

Synthesis and Characterization of Some New Series of 2-(4-Hydroxynaphthylazo)-5-Substitutedphenyltellurium Tribromides and Ditellurides Compounds

Adil A. Al-Fregi* , Atared F. Al-Asfoor and Susan F. Jabar
Department of Chemistry , University of Basra, Basra, Iraq.
*corresponding author E-mail: dr.adilalfregi@yahoo.com
Mobile: +9647707377383

ABSTRACT - A new series of 2-(4-hydroxynaphthylazo)-5-substitutedphenyl mercuric chloride compounds (I-IV) were prepared by diazo-coupling reactions of diazonium salts of 2-aminophenyl mercuric chloride, 2-amino-5-bromophenylmercuric chloride, 2-amino-5-methylphenylmercuric chloride and 2-amino-5-nitrophenylmercury chloride with α -naphthol, respectively. Reaction of compounds (I-IV) with tellurium tetrabromide in 1:1 moles ratio in dry dioxane gave the corresponding 2-(4-hydroxynaphthylazo)-5-substitutedphenyltellurium tribromide compounds (V-VIII) in good yield. Reduction of compounds (V-VIII) by ethanolic hydrazine solution gave the corresponding ditelluride compounds (IX-XII) in moderate to good yields. All the prepared compounds (I-XII) were characterized by elemental analysis, conductance measurements and spectroscopic data.

Index Terms: 1-naphthol, azo compounds, organytellurium tribromides, diorganyl ditellurides, diazo-coupling, organyl mercuric chlorides, tellurium tetrabromide

1 INTRODUCTION

In recent years there has been a considerable interest in the preparation of organotellurium compounds containing amino,[1-3] azomethine,[4-7] pyridines[8] or acetamido[9] group in ortho position with respect to tellurium atom. The high stability of such compounds are due to intramolecular interactions (N \rightarrow Te) [3]. There are few examples of organotellurium compounds which contain azo group in literatures [10,11] although the first examples, (2-phenylazophenyl-C,N) tellurium trihalides, were prepared in 1979 by trans-metallation of mercurated azobenzenes with tellurium tetrahalides, TeX₄; X= Cl, Br [10-12]. This method provided a satisfactory route to

Al-Rubaie et al [15] prepared a new series of organotellurium compounds containing azo groups by reacting {2-amino-5-phenylazo}phenylmercuric chloride with tellurium tetrabromide or 4-methoxyphenylphenyltellurium trichloride to give (2-amino-5-phenylazo)phenyltellurium tribromide and (4-methoxyphenyl)[2-amino-5-phenyl azophenyl]tellurium dichloride, respectively. Furthermore, (2-amino-5-phenyl azo) phenyl ditelluride was prepared by reduction of the

tellurated azobenzene [13]. Mc Whinnie et al [14] prepared the same compound (2-phenylazophenyl-C,N) tellurium chloride by another procedure consist a direct reaction between tellurium tetrachloride and excess of azobenzene. The hydrazine reduction of (2-phenylazophenyl-C,N)tellurium trihalide with stirring only gave (2-phenylazophenyl-C,N)tellurenyl halide while with stirring and heating gave (2-phenylazophenyl-C,N)ditelluride [10,11]. Reduction of (2-phenylazophenyl-C,N)tellurium trichloride by sodium borohydride as reducing agent afforded bis(o-aminophenyl) ditelluride

corresponding tribromide with hydrazine hydrate while (4-methoxyphenyl)[2-amino-5-phenylazophenyl] telluride

Recently, Al-Fregi et al [16] prepared a new series of 2-(2-hydroxynaphthylazo) aryltellurium tribromides and bis(2-(2-hydroxynaphthylazo)aryl)tellurium dibromides (where aryl = phenyl, 5-bromophenyl, 5-methylphenyl or 5-nitrophenyl) by reaction 2-(2-hydroxynaphthylazo) arylmercuric chloride with tellurium tetrabromide in 1:1 and 2:1 moles ratios in dry dioxane, respectively [16]. Furthermore, reactions of 2-(2-hydroxynaphthylazo)-

aryltellurium tribromides and bis(2-(2-hydroxynaphthylazo) aryltellurium dibromides with ethanolic solution of hydrazine hydrate give the corresponding ditellurides and tellurides, respectively [16].

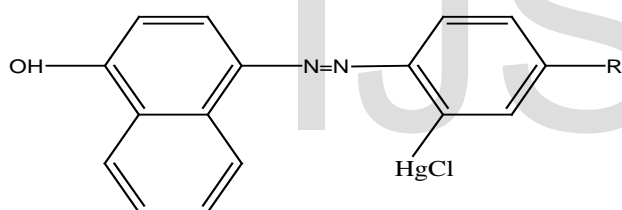
As can be seen for the literature survey that there is a little work has been done on organotellurium compounds containing azo groups. Thus, the present work will explore further the synthesis of a new route of organotellurium compounds containing azo groups.

2 EXPERIMENTAL

2-1 SYNTHESIS

2-Amino phenyl mercuric chloride, 2-amino-5-bromo phenyl mercuric chloride, 2-amino-5-methyl phenyl mercuric chloride and 2-amino-5-nitro phenyl mercuric chloride were prepared by previously methods of literatures [17,18].

Synthesis of 2-(4-Hydroxynaphthylazo)-5-substituted phenylmercury chloride



R = H (I), Br (II), CH₃ (III), NO₂ (IV)

Fig. 1: structures of compounds (I) - (IV)

2-(4-Hydroxynaphthylazo)phenyl mercuric chloride (I)

A solution of sodium nitrite (0.13 g, 2.00 mmol) in distilled water (25 mL) was added slowly to a cold solution of 2-amino mercuric chloride (0.65 g, 2.00 mmol) in 1.00 M hydrochloric acid (25 mL). To this clear solution, a cold solution of 1-naphthol (0.28 gm, 2.00 mmol) in 10% NaOH was added portionwise with stirring over a period of 30 min. The reaction mixture was stirred for 2 hrs at 0-5 °C. The reaction mixture was neutralized with 10% HCl.

A dark brown solid was formed, collected, washed several times with distilled water. The crude product was recrystallized from an ethanol and water mixture (5:2) to give brown crystals: 88 %; m.p 176 °C; FTIR: 3442 s, br, 3064 w, 1585 s, 1500, 1465 s, 1377 s, 1261 s, 1138 m, 882 m, 816 s, 762 m; UV-Vis. data: λ_{max} 208 nm, 228nm, 478 nm; molar conductance (Λ_m): 28.66 ohm⁻¹.cm².mol⁻¹

The following compounds were prepared by the same above method using the appropriate 2-amino aryl mercury chloride.

2-(4-Hydroxynaphthylazo)-5-bromo phenylmercuric chloride (II)

A dark brown solid was obtained in 81 % yield; m.p 182 °C; FTIR: 3245 s, br, 3064 w, 2972 w, 2935 w, 2857 w, 1592 s, 1542 s, 1474 s, 1442 s, 1380 s, 1313, 1260 s, 1146 m, 883m, 795 m, 757 s, 682 m; UV-Vis. data: λ_{max} 208 nm, 228nm, 476 nm; molar conductance (Λ_m): 26.34 ohm⁻¹.cm².mol⁻¹

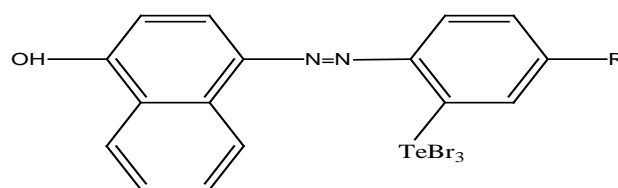
2-(4-Hydroxy naphthylazo)-5-methyl phenyl mercury chloride (III)

A dark brown solid, 83 % yield; m.p 172 °C; FTIR: 3202 s, br, 3064, 2974 w, 2927 w, 2861 w, 1590 s, 1510 s, 1479 m, 1441 m, 1379 s, 1275 s, 1148 m, 812 m, 797 s, 765 s; UV-Vis. data: λ_{max} 208 nm, 228nm, 478 nm; molar conductance (Λ_m): 31.07 ohm⁻¹.cm².mol⁻¹.

2-(4-Hydroxy naphthylazo)-5-nitro phenyl mercury chloride (IV)

A dark brown solid was obtained in 77 % yield; m.p 165 °C; FTIR: 3275 s, br, 3092 w, 3068, 2972 w, 2930 w, 2858w, 1591 s, 1559 s, 1505 m, 1437 s, 1379 s, 1315 s, 1263 s, 1156 s, 847 m, 793 s, 761 s; UV-Vis. data: λ_{max} 208 nm, 228nm, 476 nm; molar conductance (Λ_m): 25.18 ohm .cm².mol⁻¹.

Synthesis of 2-(4-Hydroxynaphthylazo)-5-substituted phenyltellurium tribromides



R = H (V), Br (VI), CH₃ (VII), NO₂ (VIII)

Fig. 2: structures of compounds (V) - (VIII)

2-(4-Hydroxynaphthylazo)phenyltellurium tribromide (V)

2-(4-hydroxynaphthylazo) phenylmercuric chloride (1.44 gm, 3.00 mmol) and tellurium tetrabromide (1.34 gm, 3.00 mmol) were mixed in dry dioxane (50 mL). The mixture was stirred under reflux for 6 hr. Cooling the mixture gave crystals of a mercury (II) halides. 2 dioxane complex, which was removed by filtration. The filtrate was poured into ice - water, and a brown precipitate was formed. The product was recrystallized from a ethanol and dichloromethane (4 :1) to give a dark brown solid: m.p 191 °C in yield 71 %; FTIR: 3448s, br, 3058 w, 2923 w, 2852 w, 1587 s, 1506 m, 1458 s, 1398 m, 1301 m, 1249 s, 1147 m, 973 m, 815 m, 763 s, 738m; UV-Vis. data: λ_{\max} 208 nm, 228nm, 478 nm; molar conductance (Λ_m): 26.26 $\text{ohm}^{-1}.\text{cm}^2.\text{mol}^{-1}$.

The following compounds were prepared by the same above method using the appropriate mercurated compounds.

2-(4-Hydroxy naphthylazo)-5- bromophenyltellurium tribromide (VI) .

A brown solid was obtained 69 % , mp 198 °C. FTIR: 3450 s, br, 3064 w, 2962 w, 2926 w, 2855 w, 1589 s, 1515 s, 1442 m, 1325 m, 1299, 1263 s, 1143 m, 867 m, 816 s, 769m, 703 m; UV-Vis. data: λ_{\max} 208 nm, 228nm, 476 nm; molar conductance (Λ_m): 24.75 $\text{ohm}^{-1}.\text{cm}^2.\text{mol}^{-1}$

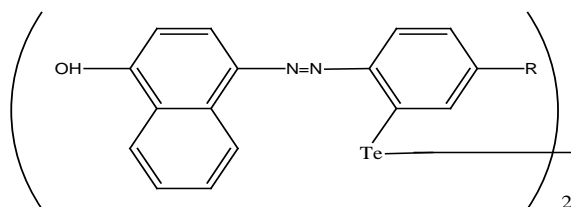
2-(4-Hydroxy naphthylazo)-5- methylphenyltellurium tribromide (VII).

A dark brown solid was obtained in 79 % , mp 183 °C; FTIR: 3438 s, br, s, 3068 w, 2926 w, 2858, 1592 s, 1514s, 1465 m, 1340 m, 1298 s, 1140 m, 817 m, 773 s, 758 m; UV-Vis. data: λ_{\max} 208 nm, 228nm, 478 nm; molar conductance (Λ_m): 30.00 $\text{ohm}^{-1}.\text{cm}^2.\text{mol}^{-1}$

2-(4-Hydroxy naphthylazo)-5-nitro phenyltellurium tribromide (VIII) .

A dark brown solid was obtained in % ; mp 178 °C. FTIR: 3393 s,br, 3065 w, 2962 w, 2928 w, 2856 w,1586, 1510 s, 1505 m, 1452 m, 1397 s, 1330 s, 1256 s, 1148 m, 879 m, 838 m, 764 s, 729 m, 718 m; UV-Vis. data: λ_{\max} 208 nm, 228nm, 476 nm; molar conductance (Λ_m): 25.56 $\text{ohm}^{-1}.\text{cm}^2.\text{mol}^{-1}$

Synthesis of Bis[2-(4-Hdroxynaphthylazo)- 5-substitutedphenyl] ditellurides



R =H (IX) , Br (X) , CH₃ (XI) , NO₂ (XII)

Fig. 3: structures of compounds (IX) - (XII)

Bis[2- (4- Hydroxynaphthylazo)phenyl] ditelluride (IX)

To a suspension of compound 2-(4-Hdroxynaphthylazo)phenyltellurium tribromide (V) (1.19 g, 2.00 mmol) in hot ethanol (25 mL), a solution of hydrazine hydrated (0.26 g, 8.00 mmol) in ethanol (25ml) was added dropwise. The mixture was warmed gently until all the solid had dissolved, and was then poured into water (300mL). After extraction with ether (3 x 50 mL), the ethereal layer was separated and dried over anhydrous calcium chloride, and the solvent was removed on a rotary evaporator. The brown solid was recrystallized from ethanol to give dark brown crystals in 67 % yield, 129 °C; FTIR: 3413 br, s, 3058 w, 2923 w, 2821 w, 1585 s, 1506 m, 1375 m, 1269m, 1149 m, 813 m, 763 s; UV-Vis. data: λ_{\max} 208 nm, 228nm, 478 nm; molar conductance (Λ_m): 4.09 $\text{ohm}^{-1}.\text{cm}^2.\text{mol}^{-1}$

The following compounds were prepared by the same method described for the preparation of compound (IX) and by reduction of compounds (X)-(XII) with ethanolic solution of hydrazine hydrate.

Bis [2- (4- Hydroxy naphthylazo)-5-bromophenyl] ditelluride (X)

A dark brown solid was obtained in 72 % , mp 133 °C . FTIR: 3415br, s, 3064 w, 2970 w, 2928 w, 1501 m, 1492 m, 1465 m, 1379 m, 1272 m, 1145 m, 873 m, 816 m, 766 m; UV-Vis. data: λ_{\max} 208 nm, 228nm, 476 nm; molar conductance (Λ_m): 5.26 $\text{ohm}^{-1}.\text{cm}^2.\text{mol}^{-1}$

Bis {2- (4-Hydroxynaphthylazo)-5-methylphenyl} ditelluride (XI)

A dark brown solid was obtained in 65 % , mp 139 °C . FTIR: 3380 s, br, 3065, 2926 w, 2850 w, 1591 s,1506 s, 1464 s, 1461 s, 1396 s,1390 m, 1275 m, 1152 s, 811 m, 764 s, 726 m. UV-Vis. data: λ_{\max} 208 nm, 228nm, 478 nm; molar conductance (Λ_m): 6.73 $\text{ohm}^{-1}.\text{cm}^2.\text{mol}^{-1}$

Bis [2- (4- Hydroxy naphthylazo)-5-nitrophenyl] ditelluride (XII)

A dark brown solid was obtained in 60 % ;mp 120 °C ; FTIR: 3448 br, s, 3066, 2920 w, 2850 w, 1510 m, 1460m, 1402 m, 1332, 1263 m, 1159 m, 820 m, 782 m, 765 m; UV-Vis. data: λ_{max} 208 nm, 228nm, 476 nm; Molare conductance (Δm) : 4.61 ohm⁻¹.cm².mol⁻¹.

2-2 PHYSICAL MEASUREMENTS

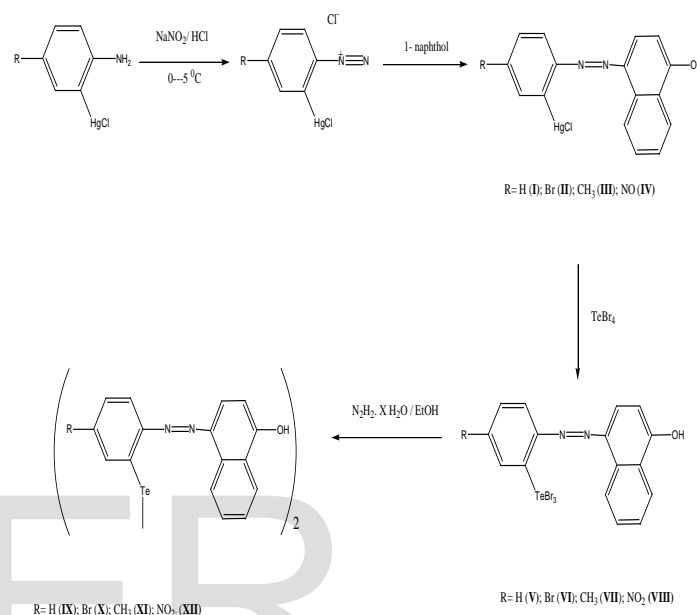
Analysis for C, H, N was done by the Analytical Service Unit , Al al-Bayt University , Jordan. FT-IR spectra were recorded for KBr discs with a FT-IR-8400 Shimadzu instrument . NMR spectra were recorded with a Bruker DPX-300(300MHZ) and using TMS as internal standard. The molar conductivity for some synthesized compounds were measured in 1x10⁻³ M solution of dimethylsulfoxide solvent at room temperature using a Konduktoskop model 365B using standard conductivity cell with constant equal to 0.81 cm⁻¹. UV-Vis spectra for the synthesized compounds were recorded at Department of Chemistry, College of Science, University of Basrah by using Scan 80D (England) at range 200-800 nm using ethanol as a solvents and 1cm³ pathway quartz cells. Melting point were measured on a Gallen Kamp-melting point apparatus and are uncorrected.

3 RESULTS AND DISCUSSION

In the present study, 2- aminoaryl mercuric chlorides (i.e 2- aminomercuric chloride, 2- amino 5- bromomercuric chloride, 2- amino 5- methylmercuric chloride, and 2- amino 5- nitromercuric chloride) were satisfactorily diazotized at 0 - 5 °C by sodium nitrite solution to form corresponding diazonium salts ,and by subsequent coupling with 1-naphthol , the required 2-(4-hydroxynaphtholazo) arylmercury chlorides [i.e., 4-HOC₁₀H₆N=NC₆H₄-1-HgCl-5-R ; where 4-HOC₁₀H₆ = 4-Hydroxynaphthyl ; R=H (I) , Br (II) , CH₃ (III) , NO₂(IV)]were obtained in very good yields (scheme 1). Reaction of tellurium tetrabromide with the corresponding 2-(4-Hydroxynaphthylazo)- 5-(R)phenylmercury chlorides, i.e (I) - (IV), in 1:1 molar ratio gave tribromides (V) -(VIII) compounds as dark brown solids in good yields (scheme1). Reduction of compounds (V) -(VIII) using ethanolic hydrazine gave the corresponding ditellurides (IX) -(XII) in moderate to good yield (scheme 1).

In general all the prepared compounds are dark brown solids with high melting points ,and they are soluble in common organic solvents.

The carbon, hydrogen and nitrogen analysis for the prepared compounds (I) -(XII) agreed well with the calculated values of the suggested structures and presented in Table 1 . The suggested structures confirm that all the prepared compounds have a ethanol molecule as adduct in their structures.



Scheme 1: illustrate the synthesise methods of compounds (I)- (XII)

The FT-IR spectra of all new synthesized compounds (I)- (XII) display common feature in certain and characteristic bands in the fingerprint and other regions. The FT-IR spectra of all mercurated and tellurated azo derivatives show the disappearance of the symmetric and a symmetric stretching bands near 3400-3200 cm⁻¹ due to the N-H bonds of NH₂. This supports the conversion of primary amino groups to azo groups. The spectra of compounds (I)- (XII) show a strong band in the range 1592- 1585 cm⁻¹ can be attributed to stretching vibration of azo group (-N=N-) [19,20]. In general, the IR spectra of compounds (V) -(VIII) and (IX)-(XII) are quite similar to those of azo organomercuric chloride (i.e. compounds I - IV), which confirms that telluration has occurred at the position initially occupied by HgCl. All compounds show a broadly strong band in the range 3450- 3413 cm⁻¹ attributed to O-H vibration band. All compounds show two strong bands between 1542-1500 cm⁻¹ and 1492-1375 cm⁻¹ which may attributed to a symmetrical and symmetrical stretching of aromatic C=C bonds [19-21]. Three strong bands between 883-718cm⁻¹ can be assigned to out-of-plane bending vibration of aromatic C-H [19-21].

Table 1: CHN analysis and ¹H NMR data for the new tellurated azo compounds based on 2-(4-Hydroxynaphthylazo)aryl

The spectra show a medium band between 1298-1249 cm⁻¹ due to C-N stretching band and a medium band between 1149-1138 cm⁻¹ due to C-O stretching [19-21]. For compounds (IV), (VIII) and (XII), the bands at 1332-1315 cm⁻¹ and 1559-1510 cm⁻¹ are assigned to a symmetrical and symmetrical vibration of the NO₂ group, respectively [19,21]. IR spectra of compounds (II), (VI) and (X) show a medium bands at 1083, 1068 and 1091 cm⁻¹ respectively can attributed to C-Br [19-21]. The IR spectra of all the synthesized compounds gave another evidence to occupy ethanol solvent as adduct molecule with these compounds.

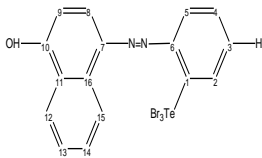
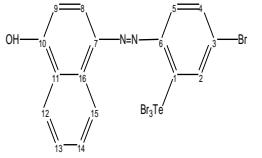
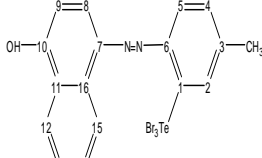
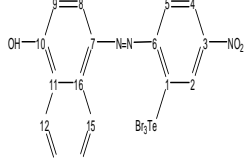
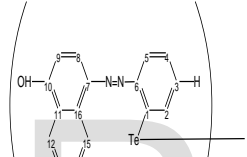
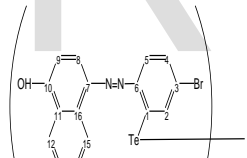
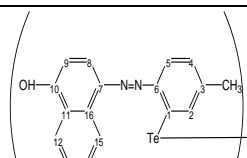
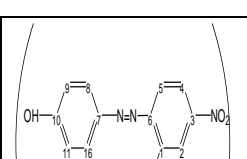
The ¹H NMR spectra of compounds (V - XII) were recorded in DMSO-d₆ and their data were summarized in Table 1. The ¹H NMR spectra of compounds (V) (XII) show a multiple signal between 8.66-6.02 ppm due to the aromatic protons, Table 2. The signal characteristic of the proton hydroxyl group was observed in region 8.93 - 8.18 ppm [16, 19, 22, 23]. The ¹H NMR spectra of compounds (VII) and (XI) show a singlet signal observed at 2.84, 2.93 ppm, respectively can be attributed to methyl protons (i.e CH₃-Ar) [16, 19-22]. The ¹H NMR spectrum of all tellurated compounds except compound V show signals in several shifts due to ethanol solvent as adduct molecule as following: quintet signal between 2.28 -1.17 ppm due to CH₂ proton of EtOH molecule, a triplet signal between 0.82 - 1.87 ppm may be attributed to proton of CH₃ group of EtOH and the singlet signal appears between 2.27 -2.98 ppm due to proton of hydroxyl group of EtOH molecules, Table 1.

The ¹³C NMR spectra of compounds (V - XII) were recorded in DMSO-d₆ and their data were summarized in Table 2. The ¹³C NMR spectra for compounds (V - XII) agree well with their structures and gave another evidences about characterization of these prepared compounds. All the ¹³C NMR spectra of compounds (V - XII) give a low field signal (high chemical shift) of aromatic carbon atom which attach with hydroxyl group (i.e C10 in compounds V- VIII or C10 and C10' in compounds IX - XII) in the range (153.42- 154.77) ppm which are in agreement with pervious reported literatures.[16,19, 20, 22] Also, the ¹³C NMR spectra for compounds (V - XII) show low field signals in the range(152.11-153.98) can be assigned to aromatic carbon atoms which attached with nitrogen atoms of azo groups (i.e C6 and C7 in compounds V- VIII or C6,C6',C7 and C7' in compounds IX - XII) [16,19, 20, 22]. The high chemical shifts for these carbon signals attributed to high electronegativity of oxygen and nitrogen atoms.

Com. No	Elemental analysis %			1H NMR (DMSO-d ₆): TMS = 0ppm
	C	H	N	
V	31.27 (31.34)	1.802 (2.69)	4.56 (4.44)	7.86-6.16(m, 9 H, Ar-H) 8.89(s, 1H, OH)
VI	30.17 (29.23)	2.16 (2.18)	4.37 (3.78)	8.4-6.05(m, 9 H, Ar-H) 8.69(s, 1H, OH) 5.82(s, 1H, OH EtOH) 2.24-2.19(t, 2H, CH ₂ EtOH) 1.87-0.87(q, 3H, CH ₃ EtOH)
VII	33.92 (33.83)	2.61 (2.24)	4.32 (4.15)	8.58-6.13(m, 9H, Ar-H) 8.90(s, 1H, OH) 2.84(s, 3H, CH ₃ -Ar) 2.98(s, 1H, OH EtOH) 1.74-1.45(q, 2H, CH ₂ EtOH) 1.2-0.82(t, 3H, CH ₃ EtOH)
VIII	31.058 (30.64)	2.63 (2.28)	6.325 (5.95)	8.66-6.37(m, 18H, Ar-H) 8.68(s, 1H, OH) 2.27(s, 1H, OH EtOH) 1.26-1.19(d, 2H, CH ₂ EtOH) 0.84(s, 3H, CH ₃ EtOH)
IX	51.378 (51.31)	4.236 (3.55)	7.365 (7.04)	7.86-6.11(m, 18H, Ar-H) 8.92(s, 2H, OH) 2.93(s, 1H, OH EtOH) 1.3-1.21(q, 2H, CH ₂ EtOH) 0.98-0.84(t, 3H, CH ₃ EtOH)
X	41.605 (41.43)	3.025 (2.66)	5.886 (5.68)	7.84-6.99(m, 18H, Ar-H) 8.18(s, 2H, OH) 2.98(s, H, OH EtOH) 2.28-1.9(q, 2H, CH ₂ EtOH) 1.41-0.91(t, 3H, CH ₃)
XI	52.471 (52.48)	4.036 (3.91)	7.138 (6.8)	8.55-6.3(m, 18 H, Ar-H) 8.93(s, 2H, OH) 2.93(s, 3H, CH ₃ -Ar). 2.98(s, 18H, OH EtOH) 1.22(q, 2H, CH ₂ EtOH) 0.83 (t, 3H, CH ₃ EtOH)
XII	64.08 (46.100)	3.148 (2.96)	9.882 (9.49)	8.23-6.02(m, 18H, Ar-H) 8.69(s, 2H, OH) 2.81(s, 2H, OH EtOH) 1.58-1.17(q, H, CH ₂ EtOH) 0.82(s, 3H, CH ₃ EtOH)

The high field signal at 21.45 ppm in both ¹³C NMR spectra of compound VII and XI, are due to methyl groups [16,19, 20, 22]. It is worth noting, the low chemical shifts (high field) signals in all tellurated compound spectra except V around 16.00 and 55.00 ppm can be attributed to methylene and methyl carbon atoms respectively of an ethanol solvent which used in recrystallization of the prepared compounds. These observations are agreement with CHN, IR and ¹H-NMR data which confirm that an ethanol molecule is bound as adduct molecule crystalline lattice of the prepared compounds.

Table 2: ¹³C NMR data for the new tellurated azo compounds V - XII

Com. No	Compound Structure	Chemical Shift(ppm); TMS = 0 ppm
V		C10(154.00); C6(153.60):C7(153.20): C3(139.16) :C2(134.65):C4(133.44):C15(132.26):C14(131.06):C13(129.36):C12(128.3):C16(127.80): C5(126.80):C11(126.30): C8(124.97):C9(122.83): C1(118.77).
VI		C10(154.76):C6(152.55):C7(152.28): C3(152.09): C2(135.90):C4(133.57): C15(132.89):C14(131.21): C13(129.29):C12(128.55): C16(127.32):C5(126.40): C11(125.50) :C8(124.54):C9(123.60):C1(118.78): EtOH:CH2(55.28):CH3(16.40).
VII		C10(153.42):C6(152.29); C7(152.11):C3(140.76): C2(135.62):C4(134.31): C15(133.56):C14(130.80): C13(129.84): C12(128.65):C16(127.31): C5(126.77): C11(125.77): C8(124.55):C9(123.59): C1(118.79): CH3-Ar(21.45) EtOH:CH2(54.97): CH3(16.68).
VIII		C3(159.12):C10(155.22): C6(154.77): C7(153.98); C2(139.17) :C4(135.29)) : C15(134.67) :C14(132.62); C13(129.50):C12(128.77); C16(127.00):C5(126.31) ; C11(125.35); C8(123.52), C9(122.72) , C1(118.57) EtOH:CH2(55.04): CH3(16.62).
IX		C10, C10' (154.00):C6, C6' (153.80): C7, C7' (153.60): C3, C3' (139.30) : C2, C2' (135.80):C4, C4' (134.80): C15, C15' (133.30):C14,C14' (131.13): C13,C13' (130.00): C12,C12' (128.80): C16,C16' (127.05): C5,C5' (126.50): C11,C11' (125.42):C8,C8' (124.50): C9,C9' (123.59): C1,C1' (118.60): EtOH:CH2(55.45) :CH3(16.17)
X		C10,C10' (154.12):C6,C6' (153.30): C7, C7' (153.22): C3,C3' (152.40) : C2,C2' (135.00):C4,C4' (134.50): C15,C15' (133.39):C14,C14' (131.30): C13,C13' (128.50): C12,C12' (128.08): C16,C16' (127.30):C5,C5' (126.83): C11,C11' (125.67):C8,C8' (124.67): C9,C9' (123.74) C1,C1' (118.80): EtOH:CH2(55.00) :CH3(16.17).
XI		C10,C10' (155.25):C6,C6' (153.99): C7,C7' (153.17): C3,C3' (150.20): C2,C2' (139.15):C4,C4' (135.09): C15,C15' (134.67):C14,C14' (134.58): C13,C13' (132.60): C12,C12' (129.40): C16,C16' (128.81):C5,C5' (127.01): C11,C11' (123.19):C8,C8' (122.72): C9,C9' (118.75): C1,C1' (117.59): CH3-Ar(21.69) EtOH:CH2(55.55):CH3(16.00).
XII		C3,C3' (159.68): C10,C10' (154.65): C6,C6' (153.42): C7,C7' (152.11): C2,C2' (135.62) :C4,C4' (134.31): C15,C15' (133.56):C14,C14' (130.80): C13,C13' (129.84): C12,C12' (128.65): C16,C16' (127.31):C5,C5' (126.45): C11,C11' (125.77):C8,C8' (124.55): C9,C9' (123.59): C1,C1' (118.79): EtOH:CH2(55.70):CH3(16.80).

The molar conductivities were determined for all the prepared compounds in 1×10^{-3} M solution of DMSO solvent at room temperature.

The molar conductances of 2-(4-hydroxynaphthylazo)-5-substitutedphenylmercuric chloride compounds (I-IV) and 2-(4-hydroxynaphthylazo)-5-substitutedphenyltellurium tribromides (V-VIII) were found at range of 24.75- 31.07 $\text{ohm}^{-1} \text{cm}^2 \text{mol}^{-1}$, while bis-[2-(4-Hdroxynaphthylazo)- 5- substitutedphenyl] ditellurides ranged at 4.09- 6.73 $\text{ohm}^{-1} \text{cm}^2 \text{mol}^{-1}$. This indicates that compounds (V-VIII) behave as 1:1 electrolytes in DMSO solvent at room temperature which may be due to ionic character of Hg-Cl and one Te-Br bond in these compounds respectively. These observations are in agree well with previous work in DMSO solutions [16,24,25]. The low conductance data of ditelluride compounds indicates that compounds (IX-XII) behave non electrolytes in DMSO solvent at room temperature.

The UV-Vis spectra of compounds I-XII were recorded absolute ethanol solution (10^{-4} M). Generally , the UV-Vis spectra for all compounds I-XII show three absorption region. The first band appeared at 208nm ($\epsilon = 10150 - 11330 \text{ M}^{-1} \cdot \text{cm}^{-1}$) is attributed to $\pi \rightarrow \pi^*$ transition of phenyl rings [19, 20]. The second band observed for all compounds at 228 nm ($\epsilon = 8925 - 10865 \text{ M}^{-1} \cdot \text{cm}^{-1}$) range which may be attributed $\pi \rightarrow \pi^*$ transition of naphthyl rings [19,20] and the third band observed as a broad shoulder between 476 - 478 nm ($\epsilon = 2384 - 2800 \text{ M}^{-1} \cdot \text{cm}^{-1}$) are attributed to $\pi \rightarrow \pi^*$ transition of azo groups.[19, 20] Thus, the UV-Vis spectra of these compounds indicated the presence azo group (-N=N-) in the prepared compounds I-XII.

ACKNOWLEDGMENTS

The authors are very grateful to University of Basra, College of Science, Department of Chemistry for providing facilities.

REFERENCES

- [1] R. Kumar, H. B. Singh and R. T. Butcher, J. Organometallics Chem., 14, 4755 (1995).
- [2] J. E. Drake, M. B. Hursthouse, M. Kulcsar, M. E. Light and A. Silvestrue, J. Organometallics. Chem., 623, 153 (2001).
- [3] M. Kulcsar, Ph.D Thesis, BABES-BOLYAI University, 2005.
- [4] I. D. Stadekov, V. I. Minkin, A. V. Zakharov, A. G. Stankov, G. S. Borodkin, S. M. Aldoshin, V. V. Tkachev, G. V. Shilov and F. J. Berry, J.Organomet. Chem., 690, 103 (2005).
- [5] S. C. Menon, H. B. Singh, R. P. Patal, K. Das and R. J. Butcher, Organometallics, 16, 563 (1997).
- [6] R. Kumar, A. K.Singh, R. J. Butcher, P.Shama and R. A. Toscano, European J. Inorg. Chem., 5, 1107 (2004).
- [8] A. K. S. Chauhan, Anamika, A. Kumar, P. Singh, R. C. Srivastava, R. J. Butcher, J. Beckmann and A. Dthie, J.Organomet. Chem., 691, 1954 (2006). N. Al-Salim, A. A. West, W. R. McWhinnie and T. A. Hamor, J.Chem. Soc., Dalton Trans., 2363(1988).
- [9] A. Z. Al-Rubaie, A. M. Fingan, N. I. Al-Salim and S. A. Al-Jadaan, Polyhedron, 14, 2575 (1995).
- [10] R. E. Cobbleidick, F. W. Einstein, W. R. McWhinnie and F. H. Musa, J. Chem. Res.; (S), 145 (1979); J.Chem. Res., (M), 1901 (1979).
- [11] M. A. K. Ahmed, A. E. McCarthy and W. R. McWhinnie, J.Chem. Soc., Dalton Trans., 771 (1986).
- [12] Z. Majeed, W. R. McWhinnie and T. A. Hamor, J.Organomet. Chem., 549, 257 (1997).
- [13] Cobbleidick, R. E.; Einstein, F. W.; McWhinnie, W. R.; Musa, F. H. J. Chem. Res. (S) 1979, 145; J. Chem. Res. (M) 1979, 1901.
- [14] M. A. Ahmed, W. R. McWhinnie and T. A. Hamor, J.Organomet. Chem., 281, 205 (1985).

[15] A. Z. Al-Rubaie, A.I. Auoob and T. A. K. Al-Allof, Iraqi J. Chem., 19,121 (1994).

[16] Ali Z. Al-Rubaie, Adil A. Al-Fregi and Shaker A. Al-Jaddan, Phosphorus, Sulfur, and Silicon and the Related Elements, 186(1),115(2011).

[17] Makarova, L.G.; Nesmeianov, A.N. The Organic Compounds of Mercury; (North-Holland Pub.Co.; Amsterdam, 1967.

[18] (a) Al-Rubaie, A.Z. ; Al-Salim, N.I. and ; Al-Jadaan, S.A.N. J. Organomet. Chem. 1993, 443, 67 ;

(b) Junk, T.; Irgolic, K. J. Phosphorus, Sulfur Silicon Relat. Elem. 1988, 88, 121.

[19] R.M. Silerstien, F.X ; Webster and D.J. Kiemle, "Spectroscopic Techniques for Organic Chemistry Compounds" , 6th Ed., John Wiley and Sons, N.Y. 2005.

[20] R. I. Shriner and C.K. Hermann, "Spectroscopic Techniques for Organic Chemistry" , John Wiley and Sons , N.Y , 2004.

[21] A.K. Chauban, Anamica, A. Kumar, R. C. Srivastava and R.J. Butcher, J. Beckman and

A. Duthie, J. Organomet. Chem., 690, 1350 (2005).

[22] G.E. Martin, " Cryogenic NMR Probs; Application, D.M. Grant and R.K. Harris", Encyclopendia of Nuclear Magnetic Resonance, Vol. 9, Wiley Chichester, 2002.

[23] R. P. Kumar, A. K. Singh, J. E. Drake, M.B. Hursthouse, and M.E. Light, Inorg. Chem. Commun., 7, 502 (2004).

[24] A. Z. Al-Rubaie, W.A. Al-Masoudi, S. A. Al-Jadaan, A.F. Jalbout and A.J. Hameed, Hetroatom Chem., 19 , 307 (2008).

[25] A.Z. Al-Rubaie, A.A. Al-Najar and F.A. Jassim, Inorg. Chim. Acta, 175, 181 (1990).

IJSER