ), 144 ($CCl_3$ - C), 172 (C=ONH) 156 (C=N) 49(CHC=O),81 (1,3,4 Oxadiazole C) 155 (1,3,4 Oxadiazole C=N); IR (KBr): $\bar{\nu}$ = 3260, 3180, 3006,1698,1602, and 1610 $cm^{-1}$. EI ms: m/z: 535.07; *Anal*. Calcd. for $C_{22}H_{20}Cl_3N_7O_3$ (536.80); C: 49.22, H: 3.76, N: 18.27 found (%);C: 49.30, H: 3.84, N: 18.35.

**(E)-N-(1-(5-(4-chlorophenyl)-2,3-dihydro-1,3,4-oxadiazol-2-yl)ethyl)-2-(5-oxo-4-(2-phenylhydrazono)-3-(trichloromethyl)-4,5-dihydro-1H-pyrazol-1-yl)acetamide 8b :** Yield 63%, M.p.:158$^0$C; $^1$H-NMR (400 MHz, DMSO-$d_6$ δ ppm)1.58-1.60 (d, 3H, $CH_3$), 3.46(s,2H, $NCH_2CO$), 4.12-4.17(q,1H $CH_3CH$),4.65-4.67 (d, HN-CH) 11.14 (s, H, CONH), 6.37 (s, H, N -NH), 13.17 (s, H, Ar-NH), 6.37 -8.19 (m, 10H, for $C_6H_5$ and $C_6H_4$ of two phenyl groups).; $^{13}$C-NMR (400 MHz, DMSO-$d_6$ δ ppm): 53 ($CH_2$), 116-143 ( Ar-C ), 128 ( NH-N=C ), 149 ( pyrazole C=O), 91 ( $CCl_3$ ), 150($CCl_3$ - C), 172 (C=ONH) 156 (C=N) 49(CHC=O),82 (1,3,4 Oxadiazole C) 157(1,3,4 Oxadiazole C=N); IR (KBr): $\bar{\nu}$ = 3262, 3178, 3008, 1691, 1604, and1612$cm^{-1}$. EI ms: m/z: 569.03 *Anal*. Calcd. for $C_{23}H_{19}Cl_4N_7O_3$ (571.24); C: 45.63, H: 2.82, N: 16.80 found (%); C: 45.82, H: 3.14, N: 17.06.

**(E)-N-(1-(5-(4-(furan-2-yl)phenyl)-2,3-dihydro-1,3,4-oxadiazol-2-yl)ethyl)-2-(5-oxo-4-(2-phenylhydrazono)-3-(trichloromethyl)-4,5-dihydro-1H-pyrazol-1-yl)acetamide 8c :** Yield 57%, M.p.: 182$^0$C; $^1$H-NMR (400 MHz, DMSO-$d_6$ δ ppm)1.57-1.59 (d, 3H, $CH_3$), 3.47(s,2H, $NCH_2CO$), 4.11-4.16(q,1H $CH_3CH$),4.66-4.68 (d, HN-CH) 11.13 (s, H, CONH), 6.36 (s, H, N -NH), 13.15 (s, H, Ar-NH), 6.35 -8.17 (m, 10H, for $C_6H_5$ and furyl 2H).; $^{13}$C-NMR (400 MHz, DMSO-$d_6$ δ ppm): 53 ($CH_2$), 116-143 ( Ar-C ), 128 ( NH-N=C ), 153 ( pyrazole C=O), 91 ( $CCl_3$ ), 144 ($CCl_3$ - C), 172 (C=ONH) 156 (C=N) 49(CHC=O),81 (1,3,4 Oxadiazole C) 155 (1,3,4 Oxadiazole C=N); IR (KBr): $\bar{\nu}$ = 3261,3179,3002,1696,1606, and 1611$cm^{-1}$. EI ms: m/z: 601.08 *Anal*. Calcd. for $C_{26}H_{22}Cl_3N_7O_4$ (602.86); C: 51.80, H: 3.68, N: 16.26 found (%); C: 52.01, H: 3.78, N: 16.41.

**(E)-2-(5-oxo-4-(2-phenylhydrazono)-3-(trichloromethyl)-4,5-dihydro-1H-pyrazol-1-yl)-N-(1-(5-p-tolyl-2,3-dihydro-1,3,4-oxadiazol-2-yl)ethyl)acetamide 8d :** Yield 64%, M.p.:171$^0$C; $^1$H-NMR (400 MHz, DMSO-$d_6$ δ ppm 3.14 (s, 3H, Ar – $CH_3$), 1.60-1.62 (d, 3H, $CH_3$), 3.48(s,2H, $NCH_2CO$), 4.13-4.18(q,1H $CH_3CH$),4.67-4.69 (d, HN-CH) 11.12 (s, H, CONH), 6.37 (s, H, N -NH), 13.14 (s, H, Ar-NH), 6.34 -8.16 (m, 10H, for $C_6H_5$ and $C_6H_4$ of two phenyl groups).; $^{13}$C-NMR (400 MHz, DMSO-$d_6$ δ ppm): 53 ($CH_2$), 116-143 ( Ar-C ), 128 ( NH-N=C ), 153 ( pyrazole C=O), 91 ( $CCl_3$ ), 144 ($CCl_3$ - C), 172 (C=ONH) 156 (C=N) 49(CHC=O),81 (1,3,4 Oxadiazole C) 155 (1,3,4 Oxadiazole C=N); IR (KBr): $\bar{\nu}$ = 3265,3179,3001,1694,1605,and1617$cm^{-1}$. EI ms: m/z: 549.08 *Anal*. Calcd. for $C_{23}H_{22}Cl_3N_7O_3$ (550.82); C: 50.15, H: 4.03, N: 17.80 found (%); C: 50.17, H: 4.07, N: 17.86.

**(E)-N-(1-(5-(4-methoxyphenyl)-2,3-dihydro-1,3,4-oxadiazol-2-yl)ethyl)-2-(5-oxo-4-(2-phenylhydrazono)-3-(trichloromethyl)-4,5-dihydro-1H-pyrazol-1-yl)acetamide 17e :** Yield 71%, m.p.:153$^0$C; $^1$H-NMR (400 MHz, DMSO-$d_6$ δ ppm 3.25 (s, 3H, $OCH_3$), 1.61-1.63 (d, 3H, $CH_3$), 3.49(s,2H, $NCH_2CO$), 4.10-4.13(q,1H $CH_3CH$),4.64-4.66 (d, HN-CH) 11.11 (s, H, CONH), 6.35 (s, H, N -NH), 13.16 (s, H, Ar-NH), 6.33 -8.15 (m, 10H, for $C_6H_5$ and $C_6H_4$ of two phenyl groups); $^{13}$C-NMR (400 MHz, DMSO-$d_6$ δ ppm): 53 ($CH_2$), 116-143 ( Ar-C ), 128 ( NH-N=C ), 153 ( pyrazole C=O), 91 ( $CCl_3$ ), 144 ($CCl_3$ - C), 172 (C=ONH) 156 (C=N) 49(CHC=O),81 (1,3,4 Oxadiazole C) 155 (1,3,4 Oxadiazole C=N); IR (KBr): $\bar{\nu}$ = 3264,3178,3007, 1695,1605,and 1616 $cm^{-1}$; EI ms: m/z: 565.08; *Anal*. Calcd. for $C_{23}H_{22}Cl_3N_7O_4$ (566.82); C: 48.74, H: 3.91, N: 17.30 found (%); C: 48.80, H: 4.02, N: 17.32.

**(E)-2-(5-oxo-4-(2-phenylhydrazono)-3-(trichloromethyl)-4,5-dihydro-1H-pyrazol-1-yl)-N-(1-(5-o-tolyl-2,3-dihydro-1,3,4-oxadiazol-2-yl)ethyl)acetamide 17f :** Yield 55%, M.p.:168$^0$C; $^1$H-NMR (400 MHz, DMSO-$d_6$ δ ppm 3.12 (s, 3H, Ar – $CH_3$), 1.62-1.64 (d, 3H, $CH_3$), 3.44(s,2H, $NCH_2CO$), 4.13-4.18(q,1H $CH_3CH$),4.63-4.65 (d, HN-CH) 11.16 (s, H, CONH), 6.34 (s, H, N -NH), 13.13 (s, H, Ar-NH), 6.32 -8.14 (m, 10H, for $C_6H_5$ and $C_6H_4$ of two phenyl groups); $^{13}$C-NMR (400 MHz, DMSO-$d_6$ δ ppm): 53 ($CH_2$), 116-143 ( Ar-C ), 128 ( NH-N=C ), 153 ( pyrazole C=O), 91 ( $CCl_3$ ), 144 ($CCl_3$ - C), 172 (C=ONH) 156 (C=N) 49(CHC=O),81 (1,3,4 Oxadiazole C) 155 (1,3,4 Oxadiazole C=N); IR (KBr): $\bar{\nu}$ = 3267,3178,3005,1697,1607,and1613$cm^{-1}$; EI ms: m/z: 549.08; *Anal*. Calcd. for $C_{23}H_{22}Cl_3N_7O_3$ (550.82); C: 50.15, H: 4.03, N: 17.80 found (%); C: 50.17, H: 4.07, N: 17.86.

**(E)-2-(5-oxo-4-(2-phenylhydrazono)-3-(trichloromethyl)-4,5-dihydro-1H-pyrazol-1-yl)-N-(1-(5-(4-(pyridin-3-ylmethyl)phenyl)-2,3-dihydro-1,3,4-oxadiazol-2-yl)ethyl)acetamide 17g:** Yield 60%, M.p.:145$^0$C; $^1$H-NMR (400 MHz, DMSO-$d_6$ δ ppm 12.23 (s, 1H, Ar - NH), 6.8- 8.5 (m, 9H, for $C_6H_5$ and $C_6H_4$ of two phenyl groups), 8.47 (s, 1H, NH ), 2.62 (s, 2H, $CH_2$) 3.84 (s, 2H, N-$CH_2$), 4.21(m,1H,CH); $^{13}$C-NMR (400 MHz, DMSO-$d_6$ δ ppm): 53 ($CH_2$), 116-143 ( Ar-C ), 128 ( NH-N=C ), 153 ( pyrazole C=O), 91 ( $CCl_3$ ), 144 ($CCl_3$ - C), 172 (C=ONH) 156 (C=N) 49(CHC=O),81 (1,3,4 Oxadiazole C) 155 (1,3,4 Oxadiazole C=N); IR (KBr): $\bar{\nu}$ = 3268, 3182, 3003, 1693, 1602, and 1612$cm^{-1}$; EI ms: m/z: 626.11, *Anal*. Calcd. for $C_{22}H_{21}Cl_3N_8O_3$ (627.91); C: 53.56, H: 4.01, N: 17.85 found (%);. C: 53.60, H: 4.20, N: 17.90.

**(E)-N-(1-(5-(4-nitrophenyl)-2,3-dihydro-1,3,4-oxadiazol-2-yl)ethyl)-2-(5-oxo-4-(2-phenylhydrazono)-3-(trichloromethyl)-4,5-dihydro-1H-pyrazol-1-yl)acetamide 17h :** Yield 62%, m.p: 154$^0$C; $^1$H-NMR (400 MHz, DMSO-$d_6$ δ ppm 1.63-1.64 (d, 3H, $CH_3$), 3.45(s,2H, $NCH_2CO$), 4.14-4.19(q,1H $CH_3CH$),4.62-4.64 (d, HN-CH) 11.17 (s, H, CONH), 6.33 (s, H, N -NH), 13.12 (s, H, Ar-NH), 6.32 -8.13 (m, 10H, for $C_6H_5$ and $C_6H_4$ of two phenyl groups); $^{13}$C-NMR (400 MHz, DMSO-$d_6$ δ ppm): 53 ($CH_2$), 116-143 ( Ar-C ), 128 ( NH-N=C ), 153 ( pyrazole C=O), 91 ( $CCl_3$ ), 144 ($CCl_3$ - C), 172 (C=ONH) 156 (C=N) 49(CHC=O),81 (1,3,4 Oxadiazole C) 155 (1,3,4 Oxadiazole C=N); IR (KBr): $\bar{\nu}$ = 3269,3181,3004, 1692,1603,and1614$cm^{-1}$; EI ms: m/z: 580.05; *Anal*. Calcd. for $C_{22}H_{19}Cl_3N_8O_5$ (581.80); C: 45.42, H: 3.29, N: 19.26 found (%);C: 45.49, H: 3.41, N: 19.44.

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