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The Reactions of 3- Mercapto-6-Methyl- 1,2,4- Triazin-5(2H)-one with Alkyl Phosphites

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Abstract: The reaction of 3-mercapto-6-methyl-1, 2, 4-triazin-5 (2H)-one **1** with dimethyl **2a** and trimethyl phosphite **3a** at 100 ^{0}C in absence of solvent yields the dimeric product **4** and while the alkylated products **5** and **6** are obtained for reaction with **3a**. Methylation of **1** by methyl iodide gives alkylated product **5.** Reaction of **1** with diethyl **2b** and triethyl phosphite **3b** by the same previous conditions yields phosphonate adduct **7** and while the acids **9a** and **10** are obtained for reaction with **3b**. Acid hydrolysis of phosphonate **7** regenerated the starting material **1**. Reaction of **1** with diisopropyl **2c** and triisopropyl phosphite **3c** takes place only in presence of a base for **2c** and a protonating agent for **3c** respectively in dry toluene at reflux temperature to give phosphonate adduct **11** and the alkylated product **12** respectively**.** Reaction time is an important factor in these reactions. Possible reaction mechanisms are considered and structures of the new products were confirmed on the basis of spectral data, and elementary analysis.

Key words: 1,2,4- Triazine, Alkyl phosphites, Alkylation, Phosphonates, Ring opening, acid hydrolysis.

INTRODUCTION

Several transmissions of infectious diseases continue to represent a major worldwide public health problem. Consequently, there is a pressing need to develop new antimicrobial agents which have a broad spectrum of activity against the resistance of micro-organisms.

The 1,2,4-triazine ring is a prominent structural motif found in numerous pharmacologically active compounds. Certain azonucleosides, structurally based on the1,2,4-triazine heterocyclic systems were proved to display antitumor (Creasey *et al* 1963 and Darke *et al* 1972), antiviral (Sidwell *et al* 1968, antifungal Matolcsy 1966), analgesic and anti-inflammatory activities (Makhlouf 2004). With some fused 1,2,4-triazine heterobicyclic nitrogen systems were observed a significant activity in Leukemia, lung, breast anticancer evaluation (Gendy *et al* 2001).

1,2,4-triazine derivatives can be developed as potential drug candidates for antiamoebic activity (Singh *et al* 2005).

Condensed 1,2,4-triazines found applications as pharmaceutical, herbicides, pesticides and dyes (Jones *et al* 1971, Neunhoeffer 1984 and El-Ashry *et al* 1994). It is worthy to mention that triazine phosphate derivatives can be used as enzyme inhibitor (Hag *et al* 2003). It should be noted that 3-pyridyl-1,2,4-triazines are interesting compounds due to their applications in transition metal analysis (Croot *et al* 2000), or in separation of lanthanides and actinides in the management of nuclear waste (Kolarik *et al* 1999) Conversion of triazines to pyridines was achieved by aza-Diels-Alder reactions to give bipyridines in high yields (Kozhevnikov *et al* 2005).

Moreover various derivatives of 1,2,4-triazines have many functional groups to be utilized as starting materials in different interesting reactions (Osman *et al* 2007).

Our growing interest in the organo-phosphorus chemistry (Hafez *et al* 2007) has prompted us to study the behavior of 1,2,4-triazines towards phosphorus reagents since it has limited attention upon such reactions (Muthusamy *et al* 2009 and Karel *et al* 2001).

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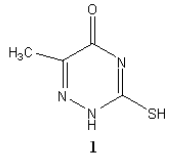
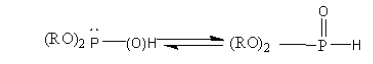
RESULTS AND DISCUSSION

In the present investigation we study the reaction of 3-mercapto-6-methyl-1, 2, 4-triazin-5 (2H)-one **1** towards dialkyl phosphites $\mathbf{2}_{\mathbf{a-c}}$ and trialkyl phosphites $\mathbf{3}_{\mathbf{a-c}}$.

Alkyl phosphites and phosphonates have been known to convert acids to esters (Sutter *et al* 1978), phenols and amines to the corresponding alkyl derivatives (Sutter *et al* 1978, Fieser 1974 and 1976) and thiol (Yosef 2010) to dimeric substances that did not containing phosphorus (Mahran *et al* 1981 and 1986).



1



2

a, R= CH_3 (DMP)
b, R= C_2H_5 (DEP)
c, R= C_3H_7-i (DiPP)

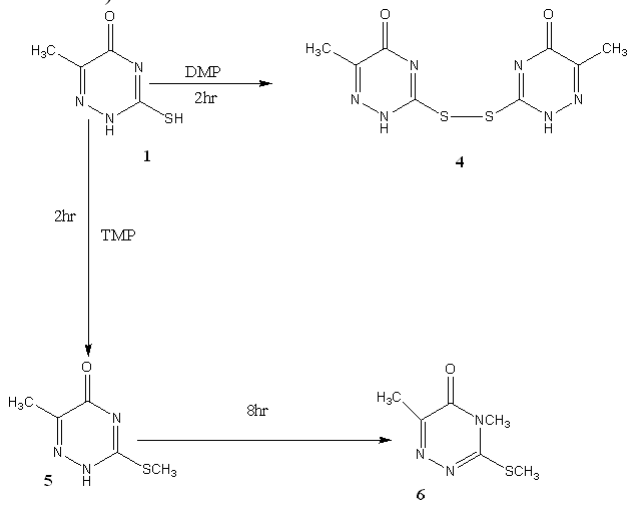
3

a, R' = CH_3 (TMP)
b, R' = C_2H_5 (TEP)
c, R' = C_3H_7-i (TiPP)

We have found that 3-mercapto-6-methyl-1,2,4-triazin-5 (2H)-one **1** reacts with dimethyl phosphite (DMP,2_a) at 100 ^{0}C in absence of solvent for 2 hr. to give pale brown crystalline substance for which the dimeric structure **4** was assigned for the following reasons: (a) elementary analysis and molecular weight determination (MS) corresponded to $C_8H_8N_6O_2S_2$ (b) IR spectrum of 4 revealed the presence of two strong absorption bands at 1722,1674 cm^{-1} for the two carbonyl groups. Two bands at 3261, 3163 cm^{-1} for the two NH groups, Stretching aliphatic- CH bands at 2924, 2794cm^{-1} (Bellamy 1964). (c) The ^{1}H-NMR spectrum (DMSO, δ ppm) showed singals at 2.00 (3H, s due to protons of the methyl group), 2.10 (3H, s due to protons of the other methyl group), 6.05 (1H, s due to the NH proton), 7.34 (1H, s due to another NH proton), the two NH protons are D_2O exchangeable (Crutchfield *et al* 1967). The mass spectra MS for $C_8H_8N_6O_2S_2$: m/z (%) 286 [(M^+-2H)] (13.79%), base peak: 143 [M^+- $C_4H_4N_3OS$] Prolonged heating for 8 hr. leads to the same dimeric product **4** (Scheme1).

Compound 4 may be present in conformers which differ in the dihedral angle, these results in different chemical environment for the two protons and functional groups in compound 4, this explained the spectral data represented above (Elie *et al* 1994).

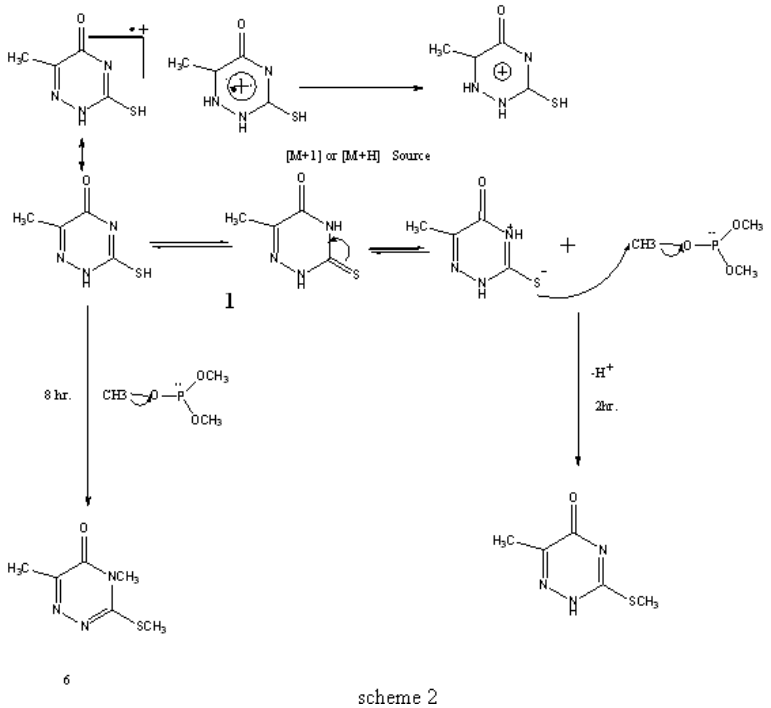
Heating a solution of **1** in dry toluene for 12 hr. returns it without change. The formation of dimer **4** through the reaction of dimethyl phosphite with 1 recalls the process of "tail-to tail" dimerization observed with p-quinonemethides (Mahran *et al* 1981).



Scheme1

By treatment of compound **1** with trimethyl phosphite (TMP, 3a) in absence of solvent at 100 ^{0}C for 2 hr. 6-methyl-3-(methylthio)-1,2,4-triazin-5 (2H)-one **5** was isolated and identified (Scheme 1) (Jacobse *et al* 1987). The reaction may be viewed as occurring via attack of sulfur on the alkyl group of phosphorus reagent as depicted in Scheme 2. This result has shown that alkyl phosphits can alkylate compounds of type 1. Extended heating of compound 1 with excess of trimethyl phosphite (TMP, 3a) by the same previous conditions for 8 hr. leads to alkylation at the nitrogen atom adjacent to the carbonyl group to yield 3,4-dihydro-4,6-dimethyl-3-(methylthio)-1,2,4-triazin-5 (2H)-one **6** (Scheme 1) (Jacobse *et al* 1987).

The alkylating power of phosphorus compounds appear to be more effective for phosphorus atom as trivalent phosphorus compounds rather than derivatives of pentavalent phosphorus. This is apparently related to the valency of the phosphorus atom which is more reactive for trivalent than pentavalent phosphorus (Sidky *et al* 1982). The alkylating power of the phosphorus nucleophiles was first directed towards sulfur atom and that is attributed to the difference of nucleophilicity between sulfur and nitrogen (Scheme2) (Miller *et al* 1999).



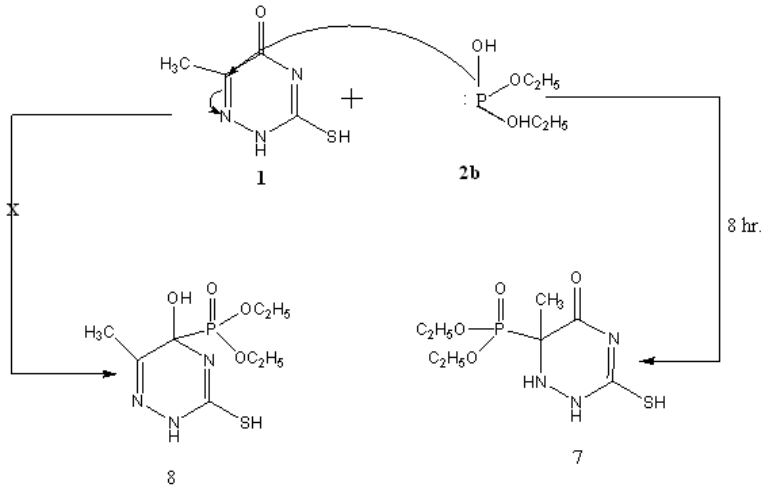
scheme 2

The fact that dialkyl phosphites (DAP) are intermediates in alkylating power might be explained in terms of the presence of these compounds as tautomeric mixtures of trivalent and pentavalent states (Mahran *et al* 1998).

This study was extended to see the action of di-and triethyl phosphites towards 1,2,4-triazine ring **1.** By heating **1** with diethyl phosphites **2b** in absence of solvent at 100 ^{0}C for 8 hr. an orange substance was separated and recrystallized from ethanol to give a compound proved to be diethyl-1,2,5,6-tetrahydro-3-mercapto- 6-methyl-5-oxo-1,2,4-triazin-6-yl-6-phosphonate **7** (scheme3) for the following reasons: (a) Its elementary analysis and molecular weight determination (MS) corresponded to $C_8H_{16}N_3O_4PS$. (b) The IR spectrum of **7** (KBr,cm^{-1}) showed two strong absorption bands at 3280,3176 for (2NH) groups, another intense band at 2793 for SH group, A strong absorption bands at 1720 for carbonyl (C=O) and 1680 for (C=N) group. Methylene group (CH_2) and methyl group (CH_3) have two characteristic absorption bands at 1430 and 1374 cm^{-1} respectively. Two bands 1216 for (P=O free) and 1020 for (P-O- C_2H_5) groups (c) Its ^{1}H-NMR spectrum (DMSO, δ scale ppm) confirmed its phosphonate structure and showed signal protons at 1.10, 1. 22 [6H, P-(O-C- CH_3), 2t], 2.00 [3H, P- (C-CH_3), s], 3.85 [2H, P- (O- CH_2 -C), m], 4.10 [2H, P- (O- CH_2 -C), m], 5.55[1H, NH, s (D_2O- exchangeable)], 7.35[1H, NH, s (D_2O- exchangeable)], 12.05[1H, SH, s (D_2O-exchangeable)].

The mechanism that accounts for the formation of phosphonate (Mahran *et al* 1998) **7** by the reaction of 1,2,4-triazine **1** with DEP **2b** involves nucleophilic attack on the imine- carbon atom by phosphite-phosphorus atom with proton migration to nitrogen atom. The IR findings that the carbonyl group is present at 1720 cm^{-1}

and the absence of the hydroxyl group around 3500 rules out an alternative structure like **8**. The carbon of the imine-centre would be attacked by phosphorus nucleophiles (DEP) more preferentially than attack on the carbonyl carbon (C=O).



Scheme 3

In addition, the phosphonate product **7** neither dissolves in dilute aqueous alkali nor exhibit colour reaction with ethanolic ferric chloride solution. Phosphonate **7** regenerated the parent 1,2,4-triazine **1** upon acid hydrolysis. This result coincides with previous studies for C=N attack by phosphorus reagents (Daasch 1958). A mechanism for addition was depicted in (Scheme 3).

Reaction of 1,2,4-triazine **1** with TEP 3b gives a completely different result. Heating 1 with triethylphosphite (TEP, 3b) in absence of solvent for 3 hr. at 100 ^{0}C leads to ring opening at $-\overset{O}{\overset{\|}{C}}-\overset{\xi}{S}-N$ centre by strong phosphorus nucleophile TEP. It is evident that the dialkyl esters, show but little of the nucleophilicity exhibited by the trialkyl esters. A pale brown compound was separated, identified and proved to be (Z)-2-thiosemicarbazidopropanoic acid **9a** for the following reasons: (a) Its elementary analysis and molecular weight determination (MS) corresponded to $C_4H_7N_3O_2S$. (b) The IR spectrum of **9a** (KBr, cm^{-1}) showed strong absorption bands at 3415, 3295, and 3193 for OH, NH_2 and NH groups respectively. A strong absorption bands at 1690 and 1606 for carbonyl (C=O) and imine (C=N) groups and a band at 1039 for C=S group respectively. (c)^{1}H-NMR spectrum (DMSO, δ scale ppm) confirmed an acidic structure and showed signals at 2.00 [3H, CH_3, s], 8.75[1H, NH_2 , d (D_2O- exchangeable)], 8.85[1H, NH_2 , d (D_2O- exchangeable)] and 10.80 [1H, OH, s (D_2O- exchangeable)] and 12.00[1H, OH, s (D_2O- exchangeable)] (Scheme 4).

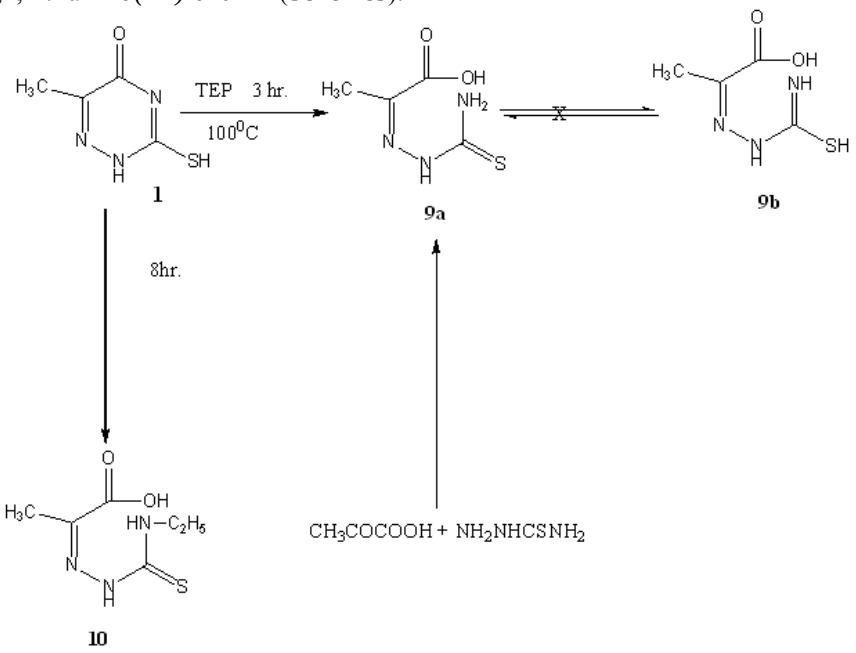
Compound **9a** dissolves in dilute aqueous alkali and exhibit colour reaction with ethanolic ferric chloride solution. Preparation of (Z)-2-thiosemicarbazid- propanoic acid **9a** in one step reaction by strong phosphorus nucleophile TEP or by reaction of pyruvic acid with thiosemicarbazide is very interesting since previous studies were made for preparing its analogue (Z)-2-methyl-2- thiosemicarbazidopropanoic acid in two step synthesis starting from acetone cyanohydrin and thiosemicarbazide (Kryl' sky *et al* 2002). Triethyl phosphite (TEP, 3b) as electron pair donors acts as a soft base, so the slight basicity of the reaction medium predominates the thione form **9a** rather than the thiol form **9b**. This in addition to the presence of strong C=S band at IR spectrum and absence of the SH group in ^{1}H-NMR spectra.

Heating of 1,2,4-triazine **1** with TEP for 8 hr. in absence of solvent at 100 ^{0}C leads to formation of the alkylated product **10**

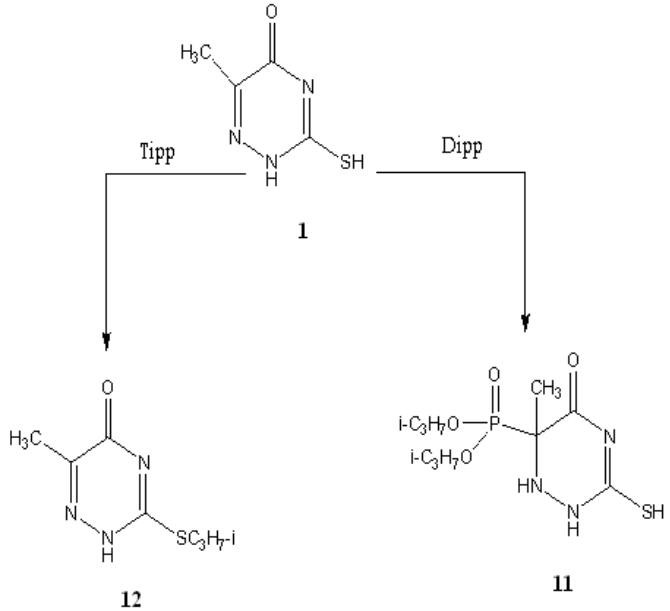
Action of di-and triisopropyl phosphites towards 1,2,4-triazine ring **1** were investigated. By heating **1** with diisopropyl phosphite (Dipp, **2c**) in dry toluene for 8 hr. at reflux temperature in presence of few drops of piperdine, a pale brown substance was separated and recrystallized from ethanol to give crystals proved to be diisopropyl 1,2,5,6-tetrahydro-3-mercapto-6-methyl-5-oxo-1,2,4-triazin-6-yl-6-phosphonate **11** (Scheme5) for the following reasons: (a) Its elementary analysis and molecular weight determination (MS) corresponded to $C_{1o}H_{20}N_3O_4SP$ (b) The IR spectrum of **11** (KBr,cm^{-1}) revealed the presence of strong absorption bands at 3355,

3149 for 2 NH groups, a band at 2926 for SH group. A carbonyl band (C=O) at 1679, imine (C=N) band at 1604 and two bands for phosphorus at 1236 (P=O), 1026 [P-O-CH- $(CH_3)_2$] (c) ^{1}H-NMR spectrum (DMSO, δ scale ppm) showed signals at 1.00 [6H P-O-C-$(CH_3)_2$, d], 1.15 [6H, P-O-C-$(CH_3)_2$, d], 2.00 [H, C-CH_3, d], 4.40 [2H, P-$(O-CH)_2$, d of sept.], 8.50, 8.75 [2H, 2NH, d (D_2O- exchangeable)] and 13.2 [1H, SH, d (D_2O-exchangeable)].

The reaction of 1,2,4-triazine ring **1** with triisopropyl phosphite (Tipp, 2c) in dry toluene at reflux temperature and in presence of 1 ml acetic acid as protonating agent yields an alkylated product 6-methyl-3-(isopropylthio) 1,2,4-triazin-5*(2H)*-one **12** (**Scheme5**).



Scheme 4



Scheme 5

Conclusion:

Phosphorus reagents play an important role in their reaction with 1,2,4-triazine ring (**1**). Alkyl phosphites

(**2,3**) act as a phosphorus nucleophiles towards triazine 6- membered heterocyclic ring. Reaction time is an important factor in these reactions. Dimethyl phosphite (**2a**) acts as a dimerizing agent while trimethyl phosphite (**3a)** was an alkylating agent. Diethyl (**2b**) and diisopropyl (**2c**) phosphites act as a phosphorylating agents for 1,2,4-triazine ring (**1**). Triethyl phosphite (**3b**) as a strong nucleophile leads to ring opening after short time (2hr.) to give **(9a)** then to an alkylated product (**10**). After long time triisopropyl phosphite (**3c**) acts as an alkylating agent to yield an alkylated product **(12)**.

Experimental:

All melting points are uncorrected. Solvents were purified and dried by usual techniques. The IR spectra (in KBr) were recorded in Philis and\or FT-IR 3000 E infracords. The ^{1}H-NMR (in DMSO or $CDCl_3$, ppm), were measured on Jeol JNM-EX 270 MHz FT. The mass spectra were run at 70 eV on Shimadzu GCMS.Q 1000 EX and /or Finnigan SSQ 700 spectrometer. Spectral data were carried out at National Research Center and/or Cairo University. Alkyl phosphites were available from Aldrich Chem. Co. and freshly distilled before use 3-Mercapto-6-methyl-1,2,4-triazine-5(2H)-one was prepared according to known procedure (Gut 1958).

Reaction of 1,2,4-triazine Ring 1 with Dialkyl Phosphites 2a,b,c and Trialkyl Phosphites 3a,b General Procedure:

A mixture of **1** (0.005mole) and DAP **2a (or 2b,c)** or TAP **3a (or 3b,c)** (0.01mole) was heated in absence of solvent at 100^{0}C until no more of the reactants could be detected (TLC). After removing the volatile materials in *vacuo*, the residual substance was collected and recrystallized from appropriate solvent to give the target products, the dimer **4** and the alkylated compounds **5** and **6** for secondary and tertiary methyl esters respectively. Reaction products with secondary and tertiary ethyl esters were phosphonate **7** and acids **9a** and **10** respectively. No reaction products were obtained by reaction of **1** with diisopropyl and triisopropyl phosphites by the same previous conditions.

3,3'-Dithiobis (6-methyl-1,2,4-triazin-5)2H-one 4:

White crystal, yield 65%, m.p:188 ^{0}C (ethanol); IR(KBr): 3261 (NH), 3163 (NH), 1722 (C=O), 1674 (C=O); ^{1}H-NMR (DMSO-d_6) 2.00 (3H, CH_3,s), 2.10 (3H, CH_3,s), 6.05 (1H, NH, s D_2O- exchangeable), 7.34 (1H, NH, s D_2O- exchangeable); MS: m\z % 286 (M^+-2H) (13.79%), base peak 143 (M^+- $C_4H_4N_3OS$).

Analysis $C_8H_8N_6O_2S_2$ **Calculated:** C, 33.80; H, 2.83**;** N, 29.56; S, 22.56
Found: C, 33.69; H, 2.91; N, 29.44; S, 22.74

Action of heat on 3-mercapto-6-methyl-1,2,4-triazin-5 (2H)-one 1:

Heating a solution of **1** in dry toluene for (10 hr.) at reflux temperature. After removing the volatile materials in *vacuo*, the residual substance was collected and re crystallized from ethanol to give unchanged substance **1** (m.p., mixed m. p. and comparative IR spectra).

6-Methyl-3-(methylthio)-1,2,4-triazin-5 (2H)-one 5 (Jacobsen et al 1987):

Yield 70 %, m.p:223 ^{0}C (ethanol) (m.p., mixed m. p. and comparative IR spectra) (Jacobsen *et al* 1987). Extended heating by the same previous condition**s** with addition of excess TMP **3a** (0.01 mole) until no more of the reactants could be detected (TLC) and by the same working up, a substance was collected and recrystallized from ethanol to give beige crystals proved to be:

3,4-Dihydro-4,6-dimethyl-3-(methylthio)-1,2,4-triazin-5 (2H)-one 6 (Jacobsen et al 1987):

Yield 55 %, m.p:97-98 ^{0}C (ethanol) (m.p., mixed m. p. and comparative IR spectra) (Jacobsen *et al* 1987).

***Diethyl-1,2,5,6-tetrahydro-3-mercapto-6-methyl-5-oxo-1,2,4-triazin-6-yl-6-phosphonate 7*:**

Orange crystal, yield 63%, m.p:201-203 ^{0}C (ethanol); IR (KBr): 3280, 3176 for (2NH), 2470 (SH), 1720 (C=O), 1680 (C=N), 1430 (CH_2), 1374 (CH_3) 1216 (P=O free) and 1020 (P-O- C_2H_5).^{1}H-NMR spectrum (DMSO, δ scale ppm) 1.10, 1. 22 [6H, P- (O-C- CH_3), 2t], 2.00 [3H, P- (C-CH_3), s], 3.51-392 [2H, P- (O-CH_2 -C), m], 4.08-4.41 [2H, P- (O- CH_2-C), m], 6.15[1H, NH, s (D_2O- exchangeable)], 7.35[1H, NH, s (D_2O-exchangeable)], 12.05[1H, SH, d (D_2O- exchangeable)]; MS: m/z % 281 (M^+, 0.49).

Analysis $C_8H_{16}N_3O_4PS$ **Calculated:** C, 34.16; H, 5.73**;** N, 14.94; P, 11.01; S, 11.40
Found: C, 34.03; H, 5.86; N, 14.76; P, 10.89; S, 11.32

(Z)-2-thiosemicarbazidopropanoic Acid 9a:

White powder,Yield 75%, m.p:178-180 ^{0}C (ethanol); IR (KBr): 3415 (OH), 3295 (NH_2), 3193 (NH), 1690 (C=O), 1606 (C=N), 1039 (C=S). ^{1}H-NMR (DMSO, δ scale ppm) 2.00 [3H, CH_3, s], 8.75[1H, NH_2, s (D_2O- exchangeable)], 8.85[1H, NH_2, s (D_2O- exchangeable)], 10.80[1H, NH, s (D_2O- exchangeable)] and 12.00[1H, OH, d (D_2O- exchangeable)]; MS: m/z % 161 (M^+, 37.36).

Analysis $C_4H_7N_3O_2S$ **Calculated:** C, 29.80; H, 4.38**;** N, 26.07; S, 19.89
Found: C, 29.75; H, 4.45; N, 25.88; S, 19.66

(Z)-2-(4-ethylthiosemicarbazido) propanoic acid 10:

Beige powder, Yield 52%, m.p:196^{0}C (ethanol); IR (KBr): 3435 (OH), 3248 (NH), 3248 (NH), 1709 (C=O), 1675 (C=N), 1038 (C=S). ^{1}H-NMR (DMSO, δ scale ppm) 1.40 [3H,C-CH_3, t], 2.00 [3H, CH_3, s], 3.70[2H, -CH_2-, q,(11.80-12.10)OH, NH, NH (D_2O- exchangeable), m).

Analysis $C_6H_{11}N_3O_2S$ **Calculated:** C, 38.08; H, 5.86**;** N, 22.20; S, 16.94
Found: C, 37.98; H, 5.99; N, 22.09; S, 16.78

Preparation of (Z)-2-thiosemicarbazidopropanoic Acid (9a) from Pyruvic Acid and Thiosemicarbazide:

A mixture of thiosemicarbazide (0.001mole) in absolute ethanol (30 ml) and pyruvic acid (0.001mole) containing a catalytic drop of pipredine was heated under reflux for 2 hr. The reaction mixture was left to cool at room temperature and the separated material, was evaporated till dryness under reduced pressure. The residual material was collected and crystallized from ethanol to give *(z)*-2-Thiosemicarbazidopropanoic acid (9a),)m.p., mixed m.ps and comparative IR spectra).

Degradation Experiment with Phosphonate 7:

Acid Hydrolysis:

Adduct **7** (0.3) was boiled with 20 ml 10% HCl aq. For 3 hr. (or heated on the steam bath with 1 ml conc. H_2SO_4 in 10 ml glacial acetic acid for 2 hr.). The reaction mixture was concentrated to half its original volume then poured onto crushed ice. The precipitated materials was collected (ca 70 %) and recrystallized from ethanol to give white crystal proved to be **1** (m.p., mixed m. p. and comparative IR spectra).

Diisopropyl 1,2,5,6-tetrahydro-3-mercapto-6-methyl-5-oxo-1,2,4-triazin-6-yl-6-phosphonate 11:

A mixture of **1** (0.005mole) and diisopropyl phosphate **2c** (0.01mole) in presence of piperdine (0.005mole) was heated in dry toluene (30ml) for 2 hr. at reflux temperature. After removing the volatile materials in *vacuo*, the residual substance so formed was collected and recrystallized from ethanol to give phosphonate **11**

Beige crystal, yield 65%, m.p:192 ^{0}C (ethanol); IR(KBr): 3355 (NH), 3149 (NH),2426 (SH), 1679 (C=O), 1604 (C=N), 1236 (P=O) and 1026 [P-O-CH- $(CH_3)_2$]; ^{1}H-NMR (DMSO, δ- scale ppm): 1.00 [6H, P-O-C-)$CH_3)_2$, d], 1.15 [6H, P-O-C-$(CH_3)_2$, d], 2.00 [3H, C-CH_3, d], 4.40 [2H, P-(O-CH-C)$_2$, d of sept.], 8.50, 8.75 [2H, 2NH, d (D_2O- exchangeable)], and 13.20 [1H, SH, d (D_2O- exchangeable)]. MS: m\z % 309 (M^+, 0.40)

Analysis $C_{10}H_{20}N_3O_4PS$ **Calculated:** C, 38.83; H, 6.52**;** N, 13.58; P.10. 01; S, 10.37
Found: C, 38.70; H, 6.66; N, 13.42; P, 9.94; S, 10.19

6-Methyl-3-(isopropylthio) 1,2,4-triazin-5*(2H)*-one 12:

A mixture of **1** (0.005mole) and triisopropyl phosphite **3c** (0.01mole)in presence of acetic acid (1ml) was heated in dry toluene (30ml) for 3 hr. at reflux temperature After removing the volatile materials in *vacuo*, the residual substance so formed was collected and recrystallized from ethanol to give alkylated product **12**.

White powder, yield 45%, m.p:230 ^{0}C (ethanol); IR (KBr): 3429(NH), 1678 (C=O), 1665 (C=N).

^{1}H-NMR (DMSO, δ- scale ppm): 1.10- 1.20 [1H, CH-$(CH_3)_2$, d], 2.00 [3H, C-CH_3, s], 4.40-4.60 [6H, CH-$(CH_3)_2$, m], 7.32 [1H, NH, (D_2O- exchangeable)]. MS: m\z % 183 (M^+, 0.10).

Analysis $C_7H_{11}N_3OS$ **Calculated:** C, 45.38; H, 5.99**;** N, 22.68; S, 17.31
Found: C, 45.16; H, 6.10; N, 22.50; S, 17.09

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