**IJPSR (2016), Vol. 7, Issue 1** **(Research Article)**

INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES AND RESEARCH

Received on 17 July, 2015; received in revised form, 19 September, 2015; accepted, 06 November, 2015; published 01 January, 2016

# SYNTHESIS OF HETEROCYCLIC NITROGEN COMPOUNDS BY CLOSURE REACTIONS USING TETRAACETYLETHANE WITH VARIOUS PRIMARY AMINES

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**Keywords:**

Closure reactions; acetylacetone; tetraacetylethane; pyrone; chromen; microwave

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**ABSTRACT:** This work includes synthesis of new five, six, and seven-heterocyclic nitrogen compounds by closure reactions of tetraacetylethane (3) with primary amines in refluxing ethanol and acetonitrile as solvents and without using any catalysts. The tetraacetylethane melting point 184-189 ºC was prepared by condensation of two anhydrous molecules of sodium salt of acetylacetone and in the presence of dry ether as solvents and Iodine as a catalysts. The heterocyclic nitrogen compounds as: 1,4,5,8-tetramethyl-4a,8a-dihydropyridazino[4,5-d]pyridazine (11), 3,7-bis (2,4-dinitrophenyl)1,4,5,8-tetramethyl-4a,8a- dihydropyridazino [4,5-d]pyridazine (12), 1,4,5,8-tetramethyl-1,4a,5,8a-tetrahydro-oxazino[4,5-d]oxazine (13), 4,4',6,6'-tetramethyl-[5,5'-bipyrimidine]-2,2'(5H,5H')-dione (14), 2,2',4,4'-tetramethyl-3H,3H'-3,3'-bibenzo[b][1,5]diazepine (15), (4,6-dimethyl-1, 3 dimethyl enepyrrolo[3,4-c]pyrrole-2,5-diyl)bis(ethan-1-amine) (16), 4,4'-(4,6-dimethyl-1,3-dimethylene pyrrolo[3,4-c]pyrrole 2,5-diyl) dibenzoic acid (17), 2,5-bis(4-bromophenyl)-4,6-dimethyl-1,3-dimethylene-pyrrolo[3,4-c] pyrrole (18), 1,1'-((4,6-dimethyl-1,3-dimethylenepyrrolo[3,4-c] pyrrole -2,5-diyl) bis (4, 1-phenylene)) bis (ethan-1-one) (19), were prepared via condensation of compound (3) with primary amines (e.g. , hydrazine hydrate and primary aromatic amines) in 1:2 molar ratios. The compounds (11-19) were also synthesized by microwave irradiation of starting materials without using any solvent to give excellent yields of these compounds ranging between 80-95. Compounds (11-19) have been identified by spectroscopic methods, IR, UV, 1H-NMR, 13C-NMR (DEPT. 90 and DEPT. 135) and elemental analysis (C.H.N).

**INTRODUCTION:** Recently, great attension has been given to synthesis of heterocyclic systems containing nitrogen, oxygen or sulfur atoms. [1-11] Such compounds proved to have wide applications as pharmaceutical drugs, [12] biologically active anti HIV, [13] anti cancer, efficient plant production. [14]

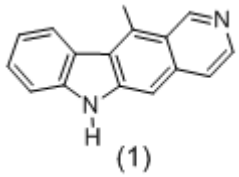
QUICK RESPONSE CODE

**DOI:**
10.13040/IJPSR.0975-8232.7(1).101-07

**Article can be accessed online on:**
www.ijpsr.com

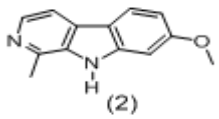
**DOI link:** http://dx.doi.org/10.13040/IJPSR.0975-8232.7 (1).101-07

Compounds containing pyrrole moiety such as (1) have increasing interest for their use as corrective of scurvy disease and also used as anti-bleeding and anti-bunions.[15]



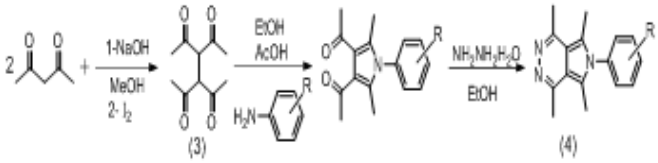

(1)

Other pyrrolic compounds, e.g., harmalin (2) drugs used for correction of fever, also it activates muscle.[16]

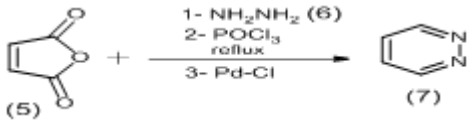


(2)

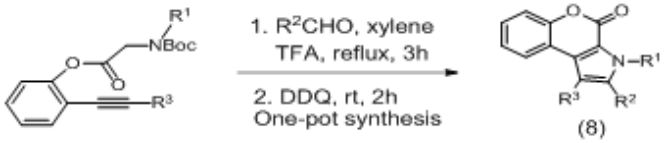
In case of synthesis of compounds containing pyrrolic moiety fused to pyridazine such as the compound (4) was first synthesized by Namedo et al, [17] from tetraacetylethane (3) and amines.



Also, six-membered ring heterocyclic compounds such as pyridazine (7) was prepared by condensation of maleic anhydride (5) with hydrazine (6).[18]



Pyrrole ring fused to chromen ring such as compound (8) was synthesized by ring closure methodology.[19]



Very recently, we have reported the synthesis of pyrone and chromen derivatives (9) and (10) using 1,3-dicarbonyl compounds and aromatic aldehyde using calcium chloride as a catalyst.[20]

In view of the important properties of the heterocyclic compounds as medical agents, we planned to synthesize some new five, six, and seven derivatives, which could possess interesting and useful biological properties.

## MATERIALS AND METHODS:

**Experimental Set Up:** Infrared (IR) spectra were recorded on Shimadzu FT-IR 8400S instrument, and were calibrated using a polystyrene film. Solid compounds were recorded in potassium bromide disks (KBr). Ultraviolet (UV) spectra were recorded on Shimadzu UV-1800 spectrophotometer. $^{1}$H-NMR spectra were recorded on 400 MHz AV III-HD-800 Bio Spin spectrometer, while $^{13}$C-NMR were recorded on 300 MHz Bruker spectrometer instrument using dimethyl sulfoxide (DMSO-$d_6$) as a solvent, using tetramethylsilane (TMS) as an internal standard. Chemical shifts were quote in parts per million (ppm) downfield from TMS. Elemental analysis was performed on the CHN elemental (Eur Vector EA 3000A) Germany, (**Table 1**).

**TABLE 1: CHN ANALYSIS OF COMPOUNDS [11-19].**

| Compd. No. | M.Wt mole/gm | Formula | Found | | | Calculated | | |
|---|---|---|---|---|---|---|---|---|
| | | | C% | H% | N% | C% | H% | N% |
| 11 | 190 | $C_{10}H_{14}N_4$ | 63.81 | 7.12 | 29 | 63.13 | 7.42 | 29.4 |
| 12 | 526 | $C_{22}H_{22}N_8O_8$ | 50.45 | 4.29 | 21.59 | 50.19 | 4.18 | 21.29 |
| 13 | 196 | $C_{10}H_{16}N_2O_2$ | 61.7 | 8.6 | 14 | 61.2 | 8.2 | 14.2 |
| 14 | 246 | $C_{12}H_{14}N_4O_2$ | 59.1 | 5.3 | 22.4 | 58.5 | 5.7 | 22.7 |
| 15 | 342 | $C_{22}H_{22}N_4$ | 76.8 | 6.7 | 16.6 | 77.16 | 6.48 | 16.3 |
| 16 | 246 | $C_{14}H_{22}N_4$ | 67.6 | 9.3 | 22.5 | 68.2 | 9 | 22 |
| 17 | 400 | $C_{24}H_{20}N_2O_4$ | 72.3 | 4.8 | 7.2 | 71.9 | 5 | 7 |
| 18 | 478 | $C_{22}H_{26}N_2Br_2$ | 55.91 | 4.18 | 5.75 | 56.17 | 3.76 | 5.95 |
| 19 | 396 | $C_{26}H_{24}N_2O_2$ | 78.2 | 6.4 | 7.2 | 78.7 | 6.1 | 7 |

Analytical thin layer chromatography (T.L.C.) was carried out on already made 5x5 cm plates coated with silica gel 0.25 cm N-HR/UV 254 and all reactions were monitored by T.L.C., while column chromatography was carried out using silica gel (60-230 mesh) as a stationary phase and different solvent systems as mobile phases.

**Preparation of (3):** This compound was prepared as previously reported. [8] A solution of sodium hydroxide was prepared by dissolving (20 g, 0.5 mole) in 25 ml of water. To this solution 100 ml of methanol was added slowly. This solution was slowly added to the acetylacetone (49 g, 0.5 mole) with hand stirring. After the addition was complete

the mixture was kept in refrigerator for three hours. The sodium salt of acetylacetone was filtered off and washed with (2x10 ml) of cold methanol, air-dried, further drying in an oven °C for 3 hours melting point 151-156 $C^o$,. (Yield, 56-65%) Anhydrous sodium salt of acetylacetone was grounded and the fine powder, (24.4g. 0.2 mol) weighed into flask, after that 200 ml of diethyl ether was added, the suspension was stirred vigorously at room temperature and a solution of iodine (25.4 g) in 200 ml diethyl ether with magnetic stirrer was added drop wise for 2.5 hour.

The reaction mixture was then poured into a large beaker, and the ether was allowed to evaporate overnight at room temperature. To the residue, 500 ml of water was added and the mixture was allowed to stand for 2 hours, and the solid was collected by Filtration, washed several times with water, and dried in a vacuum desiccator. The product was recrystallized from methanol, which gave white crystals of (3), m.p., 184-189 $C^o$ and (Yield: 11g, 45%).

**Reaction of (3) with:**

**a- Hydrazine hydrate:**

To a solution of (3) (0.19g, 0.95 mmol) in ethanol (5ml) hydrazine hydrate (0.095g, 1.9mmol), was added the mixture was stirred at room temperature for 0.5 h. Solvent was evaporated using rotary evaporator, and the residue left was recrystallized from a mixture of water : ethanol (1:1), to give white crystals of 1,4,5,8-tetramethyl-4a,8a-dihydropyridazino[4,5-d]pyridazine (11), m.p., 304-306℃, (Yield: 0.25g, 88%), $\lambda_{max}$ (EtOH) : 230 nm, υ (KBr ) : 2930 , 2825 (CH- aliph.) ; 1575 , 1550 $cm^{-1}$ (C=N). $^1$H-NMR (DMSO-$d_6$) : δ 0.99 (12H, s, $4CH_3$) ; 1.4 ppm (2H, d, $H_{4a\ ,\ 8a}$). $^{13}$C-NMR (DMSO-$d_6$) : δ 27.2 ($4CH_3$) ; 35.4 [CH(4a,8a)] ; 115.1 ppm ($C_{1\ ,\ 4\ ,\ 5\ ,\ 8}$).

**b- 2,4-Dinitrophenylhydrazine:**

To a solution of (3) (0.5g, 2.5 mmol) in acetonitrile (10ml) was added 2,4-dinitrophenylhydrazine (1g, 5mmol), the mixture was refluxed for 4 h. Solvent was evaporated, and the residue was recrystallized from acetonitrile, to give red crystals of 3,7-bis(2,4-dinitrophenyl)1,4,5,8-tetramethyl-4a, 8a -dihydropyridazino [4,5-d]pyridazine (12), m.p., 128-129℃, (Yield:1.41g, 94%), $\lambda_{max}$ ($CH_3CN$) : 290 , 363 nm, υ (KBr): 3097 (CH-aromat.) ; 2920 , 2850 (CH-aliph.) ; 1625 (C=C) ; 1580 (C=N) ; 1525 , 1334 ($NO_2$) ; 1281 , 1140 $cm^{-1}$(C-N). $^1$H-NMR (DMSO-$d_6$) : δ 1.04 [6H, d, $2CH_3$(4,8)] ; 1.50 (2H, t, $H_{4a\ ,\ 8a}$) ; 1.62 (2H, q, $H_{4\ ,\ 8}$) ; 1.75 [6H, s, $2CH_3$(1,5)] ; 7.1-8.4 ppm (6H, aromatic protons). $^{13}$C-NMR (DMSO-$d_6$) : δ 29.5 [$CH_3$(1,4,5,8)] ; 33.8 [CH(4a,8a)] ; 36.2 [CH(4,8)] ; 117.6 ($C_{1\ ,\ 5}$) 123.4-132.1 (C 3',5',6',3",5",6") ; 138.4 ($C_{1'\ ,\ 1"}$) ; 145.6 ($C_{2'\ ,\ 2"}$) 148.3 ppm ($C_{4'\ ,\ 4"}$).

**c- Hydroxylamine.HCl:**

To a solution of hydroxylamine.HCl (0.14g, 2mmol) in ethanol (5ml) containing pyridine (0.15g, 2mmol) was added a solution of (3) (0.2g, 1mmol ) in ethanol (5ml) , and the mixture refluxed for 12 h. After reaction was completed, the solvent was evaporated and the residue was taken in ethylacetate (10ml), washed with a solution of sodium carbonate (15ml), and the organic layer was separated, dried over anhydrous $MgSO_4$.

Solvent was evaporated, and the residue was recrystallized from ethylacetate: hexane (1:2), to give white crystals of 1,4,5,8-tetramethyl-1,4a,5,8a-tetrahydro-oxazino[4,5-d]oxazine (13), m.p., 268-269℃, (Yield: 0.14g, 41%), $\lambda_{max}$ (EtOH) : 290 nm, υ (KBr) : 2920 , 2830 (CH- aliph.) , 1570 (C=N) , 1250 $cm^{-1}$ (C-O). $^1$H-NMR (DMSO-$d_6$) : δ 1.13 [6H, d, CH3(1,5)] , 1.46 (2H, t, H4a , 8a) , 1.72 (2H, p, $H_1$ , 5) , 1.77 ppm [6H, s, $CH_3$(4,8)]. $^{13}$C-NMR (DMSO-$d_6$) : δ 31.4 [$CH_3$(1,4,5,8)] , 36.3 (C4a,8a) , 47.6 (C1,5) , 114.4 ppm ($C_{4\ ,\ 8}$).

**d- Urea:**

To a solution of (3) (0.1g, 0.5 mmol) in ethanol (5ml), urea (0.06g, 1mmol) was added, and the mixture was refluxed for 14 h. Solvent was evaporated and the residue was recrystallized from ethanol to give yellow crystals of 4,4',6,6'-tetramethyl-[5,5'-bipyrimidine]-2,2'(5*H*,5*H'*)-dione (14), m.p., 211-212℃, (Yield: 0.08g, 56%), $\lambda_{max}$ (EtOH) : 207 , 290 nm, υ (KBr) : 2960 , 2820 (CH-aliph.) , 1670 (C=O) , 1610 (C=N) , 1150 $cm^{-1}$ (C-N). $^1$H-NMR (DMSO-$d_6$) : δ 1.44 (2H, d, $H_{5\ ,\ 5'}$) , 1.79 ppm [12H, s, $CH_3$(4,4',6,6')]. $^{13}$C-NMR (DMSO-$d_6$) : δ 27.2 [$CH_3$(4,4',6,6')] , 35.4 ($C_{5,5'}$) , 122.1 ($C_{4\ ,\ 4'\ ,\ 6\ ,\ 6'}$) ; 175.2 ppm (2CO).

**e- 1,2-Diaminobenzene:**

To a solution of (3) (0.5g, 2.5 mmol) in ethanol (5ml), 1,2-diaminobenzene (0.54g, 5mmol) was added, the mixture was refluxed for 20 h. Solvent was evaporated, and the residue was recrystallized from ethylacetate, to give yellow crystals of 2,2',4,4'-tetramethyl-3*H*,3*H'*-3,3'-bibenzo [b] [1,5] diazepine (15), m.p., 235-238℃, (Yield: 0.71g, 68%), $\lambda_{max}$ (EtOH) : 213 , 251 , 292 nm, υ (KBr): 3060 (CH-aromat.) , 2997 , 2825 (CH-aliph.) , 1660, 1637 (C=C) , 1525 , 1504 (C=N) , 1178 , 1157 $cm^{-1}$(C-N). $^{1}$H-NMR (DMSO-$d_6$) : δ 1.99 [12H, s, $CH_3$(2,4,2',4')] , 6.65 (2H, d, $H_{3\ ,\ 3'}$) , 6.88 (4H , d, $H_{7\ ,\ 10\ ,\ 7'\ ,\ 10'}$) , 7.19 ppm (4H, t, $H_{8\ ,\ 9\ ,\ 8'\ ,\ 9'}$). $^{13}$C-NMR (DMSO-$d_6$) : δ 30.6 [$CH_3$(2,4,2',4')] , 39.7 (C3,3') ,115.2-121.0 (C7,8,9,10,7',8',9',10') , 126.4 ($C_{2\ ,\ 4\ ,\ 2'\ ,\ 4'}$) , 134.4 ppm ($C_{6\ ,\ 11\ ,\ 6'\ ,\ 11'}$).

**f- Ethylenediamine:**

To a solution of (3) (0.5g, 2.5 mmol) in ethanol (5ml), ethylenediamine (0.3g, 5mmol) was added and the mixture was refluxed for 18 h. Solvent was evaporated and the residue was chromatographed on silica gel using ethylacetate: ethanol 10:1. Solvent was evaporated and the residue was recrystallized from ethylacetate: n-hexane (1:1), gave yellow crystals of (4,6-dimethyl-1,3dimethylenepyrrolo[3,4-c]pyrrole-2,5-diyl)bis(ethan-1-amine) (16), m.p., 261-262℃, (Yield:0.38g, 48%), $\lambda_{max}$ (EtOH) : 290 nm, υ (KBr ) : 3390 , 3360 (N-H) , 2985 , 2850 (CH- aliph.) , 1260 $cm^{-1}$ (C-N). $^{1}$H-NMR (DMSO-$d_6$) : δ 1.65 [6H, s, $CH_3$(4,6)] , 2.42 (4H, t, $H_{2'\ ,\ 5'}$) , 2,81 (4H, q, $H_{3'\ ,\ 6'}$) , 4.56 (4H, t, $2NH_2$) , 5.16 ppm [4H, s, $CH_2$ (1,3)]. $^{13}$C-NMR (DMSO-$d_6$) : δ 29.2 [CH3(4,6)] , 36.3 [C(2',3',5',6') , 114.8 ($C_{3a\ ,\ 6a}$) , 117.3 ($C_{4\ ,\ 6}$) , 127.1 ($C_{1\ ,3}$) , 138.6 ppm [C(1,3)].

**g- p-Aminobenzoic acid:**

A solution of p-aminobenzoic acid (0.69g, 5mmol ) in ethanol (5ml ) was added to solution of (3) (0.5g, 2.5mmol ) in ethanol (5ml ), and the mixture was refluxed for 18 h, and allowed to stand overnight and the resulting solid was collected by filtration, and recrystallized from ethanol, to give yellow crystals of 4,4'-(4,6-dimethyl-1,3-dimethylene pyrrolo[3,4-c]pyrrole 2,5-diyl) dibenzoic acid (17), m.p., 255℃ decomp., (Yield:0.76g, 64%), $\lambda_{max}$ (EtOH) : 245 , 290 nm, υ (KBr): 3410 (O-H) , 3055 (CH-aromat.) , 2991 , 2921 (CH-aliph.) , 1708 , 1676 (C=O) , 1596 (C=C) , 1176 (C-N). 1249 $cm^{-1}$ (C-O). $^{1}$H-NMR (DMSO-$d_6$) : δ 1.65 [6H, s, $CH_3$(1', 5')] , 5.16 [4H, s, $CH_2$ (4', 2')] , 7.12-8.08 (8H, dxd, Ph-protons), ; 11.31 ppm (2H, s, 2OH). $^{13}$C-NMR (DMSO-$d_6$) : δ 28.1 [$CH_3$(1', 5')] ; 104.7 ($C_{3a\ ,\ 6a}$) ; 118.3 ($C_{1'\ ,\ 5'}$) ; 128.1 ($C_{4',\ 2'}$) , 137.5 [C(4', 2')] , 142.5-151.3 (C3', 2', 6', 5',3,2,6,5) , 154.5 ($C_{1'\ ,\ 1}$) , 159.5 ($C_{4'\ ,\ 4}$) , 182.5 ppm (2CO).

**h- p-Bromoaniline:**

p-bromoaniline (0.86g, 5mmol) was added to a solution of (3) (0.5g, 2.5mmol ) in ethanol (5ml), and the mixture was refluxed for 14 h, solvent was evaporated and the residue was recrystallized from ethanol, to give yellow crystals of 2,5-bis(4-bromophenyl)-4,6-dimethyl - 1, 3- dimethylene-pyrrolo[3,4-c] pyrrole (18), m.p., 238-240℃, (Yield:0.72g, 54%), $\lambda_{max}$ (EtOH) : 207, 238 , 287 nm, υ (KBr): 3020 (CH-aromat.) , 2999 , 2974 (CH-aliph.) , 1664 , 1640 (C=C) , 1176 (C-N). 669, 600 $cm^{-1}$(C-Br), $^{1}$H-NMR (DMSO-$d_6$) : δ 1.71 [6H, s, $CH_3$(4,6)] , 5.38 [4H, s, $CH_2$ (1,3)] , 7.06-7.51 ppm (8H, dxd, Ph-protons). $^{13}$C-NMR (DMSO-$d_6$) : δ 28.5 [$CH_3$(4,6)] , 111.2 ($C_{3a\ ,\ 6a}$) , 116.7 ($C_{4\ ,\ 6}$) , 130.5 ($C_{1\ ,3}$) , 138.1 $C_{(1,3)}$ , 144.6-150.7 ($C_{2,3,5,6,2',3',5',6'}$) , 156.3 ($C_{1\ ,\ 1'}$) , 160.4 ppm ($C_{4\ ,\ 4'}$).

**i- p-Aminoacetophenone:**

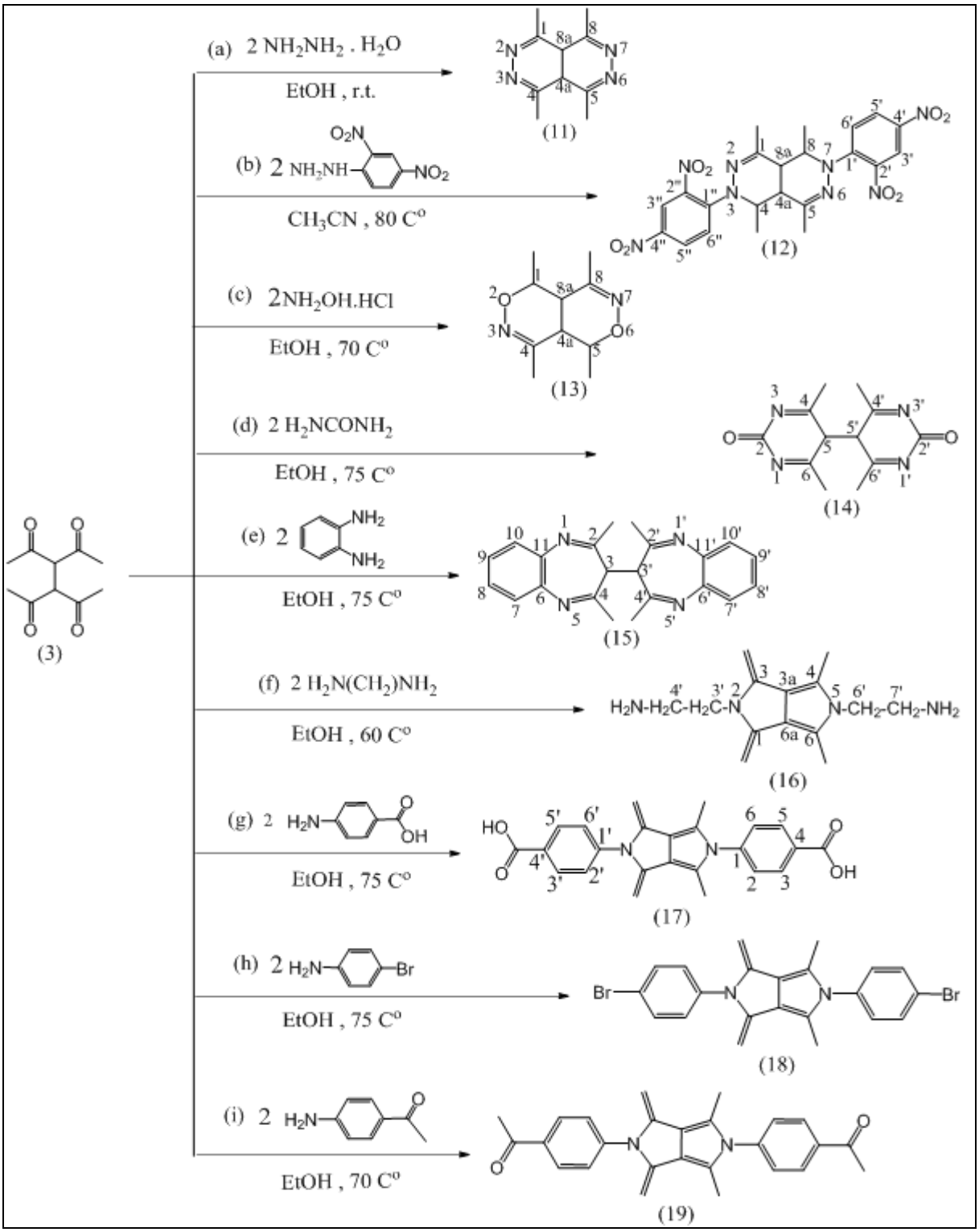
p-aminoacetophenone (0.68g, 5mmol) was added to a solution of (3) (0.5g, 2.5mmol ) in ethanol (5ml), and the mixture was refluxed for 18 h, solvent was evaporated and the residue was recrystallized from ethylacetate, to give white crystals of 1,1'-((4,6-dimethyl-1,3-dimethylene pyrrolo[3,4-c]pyrrole -2,5-diyl)bis (4,1-phenylene)) bis(ethan-1-one) (19), m.p., 288-291℃, (Yield: 0.64g, 55%), $\lambda_{max}$ (EtOH) : 225 , 275 nm, υ (KBr): 3090 (CH-aromat.) , 2990 , 2930 (CH-aliph.) ; 1750 , 1690 (C=O) , 1660 , 1610 (C=C) , 1175 $cm^{-1}$ (C-N). $^{1}$H-NMR (DMSO-$d_6$) : δ 1.64 [6H, s, $CH_3$(4,6)] , 2.32 (6H, s, $2CH_3CO$) ; 5.29 [4H, s, $CH_2$ (1,3)] , 7.21-7.90 ppm (8H, dxd, ph-protons). $^{13}$C-NMR (DMSO-$d_6$) : δ 27.8 [$CH_3$(4,6)] , 30.6 ($2CH_3CO$) , 109.2 ($C_{3a\ ,\ 6a}$) , 112.5 ($C_{4\ ,\ 6}$) ; 126.8 ($C_{1\ ,3}$) , 133.1 C(1,3) , 141.4-150.2 ($C_{2,3,5,6,2',3',5',6'}$) , 154.2 ($C_{1\ ,\ 1'}$) , 161.4 ($C_{4\ ,\ 4'}$) , 174.1 ppm (2CO).

**Organic Preparations by microwave method:**

A mixture of (3) (10 mmol) and primary amines (a-i) were mixed and grinded very well and irradiated

in domestic microwave oven (850 watt) and monitored by t.l.c reaction with authentic samples prepared previously, Products were isolated and identified as previously mentioned. See **Table (2).**

**RESULTS AND DISCUSSION:** Heterocycliczation of the synthesized compounds (11-19) were achieved by refluxing amines with tetraacetylethane (3) in ethanol and acetonitrile. In this study, reaction of amines with tetraacetylethane (3) can be considered as a standard model reaction for the synthesis of fused 5-,6-,7-membered ring heterocyclic compounds, (see **scheme 1**).




**SCHEME: 1**

From this preliminary study it was observed that the reaction of hydrazines with tetraacetylethane (3) gave fused six-membered of pyridazino pyridazines (11) and (12), while primary aromatic amines and 1,2-diaminoethane gave fused five membered pyrrolo-pyrrole (16,17,18 and 19). Other amines such as hydroxylamine hydrochloride gave fused six-membered oxazino-oxazine (13). Bicyclofused heterocyclic six-and seven ring compounds such as (14) and (15) were obtained by reaction of (3) with urea and phenylene diamine respectively. Compounds (11-19) may be formed via nucleophile attack of two mole of amines on two 1,3 or 1,4-dicarbonyl moieties followed by heterocyclization via second nucleophilic nitrogen attack on these moieties. Encouraged by these results, we then investigated the synthesis of the compounds (11-19) by microwave irradiation of the mixture of the amines and tetraacetylethane (3). After a careful study, increased product and yields were observed with dramatic decrease in reactions times (see **Table 2**).

**TABLE 2: PHYSICAL PROPERTIES, CRYSTALLIZATION SOLVENT AND YIELD% FOR THE COMPOUNDS (11-19).**

| Compd. No. | Color | M.P. [C°] | Crystallization Solvent | Conventional method | | | Microwave method | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Reaction Solvent | Reaction time [hr] | Yield [%] | Reaction Solvent | Reaction time [min] | Yield [%] |
| 15 | White | 304-6 | EtOH | EtOH | 0.5 | 88 | ---- | 1 | 90 |
| 16 | Red | 128-9 | $CH_3CN$ | $CH_3CN$ | 4 | 94 | ---- | 3 | 95 |
| 17 | White | 268-9 | EtOAC: $C_6H_{14}$ | EtOH | 12 | 41 | ---- | 5 | 80 |
| 18 | yellow | 212 | EtOH | EtOH | 14 | 56 | ---- | 8 | 85 |
| 19 | yellow | 235-8 | EtOAC | EtOH | 20 | 68 | ---- | 13 | 88 |
| 20 | yellow | 261-2 | EtOAC: $C_6H_{14}$ | EtOH | 18 | 48 | ---- | 12 | 80 |
| 21 | yellow | 255 .d | EtOH | EtOH | 18 | 64 | ---- | 10 | 90 |
| 22 | yellow | 238-2 | EtOH | EtOH | 14 | 54 | ---- | 6 | 95 |
| 23 | White | 288-91 | EtOAC | EtOH | 18 | 55 | ---- | 8 | 85 |

It was suggested that effective concentration of the organic reactants increase the reaction rate via a concentration effect. According to our understanding of the stability of the rings it is clear that the formation of 5-,6-and 7-membered rings are the more stable ones. Formation of the products (11-19) was confirmed by IR, UV, $^{1}$H-NMR, $^{13}$C-NMR (DEPT 90 + DEPT 135).

**CONCLUSION:** In conclusion, we have developed an exceedingly simple, mild, and clean synthetic method for the synthesis of fused 5-,6-and 7-heterocyclic compounds. In this method, the use of tetraacetylethane and primary amines have been described without using catalysts. Apparently the products obtained by microwave irradiation of starting materals gave high yield without using any organic reagents or solvents.

**ACKNOWLEDGMENT:** The authors would like to thank the department of chemistry, university of Samarra, Iraq for providing the facilities.

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**How to cite this article:**
Alsamarrai ASH and Mohammad HJ: Synthesis of Heterocyclic Nitrogen Compounds by Closure Reactions Using Tetraacetylethane with Various Primary Amines. Int J Pharm Sci Res 2016; 7(1): 101-07.doi: 10.13040/IJPSR.0975-8232.7(1).101-07.