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Research Article

# SYNTHESIS AND CHARACTERIZATION A NEW THIADIAZEPINE COMPOUNDS FROM NEW BIS4-AMINO-3-MERCPTO-1,2,4-TRIAZOL DERIVATIVES

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**ABSTRACT**

Synthesis of [1,2,4] triazolo [3,4-b] [1,3,4]thiadiazepines $(T)_{1-18}$ is described from new synthesis compounds containing amino groupin (4) position of 4-Amino-3-mercpto-1,2,4-triazoland substituted chalcones $(C)_{1-15}$ in ethanol by reflux for 3-4 hrs. Characterization of the new compounds was established by FTIR, and some of them were characterized using $^1$HNMR and Mass spectral data.

## INTRODUCTION

1,2,4-Triazole system is an important starting material in the synthesis of biologically active heterocycles, which constitute an important class of organic compounds with diverse biological activities, including antiparasitic, analgesic, antibacterial and anti-inflammatory activities[1-3].

Thiadiazepines are not only known for their potent antimicrobial activities[4] but they are alsexcellent charge generating agents[5].They also act as intermediate for preparation of substituted caprolactams

Useful for treatment of HIV disease.

In this paper we describe the synthesis and structuralcharacterization of a new series of Bis(3,4-b) 1,3,4-thiadiazepines. 4-amino-3-mercapto-1,2,4-triazole and chalcone derivatives were prepared as per the literature procedure.

## Experimental

### Succinic dihydrazide Preparation

Dimethyl succinate (5ml) in 25ml of ethanol was taken in round bottom flask. To that hydrazine hydrate (6ml) was added and refluxed for (4 hours). The solution was cooled in ice[6]. The solid crystals was precipitated out and recrystallized with ethanol to give compound [89%], yield, m.p.= 170-172°C.

### Terephthalicdihydrazide Preparation

Dimethyl terephthaliate (5g, mol) solved in (50 ml of ethanol absolute) was taken in round bottom flask. To that hydrazine hydrate (2ml) was added and refluxed for (4 hours). The solution was cooled in ice[(6)]. The solid crystals was precipitated out and recrystallized with ethanol to give compound [ 90% ], yield 88%, mp.=132-135°C.

### Succinic dihydrazide[Bis(potassium dithiocarbazinate)] Preparation

To a solution of potassium hydroxide (2.24g) in ethanol absolute (150ml), succinic dihydrazide (2.92g, 0.02mol) and carbon disulfide (3ml) were added as a drops and the mixture was stirred in ice bath (0-6 $^o$c)[6]. The yellow solid was precipitated out and the potassium salt obtained in quantitative yield was directly used without purification.

### Terephthalicdihydrazid[Bis(potassium dithiocarbazinate)] Preparation

To a solution of potassium hydroxide (1.75g) in ethanol absolute (150ml), terephthalicdihydrazide (3g, mol) and carbon disulfide (3ml) were added as a drops and the mixture was stirred in ice bath (0-6 $^o$c)[6]. The yellow solid was precipitated out and recrystallized with ethanol to give compound [88%], yield 84%, mp.=320-321°C.

**Bis[(3,3`-thio-4,4`-amino-1,2,4-triazole)-5-yl]ethane Preparation**

Suspension of potassium salt was direct used because it was non stable, hydrazine hydrate (2 ml) and water (80 ml) was refluxed for 4 hrs. the color of the reaction mixture changed to green, hydrogen sulfide was evolved and a homogenous solution resulted. A white solid was precipitated by dilution with cold water (100 ml) and acidification with concentrated hydrochloric acid[6]. The product was filtered, washed with cold water (2×30 ml) and recrystallized from ethanol, compound [ 72% ] yield 62%, mp.= 220-222°C.

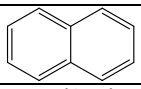
**Bis[(3,3`-thio-4,4`-amino-1,2,4-triazole)-5-yl]phenyl Preparation**

A suspension of potassium salt of terephthalicdihydrazide (2g, mol), hydrazine hydrate (2 ml, 0.04 mol) and water (100 ml) was refluxed for (3 hrs). the color of the reaction mixture changed to light green, hydrogen sulfide was evolved and a homogenous solution resulted A solid was precipitated by dilution with cold water (100 ml) and acidification with concentrated hydrochloric acid[6]. The product was filtered, washed with cold water (2×30 ml) and recrystallized form ethanol**.**

**General procedure for preparation of substituted benzylideneacetophenone(C)$_{1-15}$**

To asolution of substituted aldehyde (0.01 mol) in ethanol (25 ml), a solution of NaOH (6 ml, 40%) was added. The reaction mixture was stirred at room temperature for (4 hr), diluted with water (100 ml) and acidified with dil. HCl. The product obtained was filtered, washed with water, and recrystallized form ethanol[7] .

**Table 1: Physical properties of compounds (C)$_{1-15}$**

| Comp.No. | X | Z | Molecular Formula | Molecular Weight | Solvent | Yield % | Color | mp.°C |
|---|---|---|---|---|---|---|---|---|
| $C_1$ | *P*-$NH_2$ | *P*-$NO_2$ | $C_{15}H_{12}N_2O_3$ | 268 | Ethanol absolute | 85% | Orange | 154-157 |
| $C_2$ | *P*-OH | *P*-$NO_2$ | $C_{15}H_{11}NO_4$ | 269 | Ethanol absolute | 77% | Dark Orange | 107-110 |
| $C_3$ | *P*-$NH_2$ | *P*-Br | $C_{15}H_{12}NOBr$ | 301.9 | Ethanol absolute | 73% | Yellow | 175-178 |
| $C_4$ | *P*-$NH_2$ | *m*-$NO_2$ | $C_{15}H_{12}N_2O_3$ | 268 | Ethanol absolute | 69% | Orange | 157-160 |
| $C_5$ | *P*-$NH_2$ | *P*-$CH_3$ | $C_{16}H_{15}NO$ | 237 | Ethanol absolute | 72% | Yellow | 118-120 |
| $C_6$ | *P*-$NH_2$ | *P*-$OCH_3$ | $C_{16}H_{15}NO_2$ | 253 | Ethanol absolute | 66% | Orange | 121-123 |
| $C_7$ | *P*-$NH_2$ | *P*-Cl | $C_{15}H_{12}NOCl$ | 257.5 | Ethanol absolute | 74% | Yellow | 218-220 |
| $C_8$ | *P*-$NH_2$ |  | $C_{19}H_{15}NO$ | 273 | Ethanol absolute | 82% | Yellow | 148-150 |
| $C_9$ | *P*-$NH_2$ | *P*-N-$(CH_3)_2$ | $C_{17}H_{18}N_2O$ | 266 | Ethanol absolute | 62% | Orange | 98-100 |
| $C_{10}$ | *P*-$NH_2$ | *o*-$NH_2$ | $C_{15}H_{15}N_2O$ | 239 | Ethanol absolute | 70% | Brown | Over 300 |
| $C_{11}$ | *P*-$NH_2$ | 1,3-$(OCH_3)_2$ | $C_{17}H_{17}NO_3$ | 283 | Ethanol absolute | 67% | Yellow | 100-103 |
| $C_{12}$ | 1,3-$(OCH_3)_2$ | *P*-$NO_2$ | $C_{17}H_{15}NO_5$ | 313 | Ethanol absolute | 77% | Orange | 220-222 |
| $C_{13}$ | 1,3$(OCH_3)_2$ | P-Br | $C_{17}H_{15}O_3Br$ | 346.9 | Ethanol absolute | 82% | Pale yellow | 117-120 |
| $C_{14}$ | 1,3-$(OCH_3)_2$ | *P*-Cl | $C_{17}H_{15}O_3Cl$ | 302.5 | Ethanol absolute | 86% | Pale yellow | 135-138 |
| $C_{15}$ | 1,3-$(OCH_3)_2$ | *p*-N-$(CH_3)_2$ | $C_{19}H_{21}$ $NO_3$ | 311 | Ethanol absolute | 73% | Orange | 88-90 |

**General procedure for preparation of substituted [1,2,4] triazolo [3,4-b][1,3,4] thiadiazepine**

Amixture of triazole (0.001 mol) and the corresponding chalcones (0.002 mol) in ethanol absolute (30 ml) was refluxed for (4 hr). reaction mixture on cooling was diluted with (500 ml ) water and stile to night. The color solid was filtered and purified by recrystallization form (ethanol-water)[8].

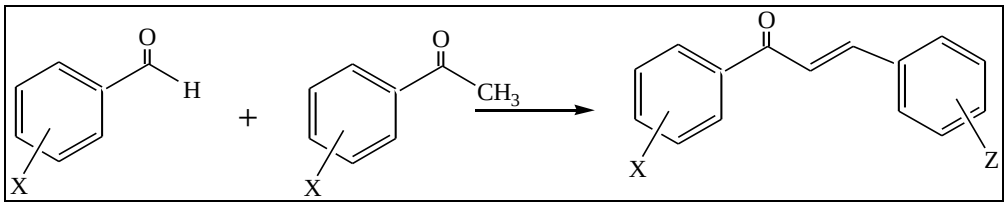
**Table 2: Physical properties of compounds $(T)_{1-18}$**

| Comp No. | G | With $C_n$ | Molecular formula | Molecular Weight | Solvent | Yield % | Color | mp. |
|---|---|---|---|---|---|---|---|---|
| $T_1$ | -Ph- | $C_2$ | $C_{40}H_{24}N_{10}O_6S_2$ | 804 | Ethanol absolute | 69% | White | +340 |
| $T_2$ | -Ph- | $C_3$ | $C_{40}H_{26}N_{10}S_2Br_2$ | 869.8 | Ethanol absolute | 78% | Pale yellow | 145-147 |
| $T_3$ | -Ph- | $C_4$ | $C_{40}H_{24}N_{12}O_4S_2$ | 800 | Ethanol absolute | 77% | Light brown | +340 |
| $T_4$ | -Ph- | $C_5$ | $C_{42}H_{32}N_{10}S_2$ | 740 | Ethanol absolute | 62% | White | +340 |
| $T_5$ | -Ph- | $C_8$ | $C_{48}H_{32}N_{10}S_2$ | 812 | Ethanol absolute | 55% | Red | 130-133 |
| $T_6$ | -Ph- | $C_9$ | $C_{44}H_{38}N_{12}S_2$ | 798 | Ethanol absolute | 66% | Red | 120-123 |
| $T_7$ | -Ph- | $C_{11}$ | $C_{44}H_{36}N_{10}O_4S_2$ | 832 | Ethanol absolute | 62% | Dark red | 102-104 |
| $T_8$ | -Ph- | $C_{12}$ | $C_{44}H_{32}N_{10}O_8S_2$ | 892 | Ethanol absolute | 71% | Orange | 148-150 |
| $T_9$ | -Ph- | $C_{15}$ | $C_{48}H_{44}N_{10}O_4S_2$ | 888 | Ethanol absolute | 68% | Dark brown | 124-126 |
| $T_{10}$ | $-CH_2-CH_2-$ | $C_1$ | $C_{36}H_{26}N_{12}O_4S_2$ | 754 | Ethanol absolute | 75% | Orange | 198-221 |
| $T_{11}$ | $-CH_2-CH_2-$ | $C_3$ | $C_{36}H_{26}N_{10}S_2Br_2$ | 821.8 | Ethanol absolute | 78% | White | 174-176 |
| $T_{12}$ | $-CH_2-CH_2-$ | $C_7$ | $C_{36}H_{26}N_{10}S_2Cl_2$ | 733 | Ethanol absolute | 71% | Light yellow | 152-154 |
| $T_{13}$ | $-CH_2-CH_2-$ | $C_9$ | $C_{40}H_{38}N_{12}S_2$ | 750 | Ethanol absolute | 68% | Brown | 160-164 |
| $T_{14}$ | $-CH_2-CH_2-$ | $C_{11}$ | $C_{40}H_{36}N_{10}O_4S_2$ | 784 | Ethanol absolute | 74% | Red | 181-182 |
| $T_{15}$ | $-CH_2-CH_2-$ | $C_{12}$ | $C_{40}H_{32}N_{10}O_8S_2$ | 844 | Ethanol absolute | 76% | Yellow | 201-203 |
| $T_{16}$ | $-CH_2-CH_2-$ | $C_{13}$ | $C_{40}H_{32}N_8O_4S_2Br_2$ | 911.8 | Ethanol absolute | 82% | White | 214-216 |
| $T_{17}$ | $-CH_2-CH_2-$ | $C_{14}$ | $C_{40}H_{32}N_8O_4S_2Cl_2$ | 823 | Ethanol absolute | 78% | White | 222-225 |
| $T_{18}$ | $-CH_2-CH_2-$ | $C_{15}$ | $C_{44}H_{44}N_{10}O_4S_2$ | 840 | Ethanol absolute | 71% | Green | 90-92 |

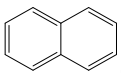
## RESULTS AND DISCUSSION

### Synthesis of 4,4`- benzylideneacetophenone$(C)_{1-15}$

The title compound was prepared according to the following:




$(C)_{1-15}$

**Z= *P*-$NO_2$, *P*-Br, *m*-$NO_2$, *P*-$CH_3$, *P*-$OCH_3$, *P*-Cl,  , *P*-N-$(CH_3)_2$, *o*-$NH_2$, 1,3-$(OCH_3)_2$. X= *P*-$NH_2$, *P*-OH, 1,3-$(OCH_3)_2$,**

Compounds $(C)_{1-15}$ were synthesized by the reaction of aromatic substituted benzaldehyde with substituted acetophenone to achieve calcones $(C)_{1-15}$.

The structures of all products were identified by using FT-IR and $^1$H-NMR for some of theme. The purities of compounds were confirmed by using an elemental analysis. The elemental analysis of compounds $(C)_{1-8}$ are listed in Table (3). The observed values are in well agreement with theoretical values indicating structure of respective compounds.

**Table 3: Elemental Analysis (CHNS-O) for compounds $(C)_{1-8}$**

| Comp. No. | Formula | %C | | % H | | % N | |
|---|---|---|---|---|---|---|---|
| | | Calc. | Found | Calc. | Found | Calc. | Found |
| $C_1$ | $C_{15}H_{12}N_2O_3$ | 67.16 | 67.35 | 4.47 | 5.16 | 10.44 | 9.80 |
| $C_2$ | $C_{15}H_{11}NO_4$ | 66.91 | 69.34 | 4.08 | 4.12 | 5.20 | 4.97 |
| $C_3$ | $C_{15}H_{12}NOBr$ | 59.62 | 59.34 | 3.97 | 4.04 | 4.63 | 4.85 |
| $C_4$ | $C_{15}H_{12}N_2O_3$ | 67.16 | 66.82 | 4.47 | 4.30 | 10.44 | 11.01 |
| $C_5$ | $C_{16}H_{15}NO$ | 81.01 | 81.63 | 6.32 | 7.31 | 5.90 | 5.84 |
| $C_6$ | $C_{16}H_{15}NO_2$ | 75.88 | 76.48 | 5.92 | 6.05 | 5.53 | 5.83 |
| $C_7$ | $C_{15}H_{12}NOCl$ | 69.90 | 69.77 | 4.66 | 3.94 | 5.43 | 5.18 |
| $C_8$ | $C_{19}H_{15}NO$ | 83.51 | 82.30 | 5.49 | 5.88 | 5.12 | 4.98 |

The spectroscopic observation of $(C)_9$ is given: FT-IR (KBr, $cm^{-1}$) figure (1): show the appearance of bands at 3413, 3334, 3143, 2975, 2891, 1682, 1631 and 847 which could be assigned to asymmetrical and symmetrical stretching of amino group, ν C – H of ethylene group[9], ν C –H aliphatic, ν (C = O), ν C = C and out of plane bending of *para*- disustituted benzene ring.

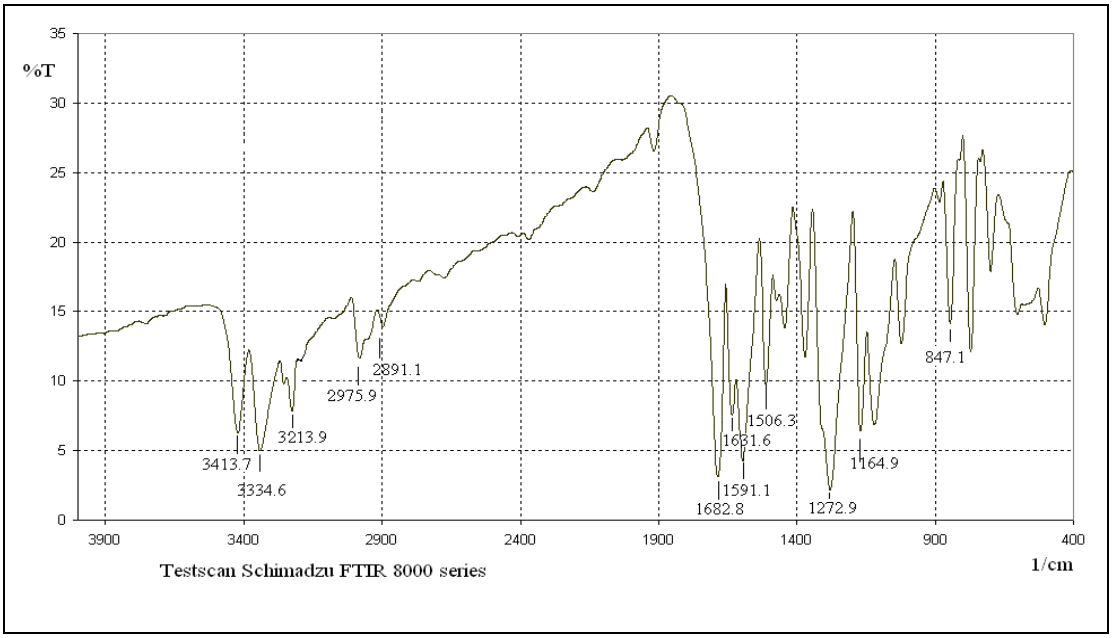



**Fig. 1: FTIR spectrum of 4-N,Ndimethylaminobenzylidene-4`-aminoacetophenone$(C)_9$**

$^1$HNMR (DMSO-$d_6$), δ in ppm) figure (2) compound $(C)_7$: 6.9-8.1 (d-d, 8H, arom. H), 6.5 (s, 2H, CH = CH), 4.5 (s, 2 H, $NH_2$). Table (4) shows the FT-IR absorption bands for synthesizes compounds.

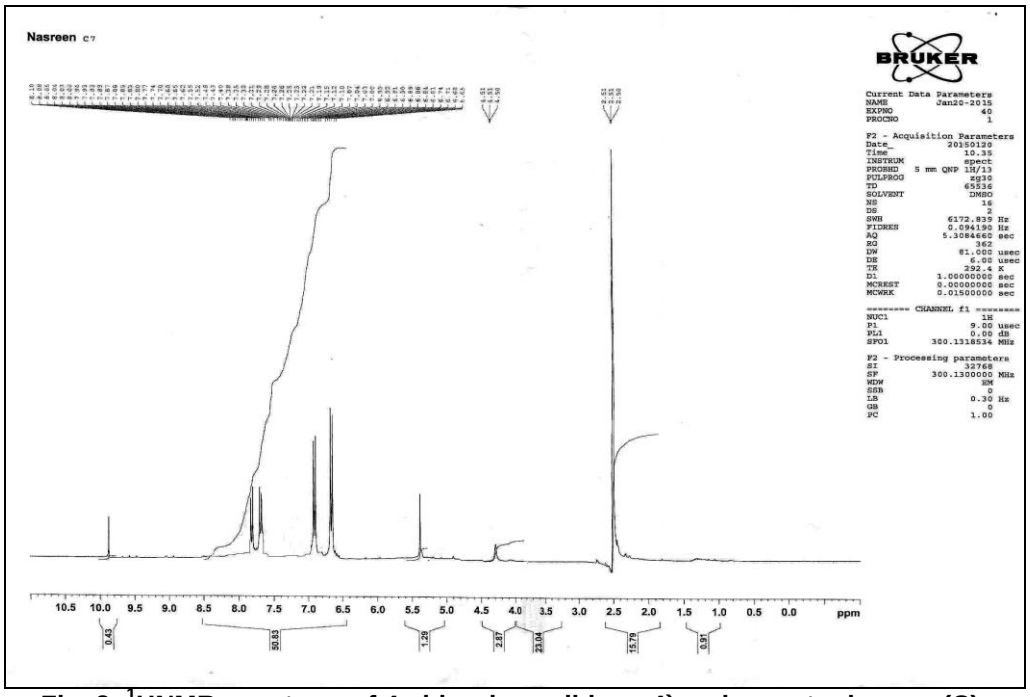
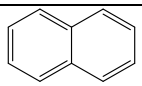
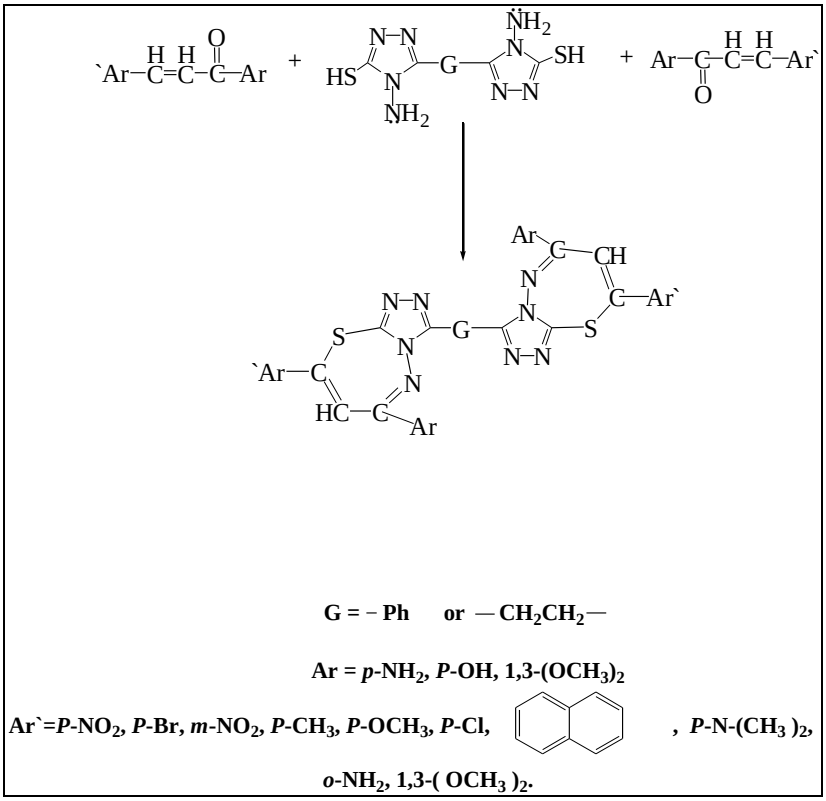



**Fig. 2: $^1$HNMR spectrum of 4-chlorobenzylidene-4`-aminoacetophenone$(C)_7$**

**Table 4: Characteristic FTIR absorption bands of synthesizes compounds $(S)_{1-10}$**

| Comp. No. | X | Z | ν C = CH | ν C = O | ν C = C | γ *para-Sub.* | Other |
|---|---|---|---|---|---|---|---|
| $C_1$ | *P*-$NH_2$ | *P*-$NO_2$ | 3107 | 1637 | 1589 | 825 | 3483, 3384 (ν $NH_2$) |
| $C_2$ | *P*-OH | *P*-$NO_2$ | 3207 | 1647 | 1591 | 834 | 3302 ((ν O-H) |
| $C_3$ | *P*-$NH_2$ | *P*-Br | 3198 | 1652 | 1600 | 841 | 3454, 3313 (ν $NH_2$) |
| $C_4$ | *P*-$NH_2$ | *m*-$NO_2$ | 3201 | 1657 | 1597 | 837 | 3457, 3320 (ν $NH_2$) |
| $C_5$ | *P*-$NH_2$ | *P*-$CH_3$ | 3178 | 1642 | 1602 | 829 | 3461, 3371 (ν $NH_2$) |
| $C_6$ | *P*-$NH_2$ | *P*-$OCH_3$ | 3176 | 1658 | 1595 | 842 | 3423, 3315 (ν $NH_2$) |
| $C_7$ | *P*-$NH_2$ | *P*-Cl | 3180 | 1639 | 1600 | 831 | 3419, 3376 (ν $NH_2$) |
| $C_8$ | *P*-$NH_2$ |  | 3217 | 1637 | 1584 | 829 | 3481, 3327 (ν $NH_2$) |
| $C_9$ | *P*-$NH_2$ | *P*-N-$(CH_3)_2$ | 3213 | 1682 | 1631 | 847 | 3413, 3334 (ν $NH_2$) |
| $C_{10}$ | *P*-$NH_2$ | *o*-$NH_2$ | 3176 | 1663 | 1602 | 837 | 3404, 3310 (ν $NH_2$) |
| $C_{11}$ | *P*-$NH_2$ | 1,3-$(OCH_3)_2$ | 3242 | 1645 | 1591 | 827 | 3442, 3348(ν $NH_2$) |
| $C_{12}$ | 1,3-$(OCH_3)_2$ | *P*-$NO_2$ | 3190 | 1652 | 1585 | 840 | 1514, 1342(ν $NO_2$) |
| $C_{13}$ | 1,3$(OCH_3)_2$ | P-Br | 3076 | 1652 | 1587 | 846 | 2941&2842 (ν CH - Aliphatic ) |
| $C_{14}$ | 1,3-$(OCH_3)_2$ | *P*-Cl | 3104 | 1647 | 1585 | 837 | 2987& 2850(ν CH - Aliphatic ) |
| $C_{15}$ | 1,3-$(OCH_3)_2$ | *p*-N-$(CH_3)_2$ | 3152 | 1645 | 1586 | 838 | 2935(ν CH - Aliphatic ) |

**Synthesis of substituted [1,2,4] triazolo [3,4-b] [1,3,4]thiadiazepines $(T)_{1-18}$:**
The title compound was prepared according to the following scheme




**Scheme. 1: The synthetic pathway for [1,2,4] triazolo [3,4-b] [1,3,4]thiadiazepines $(T)_{1-18}$**

Compounds $(T)_{1-18}$ were synthesized by the reaction of chalcone compounds $(C)_{1-15}$ with Bis[(3,3`-thio-4,4`-amino-1,2,4-triazole)-5-yl]phenyl or ethane in absolute ethanol to give [1,3,4]thiadiazepines $(T)_{1-18}$ derivatives compounds.

The structures of all products were identified by using FT-IR and $^1$H-NMR for some of

theme. The purities of compounds were confirmed by using an elemental analysis. The elemental analysis of compounds $(T)_{1-18}$ are listed in Table (5).

**Table 5: Elemental Analysis (CHNS-O) for compounds $(T)_{1-18}$**

| Comp. No. | Formula | % C | | % H | | %N | | % S | |
|---|---|---|---|---|---|---|---|---|---|
| | | Calc. | Found | Calc. | Found | Calc. | Found | Calc. | Found |
| $T_2$ | $C_{40}H_{26}N_{10}S_2Br_2$ | 55.18 | 54.53 | 2.98 | 2.69 | 16.09 | 15.67 | 7.35 | 6.98 |
| $T_3$ | $C_{40}H_{24}N_{12}O_4S_2$ | 60.00 | 58.88 | 3.00 | 2.43 | 21.00 | 22.49 | 8.00 | 7.34 |
| $T_4$ | $C_{42}H_{32}N_{10}S_2$ | 68.10 | 65.12 | 4.32 | 3.96 | 18.91 | 20.04 | 8.64 | 8.91 |
| $T_6$ | $C_{44}H_{38}N_{10}S_2$ | 66.16 | 64.30 | 4.76 | 3.90 | 17.54 | 18.74 | 8.02 | 9.03 |
| $T_8$ | $C_{44}H_{34}N_{10}O_8S_2$ | 59.19 | 60.89 | 3.81 | 3.65 | 15.69 | 16.64 | 7.17 | 8.45 |
| $T_9$ | $C_{48}H_{46}N_{10}O_4S_2$ | 64.86 | 63.48 | 5.18 | 5.54 | 15.76 | 17.45 | 7.20 | 8.03 |
| $T_{11}$ | $C_{36}H_{26}N_{10}S_2Br_2$ | 52.56 | 53.46 | 3.16 | 3.50 | 17.03 | 16.90 | 7.78 | 8.28 |
| $T_{13}$ | $C_{40}H_{38}N_{12}S_2$ | 64.00 | 62.94 | 5.06 | 5.37 | 22.40 | 20.07 | 8.53 | 9.07 |
| $T_{15}$ | $C_{40}H_{34}N_{10}O_8S_2$ | 56.87 | 55.42 | 4.02 | 5.01 | 16.58 | 18.00 | 7.58 | 8.82 |
| $T_{18}$ | $C_{40}H_{34}N_8O_4S_2Br_2$ | 57.14 | 58.78 | 4.04 | 4.98 | 13.33 | 14.71 | 7.61 | 9.00 |

Spectroscopic observation of $(T)_{11}$ for example is given: FT-IR (KBr, $cm^{-1}$) figure (3): 3477and 3384 ( $NH_2$ asymmertical and symmetrical stretching ), 3074 (Ar–H), 2974–2874 (*v* C–H, aliphatic stretching), 1624 (*v* CH=N), 1614 (*v* C=C) and 822 (out of plane bending for *para*-substituted benzne ring).

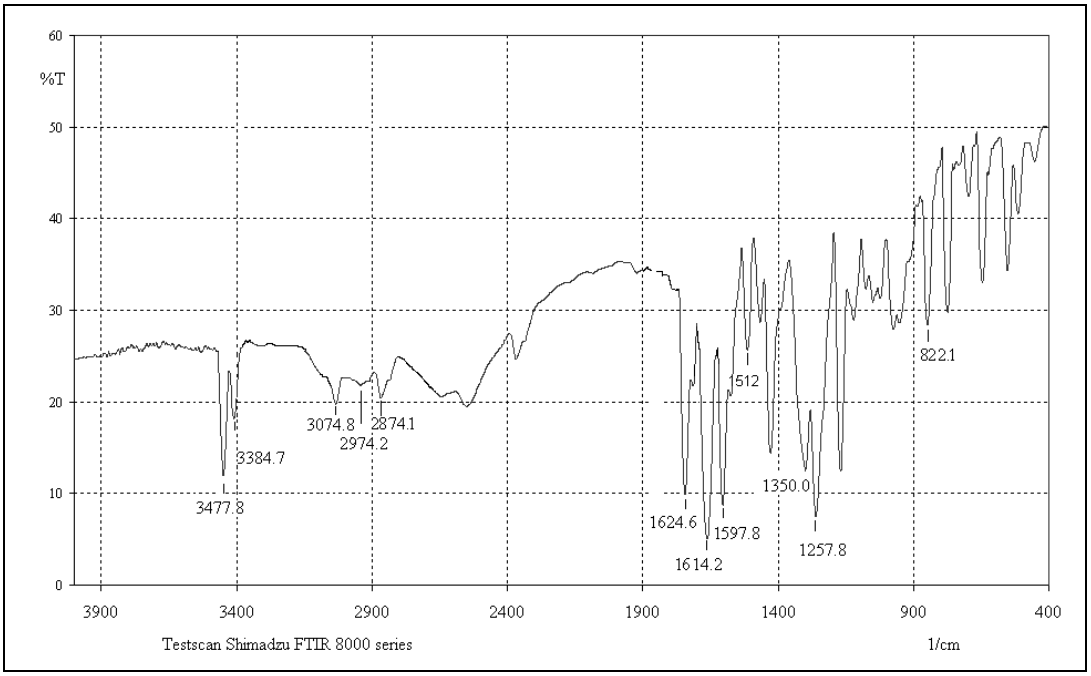



**Fig. 3: FTIR spectrum of compound $(T)_{11}$**

$^1$HNMR spectrum of compound $(T)_{13}$ (Acetone-$d_6$, $\delta$ in ppm) figure (4): 6.57-7.807.90 (d-d, 16H, arom. H), 4.47 (4H, $NH_2$), 2.8(s, 12H, $N(CH_3)_2$), 3.0(t, 4H, $CH_2$ – $CH_2$), 1.3 (s, 2 H, CH (thiadiazepine ring). Table (6) shows the FT-IR absorption bands for synthesizes compounds.

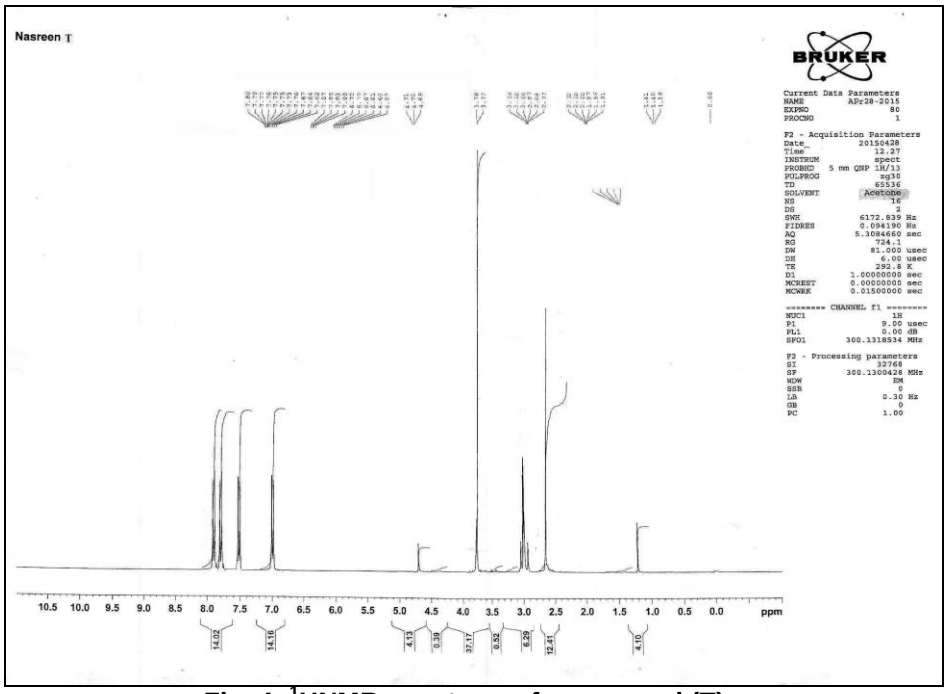



**Fig. 4: $^{1}$HNMR spectrum of compound $(T)_{13}$**

**Table 6: Characteristic FTIR absorption bands of synthesizes compounds $(T)_{1\text{-}18}$**

| Comp.No. | ν $NH_2$ | νAr - H | ν C = N | ν C= C | γ *para-Sub.* | Other |
|---|---|---|---|---|---|---|
| $T_1$ | - | 3056 | 1621 | 1593 | 827 | 1563, 1394 ($NO_2$) & 3203 (O- H) |
| $T_2$ | 3324 &3223 | 3057 | 1632 | 1598 | 833 | - |
| $T_3$ | 3423 **&** 3315 | 3072 | 1622 | 1585 | 820 | 1555 1398 ($NO_2$) |
| $T_4$ | 3342 &3218 | 3072 | 1640 | 1599 | 823 | 2962 & 2856 (C-H Aliphatic |
| $T_5$ | 3434 & 3335 | 3074 | 1633 | 1602 | 846 | - |
| $T_6$ | 3356 & 3281 | 3068 | 1628 | 1604 | 842 | 2973 & 2871 (C-H Aliphatic |
| $T_7$ | 3356 & 3281 | 3043 | 1624 | 1601 | 840 | 2981 & 2879 (C-H Aliphatic |
| $T_8$ | **-** | 3064 | 1631 | 1610 | 836 | 1553, 1357 ($NO_2$), 2986 & 2877 (C-H Aliphatic |
| $T_9$ | **-** | 3058 | 1629 | 1603 | 827 | 2971 & 2891 (C-H Aliphatic |
| $T_{10}$ | 3407 & 3299 | 3061 | 1632 | 1598 | 838 | 1551, 1361 ($NO_2$) |
| $T_{11}$ | 3477 & 3384 | 3074 | 1624 | 1614 | 822 | 2974 & 2874 (C-H Aliphatic |
| $T_{12}$ | 3435 & 3321 | 3065 | 1621 | 1598 | 824 | 2962 & 2885 (C-H Aliphatic |
| $T_{13}$ | 3469 **&** 3369 | 3064 | 1630 | 1602 | 820 | 2912 & 2804 (C-H Aliphatic |
| $T_{14}$ | 3378 & 3251 | 3076 | 1633 | 1612 | 831 | 2973 & 2871 (C-H Aliphatic |
| $T_{15}$ | - | 3041 | 1628 | 1610 | 840 | 1535, 1334 ($NO_2$), 2966 & 2851 (C-H Aliphatic |
| $T_{16}$ | - | 3053 | 1627 | 1597 | 842 | 2973 & 2871 (C-H Aliphatic |
| $T_{17}$ | **-** | 3061 | 1630 | 1602 | 838 | 2951 & 2854 (C-H Aliphatic |
| $T_{18}$ | - | 3050 | 1639 | 1608 | 818 | 2906& 837 (C-H Aliphatic |

## REFERENCES


1. Rajput SS. Int J Pharm Pharm Sci. 2012;4:164-167.
2. Bayrak H, Demirbas A, Demirbas N and Karaoglu SA. Eur J Med Chem. 2009;44:4362–4366.
3. Toraskar MP, Kadam VJ and Kulkarni VM. Int J Pharm Pharm Sci. 2010;2:132-133.
4. Khalil MA, El-Sayed OA and El-Shamy HA. Arch Pharm. 1993;326:489; Chemabstr. 1994; 120:270336W.
5. Kuroda M, Amano M, Noboru F and Ger. Often DF 1991;4028, 184; Chem. Abstr. 1992;116, 313034.
6. Ammar H. AL-Dujaili, Nisreen H. Karam and Jumbad H Tomma. Journal of Internation Academic Research For Multidisciplinary. 2013;1(11):184-196.
7. LaithWaad Allah Allah. Tikrit Journal of pure science. 2012;17(4).
8. Refat El-Sayed. Indian Journal of chemistry. 2006;45B:738-746.
9. Robert M Silverstein, Francis X Webster, David J Kiemle and David L Bryce. Spectrometric Identification of Organic Compounds. Wiley, 8th Edition, 2015.