

Synthesis and Spectral Studies of Telluracyclohexane-1-Cinnamato-1 Dithiocarbamates

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Abstract: The synthesis and spectral studies of new monothioligand derivatives of 1, 1, 2, 3, 4, 5, 6-heptahydro-1, 1-dicinnamato telluranes $[C_5H_{10}Te(C_6H_5CH=CHOCO)_2]$ have been given in the present investigation. The synthesis of $C_5H_{10}TeOOCCH=CHC_6H_5R$ $[R=S_2CN(C_2H_5)_2, S_2CNC_4H_8O, S_2CNC_5H_{10}$ and $S_2CNHC_6H_5]$ was done and they have been characterized through IR, (¹H, ¹³C,) NMR spectral data.

Keywords: Organotelluriums, Cinnamic acid, dithiocarbamate and spectral studies

1. Introduction

From the literature it is evident that among organotellurium dithiocarbamates, Foss⁽¹⁾ reported organotellurium dithiocarbamates of the type $[(p-OCH_3C_6H_4)Te(dtc)][dte=dithiocarbamate]$. Various reports on organotellurium(IV) N, N-dialkyl dithiocarbamates are available.⁽²⁻⁵⁾ The synthetic aspects and spectral (IR, ¹H NMR) studies of $R_2Te(R'dtc)_nX_{2-n}$ [where $R_2=(CH_3)_2, C_4H_8, (C_6H_5)_2, (p-CH_3C_6H_4)_2$ and $(p-OCH_3C_6H_4)_2$; $X=Cl$ or I ; $n=1$ or 2 and $R'dtc =$ diethyl-, dimethyl-, pyrrolidine-, piperidine- and morpholine dithiocarbamates] have been reported by Srivastava et al.^(3b) A variety of dithiocarbamate derivatives of heterocyclic organotellurium dihalides of the type $C_5H_{10}Te(R')_2$ [$R' = S_2CN(C_2H_5)_2, S_2CNC_5H_{10}, S_2CNC_4H_8O, C_8H_8Te(R)_2$ [$R = S_2CNC_5H_{10}, S_2CNC_4H_8O, S_2CNHC_6H_5]$ and $C_8H_8TeI(R)$ [$R = S_2CN(C_2H_5)_2, S_2CNC_5H_{10}, S_2CNC_4H_8O, S_2CNHC_6H_5]$] has been reported from our group.^(6, 7) They have been characterized through IR (¹H, ¹³C) NMR spectral data and single crystal X-ray diffraction studies. The crystal/molecular structures and solution NMR data of $C_8H_8Te[S_2CN(C_2H_5)_2]_2, C_8H_8Te[S_2P(OC_2H_5)_2]_2$ and $C_8H_8Te[S_2CO(C_2H_5)_2]_2$ have been reported by Dakternieks et al.⁽⁸⁾

It is thus evident that there are a number of reports⁽¹⁻⁸⁾ on N, N-dialkyl dithiocarbamates where they behave as 1, 1-dithio ligands. In general the chemistry of monothio ligands has received much less attention and to our knowledge there is only one report⁽⁹⁾ of mono thiocarbamate group containing cyclic organotellurium compounds viz. 1-iodo-1-N, N-dialkyl dithiocarbamato-1, 1, 2, 3, 4, 5-hexahydro cyclic organotellurium compounds viz. 1-iodo-1-N, N-dialkyl dithiocarbamato-1, 1, 2, 3, 4, 5-hexahydro tellurophene $[C_4H_8TeIR$ ($R=S_2CNC_4H_6, S_2CNC_4H_{10}$)]. Reports on the coordination chemistry of dithiocarbamate ligands are available⁽¹⁰⁾ and its application in the field of self-assembly viz. (i) reaction of dialkyl dithiocarbamate complexes with a wide variety of transition metals and organometals resulting in the formation of supramolecular arrays and (ii) use of optical and electrochemical properties of dithiocarbamate complexes in constructing sensors for guest molecules has been reported.^(11a, 11b, 11c)

The chemotherapeutic use of cis-diamine dichloroplatinum (II) and related drugs consists of some negative side effects including nephrotoxicity which are thought to be primarily because of the inactivation of enzymes by coordination of Pt (II) to thiol groups.^(11d) The protection of these thiols is done by the use of competitive "rescue agents" diethyl dithiocarbamate (Et₂NCS₂) ion^(11e, 11f, 11g) containing soft sulfur atoms.

In view of these features, we considered it of interest to investigate a series of new monothioligand derivatives of 1, 1, 2, 3, 4, 5, 6-heptahydro-1, 1-dicinnamato telluranes $[C_5H_{10}Te(C_6H_5CH=CHOCO)_2]$. Here, in the present investigation, we have been successful in the synthesis of $C_5H_{10}TeOOCCH=CHC_6H_5R$ [$R=S_2CN(C_2H_5)_2, S_2CNC_4H_8O, S_2CNC_5H_{10}$ and $S_2CNHC_6H_5]$. They have been characterized through IR, (¹H, ¹³C,) NMR spectral data.

2. Experimental

2.1. Reagents, general procedure & instrumentation

1, 1, 2, 3, 4, 5, 6-heptahydro-1, 1-diiidotellurane $[C_5H_{10}TeI_2]$ ^(12, 13) and $[C_5H_{10}Te(C_6H_5CH=CHOCO)_2]$ ⁽¹⁴⁾ were prepared by the literature method. Its purity was checked through m.p., elemental analysis and ¹H NMR spectral studies. 1, 1, 2, 3, 4, 5, 6-heptahydro-1-Cinnamato-1-dithiocarbamates were prepared by the reaction of 1, 1, 2, 3, 4, 5, 6-heptahydro-1, 1-di(cinnamato) tellurane $[C_5H_{10}Te(C_6H_5CH=CHOCO)_2]$ with the freshly prepared ammonium salts of piperidine, morpholine, and aniline dithiocarbamate in 1:1 molar ratio respectively while $C_5H_{10}Te[(OOCCH=CHC_6H_5)_2]$ was prepared by the reaction of $C_5H_{10}TeI_2$ with freshly prepared by the reaction of silver salt of cinnamic acid in 1:2 molar ratio.

2.2 Synthesis

2.2.1 Synthesis of telluracyclohexane-1-cinnamato -1 dithiocarbamates

1, 1, 2, 3, 4, 5, 6-heptahydro-1, 1-di(cinnamato) tellurane (0.650g, 1.32 mmol,) was added freshly prepared sodium diethyl dithiocarbamate (0.29g, 1.28 mmol) in 1:1 molar ratio in ~50 ml of dry acetone and stirred for ~4hours. The reaction mixture was filtered to get rid of precipitated residue. The filtrate was concentrated under reduced pressure to obtained light orange colour solid mass of $C_5H_{10}TeOOCCH=CHC_6H_5[S_2CN(C_2H_5)_2]$ (**1**) [(Yield: 0.300g, 44.30%, m.p.77°C)].

In the same way $C_5H_{10}TeOOCCH=CHC_6H_5(S_2CNC_4H_8O)$ (**2**), $C_5H_{10}Te OOCCH=CHC_6H_5(S_2CNHC_6H_5)$ (**3**) and $C_5H_{10}TeOOCCH=CHC_6H_5(S_2CN(C_2H_5)_2)$ (**4**) were obtained by the reaction of $C_5H_{10}Te[(OOCH=CHC_6H_5)_2]$ (1g, 2.03mmol) with $C_4H_8ONCS_2NH_4$ (0.36g, 2.00 mmol), $C_5H_{10}NCS_2NH_4$ (0.36g, 2.02 mmol) and $C_6H_5HNCS_2NH_4$ (0.38g, 2.04 mmol).

3.Results and Discussion

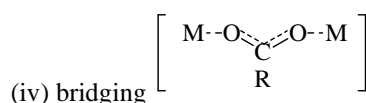
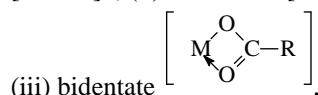
The analytical data of 1, 1, 2, 3, 4, 5, 6-heptahydro-1-cinnamato-1-(N, N diethyl dithiocarbamato) telluranes [$C_5H_{10}TeOOCCH=CHC_6H_5(S_2CN(C_2H_5)_2)$] and 1, 1, 2, 3, 4, 5, 6 heptahydro-1-cinnamato(-1morpholine, -1aniline, -1piperidine dithiocarbamates) telluranes are given in Table 1.

Table 1: Analytical data of Complexes 1, 2, 3 & 4

Complex	m. p. (°C)	Color	Yield	Elemental Analysis (%) Obsd., (Calcd.)			
				C	H	N	Te
$C_5H_{10}TeOOCCH=CHC_6H_5(S_2CNC_4H_8O)$ 1	70	Brown	98.05	44.08 (45.00)	4.93 (4.93)	2.73 (2.76)	25.15 (25.18)
$C_5H_{10}Te OOCCH=CHC_6H_5[S_2CN(C_2H_5)_2]$ 2	70	Light Orange	44.30	48.22 (48.24)	5.69 (5.71)	2.94 (2.96)	26.96 (26.99)
$C_5H_{10}Te OOCCH=CHC_6H_5(S_2CNC_5H_{10})$ 3	114	Orange Brown	64.70	47.63 (47.65)	5.33 (5.36)	2.72 (2.77)	25.32 (25.33)
$C_5H_{10}Te OOCCH=CHC_6H_5(S_2CNHC_6H_5)$ 4	53	Yellow	48.07	49.14 (49.16)	4.46 (4.48)	2.71 (2.73)	24.87 (24.89)

3.1 Infrared Spectra

The infrared spectra of 1, 1, 2, 3, 4, 5, 6-heptahydro-1-cinnamato-1-(N, N dialkyl dithiocarbamato) telluranes [$C_5H_{10}TeOOCCH=CHC_6H_5(S_2CN(C_2H_5)_2)$] and 1, 1, 2, 3, 4, 5, 6 heptahydro-1-cinnamato (-1morpholine-1aniline-1piperidine dithiocarbamates) telluranes in KBr have been recorded in the range of 4000-500 cm^{-1} and the data are listed in Table 2. The various possible modes of bonding of carboxylate group to metal ions are as (i) ionic $[M]^+ [OCOR]^-$, (ii) unidentate $[M-COR]$



The $\Delta\nu OCO$ ($\nu_{asym} OCO - \nu_{sym} OCO$) is the widely accepted criterion for distinguishing between the above-described different modes of bonding. Thus $\Delta\nu OCO$ for unidentate tricyclohexyl tin acetate is 361 $cm^{-1(15)}$ and for bidentate dimethyl tin diacetate is 227 $cm^{-1(16)}$ and in trimethyl tin acetate (containing bridging carboxylate group); its value is reported as 153 $cm^{-1(17)}$.

In the free carboxylic acids, used in the present investigation, the $\nu_{asym} OCO$ absorption lies in the range of 1610-1555 cm^{-1} and the $\nu_{sym} OCO$ absorption lies in the range 1400-1300 $cm^{-1(18)}$. In newly synthesized Telluracyclohexane-1-cinnamato-1-dialkyl dithiocarbamate [$C_5H_{10}TeOOCCH=CHC_6H_5(S_2CN(C_2H_5)_2)$] $\nu_{asym} OCO$ and $\nu_{sym} OCO$ absorptions appear at 1660 ± 24 cm^{-1} and 1323 ± 9 cm^{-1} respectively. The $\Delta\nu OCO$ values are in the range of 338 ± 32 cm^{-1} Table 2 which indicate unidentate nature of the carboxylate groups. $\nu TeCH_2$ appear at 566 ± 27 cm^{-1} .

Table 2: Infrared frequencies (cm^{-1}) of complexes 1, 2, 3 & 4

Complex	$\nu C-N$	$\nu C-S$	$\nu_{asym} OCO$	$\nu_{sym} OCO$	$\Delta \nu OCO$	$\nu Te-CH_2$
$C_5H_{10}TeOOCCH=CHC_6H_5(S_2CNC_4H_8O)$ 1	1449(s) 1400(m)	1104(s) 977(s)	1637 (vs)	1332 (vs)	306	539(s)
$C_5H_{10}Te OOCCH=CHC_6H_5[S_2CN(C_2H_5)_2]$ 2	1449(s) 1415(s)	1026 (s) 990(m)	1638 (vs)	1332 (vs)	306	593(s)
$C_5H_{10}Te OOCCH=CHC_6H_5(S_2CNC_5H_{10})$ 3	1473(m) 1447(s)	1069(m) 973(m)	1637(vs)	1331 (vs)	306	525(m)
$C_5H_{10}Te OOCCH=CHC_6H_5(S_2CNHC_6H_5)$ 4	1576 (m) 1494(s)	1072(m) 1027(m)	1684 (vs)	1314 (vs)	370	526(m)

In 1, 1, 2, 3, 4, 5, 6-heptahydro-1-cinnamato-(N, N-dialkyl dithiocarbamato telluranes), the νCN and νCS lie in the

range of 1488 ± 88 cm^{-1} and 1065 ± 39 cm^{-1} respectively. It has been reported that doublets at ~ 1500 and ~ 1000 cm^{-1}

assignable to ν_{CN} and ν_{CS} modes of vibrations respectively are associated with monodentate dithiocarbamate group.⁽¹⁹⁻²¹⁾ However, some reports suggest that a doublet for ν_{CN} is not necessary while for ν_{CS} , it is invariably present.^(22, 23) The bidentate thiocarbamate group,⁽²⁴⁾ on the other hand gives rise to a single intense absorption for these two modes of vibrations. In 1, 1, 2, 3, 4, 5, 6-heptahydro-1-Cinnamato -1-N, N-dialkyl dithiocarbamate telluranes, reported here, the doublets are observed for ν_{CN} and ν_{CS} (Table 5.2) which indicate monodentate nature of dithiocarbamate in agreement with the observations of Drake et al.^(4b) and Dakternieks et al.⁽⁸⁾ The $\nu(\text{TeCH}_2)$ of $\text{C}_5\text{H}_{10}\text{Te}$ group appear at their usual positions.

3.2 Proton nuclear magnetic resonance (^1H NMR) spectra

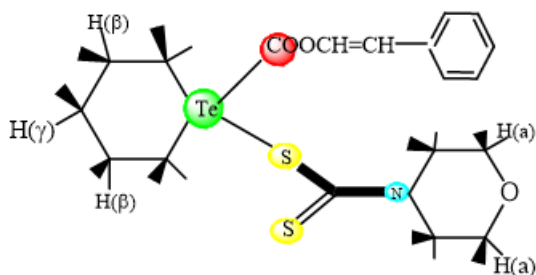
The ^1H NMR spectra of $\text{C}_5\text{H}_{10}\text{TeOOCCH}=\text{CHC}_6\text{H}_5(\text{S}_2\text{CNC}_4\text{H}_8\text{O})$, $\text{C}_5\text{H}_{10}\text{TeOOCCH}=\text{CHC}_6\text{H}_5[\text{S}_2\text{CN}(\text{C}_2\text{H}_5)_2]$, $\text{C}_5\text{H}_{10}\text{TeOOCCH}=\text{CHC}_6\text{H}_5(\text{S}_2\text{CNC}_5\text{H}_{10})$, and $\text{C}_5\text{H}_{10}\text{TeOOCCH}=\text{CHC}_6\text{H}_5(\text{S}_2\text{CNHC}_6\text{H}_5)$ have been recorded in CDCl_3 . The ^1H NMR data of 1, 1, 2, 3, 4, 5, 6-heptahydro-1-cinnamato-1-(N, N dialkyl dithiocarbamate) telluranes [$\text{C}_5\text{H}_{10}\text{TeOOCCH}=\text{CHC}_6\text{H}_5(\text{S}_2\text{CN}(\text{C}_2\text{H}_5)_2)$] and 1, 1, 2, 3, 4, 5, 6 heptahydro-1-cinnamato (-1morpholine-1aniline-1piperidine dithiocarbamates) telluranes are listed in Tables 3.

Table 3: ^1H NMR data of complexes 1, 2, 3 & 4

Complex	Chemical Shift (δ) ppm					
	TeCH_2 protons	TeCCH_2 & TeCCCH_2^* / TeCCH_2 protons	NCCCH_2 & NCCCH_2^* / TeCCH_2 & TeCCCH_2 / protons	$\text{CH}=\text{CH}^+$ / $\text{C}_6\text{H}_5^{++}$ protons	NCH_2 protons	NCCH_3 / CH_2O^* / $\text{C}_6\text{H}_5^{**}$ protons
$\text{C}_5\text{H}_{10}\text{TeOOCCH}=\text{CHC}_6\text{H}_5$ ($\text{S}_2\text{CNC}_4\text{H}_8\text{O}$) 1	3.20(m)	1.26-2.00 (m)*	-	6.48 (d) ⁺ 7.24-7.26 (m) ⁺⁺	3.86(t)	3.76(t)*
$\text{C}_5\text{H}_{10}\text{TeOOCCH}=\text{CHC}_6\text{H}_5$ [$\text{S}_2\text{CN}(\text{C}_2\text{H}_5)_2$] 2	3.02(q)	1.80-2.00(m)*	-	6.46 (d) ⁺ 7.24-7.62 (m) ⁺⁺	3.18 (q)	1.28 (t)
$\text{C}_5\text{H}_{10}\text{TeOOCCH}=\text{CHC}_6\text{H}_5$ ($\text{S}_2\text{CNC}_5\text{H}_{10}$) 3	3.19 (t)	2.01 (m)	1.84 (m)*	6.44 (d) ⁺ 7.47-7.65 (m) ⁺⁺	4.07(s)	-
$\text{C}_5\text{H}_{10}\text{TeOOCCH}=\text{CHC}_6\text{H}_5$ ($\text{S}_2\text{CNHC}_6\text{H}_5$) 4	3.92(t)	1.24(m)	0.84(m)	6.44 (d) ⁺ 7.24-7.40 (m) ⁺⁺	-	7.24-7.84(m)**

Multiplicity: (s) = singlet; (t) = triplet; (q) = quartet; (m) = multiplet

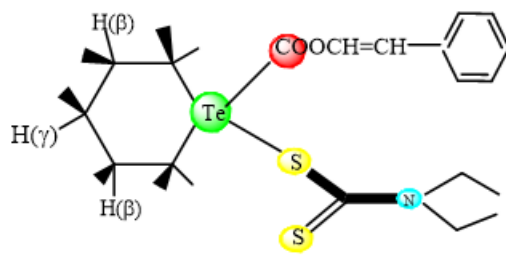
3.2.1 ^1H NMR spectrum of $\text{C}_5\text{H}_{10}\text{TeOOCCH}=\text{CHC}_6\text{H}_5$ ($\text{S}_2\text{CNC}_4\text{H}_8\text{O}$)



In the ^1H NMR spectrum of the title compound, a triplet at 3.20 ppm is for $-\text{CH}_2$ protons of TeCH_2 group, multiplets in the range of 2.00-1.26ppm are attributed to $-\text{CH}_2$ protons of TeCCH_2 & TeCCCH_2 group. A triplet centered at 3.86 ppm is due to $-\text{CH}_2$ protons of NCH_2 group. A triplet centered at 3.76 ppm is attributed to $-\text{CH}_2$ protons of OCH_2 group. $\text{CH}=\text{CH}$ protons appear as a doublet at 6.48 ppm. A multiplet observed in the range 7.24-7.66 ppm for C_6H_5 protons of cinnamate group. The integration of the peak areas of TeCH_2 , TeCCH_2 & TeCCCH_2 , NCH_2 , $\text{CH}=\text{CH}$,

C_6H_5 and OCH_2 groups corresponds to the protons corresponds to the proposed stoichiometry of the complex.

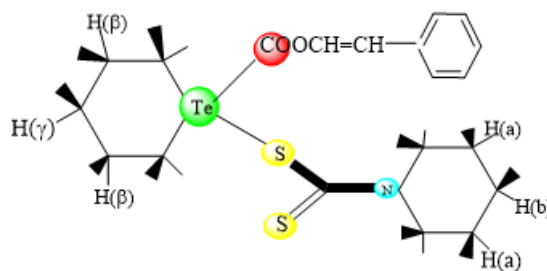
3.2.2 ^1H NMR spectrum of $\text{C}_5\text{H}_{10}\text{TeOOCCH}=\text{CHC}_6\text{H}_5$ [$\text{S}_2\text{CN}(\text{C}_2\text{H}_5)_2$]



In the ^1H NMR spectrum of the title compound, a quartet at 3.02 ppm is for $-\text{CH}_2$ protons of TeCH_2 group. Multiplets in the range of 1.80-2.00 ppm are attributed to $-\text{CH}_2$ protons of TeCCH_2 & TeCCCH_2 group. A quartet at 3.18 ppm is due to $-\text{CH}_2$ protons of NCH_2 group and a triplet centered at 1.28 ppm is attributed to $-\text{CH}_3$ protons of NCCH_3 group. $\text{CH}=\text{CH}$ protons appear as a doublet at 6.46 ppm. A multiplet observed in the range 7.24-7.62 ppm are for C_6H_5 protons of cinnamate group. The integration of the peak areas of TeCH_2 , TeCCH_2 & TeCCCH_2 , NCH_2 , NCCH_3 ,

CH=CH and C₆H₅ protons corresponds to the proposed stoichiometry of the complex.

3.2.3 ¹H NMR spectrum of C₅H₁₀Te OOCCH=CHC₆H₅ (S₂CNC₅H₁₀)



The ¹H NMR spectrum of C₅H₁₀Te OOCCH=CHC₆H₅ (S₂CNC₅H₁₀), shows a triplet at 3.19 ppm is due to -CH₂ protons of TeCH₂ group. Multiplet at 2.01 ppm is attributed to -CH₂ protons of TeCCH₂ group. The singlet at 4.07 ppm is attributed to -CH₂ protons of NCH₂ group. The triplet centered at 1.84 ppm is attributed to CH₂(a) and CH₂(b) protons of NCCH₂ & NCCCH₂ groups respectively. CH=CH protons appear as a doublet at 6.44 ppm. A multiplet observed in the range 7.47-7.65 ppm are for C₆H₅ protons of cinnamate group. The integration of the peak areas of TeCH₂, TeCCH₂, NCH₂, NCCH₂, CH=CH, C₆H₅ and NCCCH₂ groups correspond to the proposed stoichiometry of the complex.

3.2.4 ¹H NMR spectrum of C₅H₁₀Te OOCCH=CHC₆H₅(S₂CNHC₆H₅)

In the ¹H NMR of the title compound, a triplet centered at 3.92 ppm is due to -CH₂ protons of TeCH₂ group. Two multiplets at 2.21 ppm and 0.84 ppm are for -CH₂ protons of TeCCH₂ and TeCCCH₂ group respectively. Multiplets in the range of 7.24-7.484 ppm are due to C₆H₅ protons of aniline group. CH=CH protons appear as a doublet at 6.44 ppm. Another multiplets in the range of 7.24-7.40 are due to C₆H₅ protons of cinnamate group. The integration of the peak areas of TeCH₂, TeCCH₂, TeCCCH₂ CH=CH, and C₆H₅ groups correspond to the proposed stoichiometry of the complex.

3.3 ¹³C Nuclear magnetic resonance (¹³C NMR) spectra

The ¹³C NMR spectra of C₅H₁₀TeOOCCH=CHC₆H₅(S₂CNC₄H₈O), C₅H₁₀TeOOCCH=CHC₆H₅[S₂CN(C₂H₅)₂], C₅H₁₀TeOOCCH=CHC₆H₅(S₂CNC₅H₁₀), and C₅H₁₀TeOOCCH=CHC₆H₅(S₂CNHC₆H₅) have been recorded in CDCl₃. The ¹³C NMR data are listed in Table 4.

3.3.1 ¹³C NMR spectrum of C₅H₁₀Te OOCCH=CHC₆H₅ (S₂CNC₄H₈O)

The ¹³C NMR spectrum of C₅H₁₀Te OOCCH=CHC₆H₅ (S₂CNC₄H₈O) shows two singlets at 27.05 ppm and 20.35

ppm is attributed to CCH₂ and CCH₂CH₂ carbons respectively. A singlet found at 29.67 ppm is due to TeCH₂ carbons and two singlets at 64.62 ppm and 66.17 ppm are due to NCH₂ and OCH₂ carbons respectively. A singlet centered at 143.71 ppm is due to CH=CH carbons. Three singlets observed at 127.96, 128.82 and 129.85 ppm are attributed to ortho-, meta- and para carbons of C₆H₅ group. A singlet at 172.43 ppm is due to OCO carbon.

3.3.2 ¹³C NMR spectrum of C₅H₁₀Te OOCCH=CHC₆H₅ [S₂CN(C₂H₅)₂]

In ¹³C NMR spectrum of the title complex there are nine types of carbons (i) CCH₂ carbons (ii) CCH₂CH₂ carbons (iii) TeCH₂ carbons (iv) NCH₂ carbons (v) CH₂CH₃ carbons (vi) S₂CN carbons (vii) C₆H₅ (viii) CH=CH and (ix) OCO. The spectrum shows two singlets at 27.15 ppm and 20.37 ppm is attributed to CCH₂ and CCH₂CH₂ carbons respectively. A singlet found at 41.36 ppm is due to TeCH₂ carbons and two singlets at 48.47 ppm and 11.43 ppm are attributed to NCH₂ and CH₂CH₃ carbons respectively. A singlet centered at 143.68 ppm is due to CH=CH carbons. Three singlets observed at 127.96, 128.73 and 129.89 ppm are attributed to ortho-, meta- and para carbons of C₆H₅ group. A singlet at 172.41 ppm is due to OCO carbons. The singlet at 172.67 ppm corresponds to S₂CN carbon.

3.3.3 ¹³C NMR spectrum of C₅H₁₀TeOOCCH=CHC₆H₅(S₂CNC₅H₁₀)

The ¹³C NMR spectrum of C₅H₁₀TeOOCCH=CHC₆H₅(S₂CNC₅H₁₀) shows two singlets at 27.05 ppm and 20.35 ppm is attributed to CCH₂ and CCH₂CH₂ carbons respectively. A singlet found at 29.66 ppm is due to TeCH₂ carbons and two singlets at 47.81 ppm and 22.26 ppm are due to NCH₂ and CCH₂ carbons respectively. A singlet centered at 143.69 ppm is due to CH=CH carbons. Three singlets observed at 127.96, 128.83 and 129.89 ppm are attributed to ortho-, meta- and para carbons of C₆H₅ group. A singlet at 172.42 ppm is due to OCO carbons. The singlet at 193.32 ppm corresponds to S₂CN carbon.

Table 4: ¹³C NMR data of complexes 1, 2, 3 & 4

Complex	Chemical Shift (δ) ppm					
	TeCH ₂ Carbons	TeCCH ₂ & TeCCCH ₂ */ TeCCH ₂ Carbons	NCCH ₂ & NCCCH ₂ */ TeCCH ₂ & TeCCCH ₂ */ Carbons	CH=CH ⁺ Carbons& S ₂ CN*	C ₆ H ₅ Carbons	NCH ₂ / OCO# Carbons
C ₅ H ₁₀ TeOOCCH=CHC ₆ H ₅ (S ₂ CNC ₄ H ₈ O) 1	29.67	27.05	-	143.71 ⁺	127.96 128.82 129.85	64.62 172.43#
C ₅ H ₁₀ Te OOCCH=CHC ₆ H ₅ [S ₂ CN(C ₂ H ₅) ₂] 2	41.36	27.15	-	143.68 ⁺ 172.67*	127.96 128.73 129.89	48.47 172.41#
C ₅ H ₁₀ Te OOCCH=CHC ₆ H ₅ (S ₂ CNC ₅ H ₁₀) 3	29.60	27.05	20.35 22.26*	143.69 193.32*	127.96 128.73 129.89	47.81 172.42#
C ₅ H ₁₀ Te OOCCH=CHC ₆ H ₅ (S ₂ CNHC ₆ H ₅) 4	29.79	28.96	23.05	146.93	128.42 129.04 130.77	38.65 171.51#

3.3.4 ¹³C NMR spectrum of C₅H₁₀Te OOCCH=CHC₆H₅ (S₂CNHC₆H₅)

The ¹³C NMR spectrum of C₅H₁₀Te OOCCH=CHC₆H₅ (S₂CNHC₆H₅) shows two singlets at 28.96 ppm and 23.05 ppm is attributed to CCH₂ and CCH₂CH₂ carbons respectively. A singlet found at 29.79 ppm is due to TeCH₂ carbons and two singlets at 38.65 ppm and 23.05 ppm are due to NCH₂ and CCH₂ carbons respectively. A singlet centered at 146.93 ppm is due to CH=CH carbons. Three singlets observed at 128.42, 128.04 and 130.77 ppm are attributed to ortho-, meta- and para carbons of C₆H₅ group. A singlet at 171.51 ppm is due to OCO carbon.

4. Conclusion

In the above study we have investigate a series of new monothioligand derivatives of 1, 1, 2, 3, 4, 5, 6-heptahydro-1, 1-dicinnamato telluranes [C₅H₁₀Te(C₆H₅CH=CHOCO)₂]. and characterized through different spectral studies.

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