



Synthesis of Some New Selenonitrone Compounds

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ABSTRACT

The carbonyl selenonitrile and dicarbonyl diselane compounds were prepared by using the inorganic reagent such as potassium selenocyanate. New nitrone compounds were synthesized from the condensation of carbonyl group in the selenocarbonyl compounds with substituted N-phenylhydroxylamine and N-benzyl hydroxylamine. The resulting products were identified by physical properties such as melting point (M.p.), retardation factor (Rf) and color. Also compounds showed the expected data in identification techniques such as FTIR, ¹H NMR, ¹³C NMR, mass spectroscopy and Elemental analysis (CHN). The results proved the validity of the expected chemical structures of synthesized compounds.

Keywords: Nitrones, Potassium selenonitryl, Carbonyl selenonitrile,

INTRODUCTION

Interest in nitrone is due to their successful application, can be used as building blocks in the synthesis of various natural and biologically active compounds. Nitrone has been extensively investigated, because of their utility as versatile synthetic intermediates. Interest in nitrone also due to their successful application, can be used as building blocks in the synthesis of various natural and biologically active compounds. The synthesis of nitrone containing sulfur and nitrogen have been extensively studied^{1,2}, while the synthesis of nitrone containing selenonitrile and diselenide analogues have not been appreciably investigated^{3,4}. This is mainly due to the easily decomposed of nitrone and organoselenium compounds in light and moisture. In this research^{5,6}, several new carbonyl

compounds containing selenonitrile group and diselenide⁷ group were prepared. Diphenyl diselenide [(PhSe)₂] is being carried out by the alkaline hydrolysis of substituted phenylselenonitrile (the synthesis of phenylselenonitrile) is being carried out by the reaction between potassium cyanide and selenium metal⁸. For the preparation of nitrones, the most popular method is the condensation of aldehydes or ketones with N-monosubstituted hydroxylamines^{9,10,11}. Recently, organoselenium compound has gradually investigated because of their interesting reactivities and their pharmaceutical applications^{12,13}. The nitrone compounds are of marked interest because of their anti-tumor^{14,15}, antibacterial¹⁶ and of anti-cancer agents by intercalating DNA^{17,18,19} with higher affinity and found it was easily metabolized with low toxicity²⁰. The aim of the study : according

to the literature, study has been done on nitron compounds and organoselenium compounds separately. These two classes of compounds have been combined in this study.

MATERIALS AND METHODS

FT-IR spectra were measured by an instrument called BRUKER and the range was between 375-4500 cm^{-1} . ^1H NMR spectra were measured by an instrument called BRUKER 300 MHz. The samples were recorded in DMSO solutions containing TMS as internal standard. Chemical shifts for all ^1H and ^{13}C NMR spectra were reported in δ units downfield from internal reference Me_4Si . Elemental analyses (C, H and N) were obtained and Mass spectra were measured by instruments called MP- H- Vario Elemental analyzer and Agilent- O.T-LABRO, respectively.

All the carbonyl selenonitrile compounds being carried out by the reaction of the corresponding benzoyl chloride with potassium selenocyanate. Nitron compounds were prepared from the condensation of carbonyl selenonitrile with N-phenyl hydroxylamine and N-benzyl hydroxylamine compounds.

The general procedure of preparation carbonyl selenonitrile^{21,22}: To a stirred Solution of (0.8) KCN in absolute ethanol (50 ml), (1 g.; 125 mole) of selenium metal was added. The reaction was in red color. After 3 h. of reflux, (206 ml 0.025 mole) of substituted benzoyl chloride was added

and refluxed for 2 h. The reaction was followed by TLC. The result was filtered, washed, dried and recrystallized from absolute ethanol.

The general procedure of preparation diorgano diselenide²³: To a stirred solution of (0.28 gm; 1.02 mole) in 25ml absolute ethanol of carbonyl selenonitrile, a solution of (0.16 g, 2.47 mole) in 15 ml absolute ethanol sodium hydroxide was added. The mixture was stirred for 50 min. at 40°C. After one h of reflux, the reaction was followed by TLC, the mixture reaction cooled to R. T. and filtered. The filtrate was acidified with 10% HCL. A red solid compound was obtained, washed with a small amount of benzene and dried. Recrystallization from a mixture of methanol and dichloro methane (1:4), gave a red solid compounds.

The General Procedure of synthesis nitron²⁴⁻²⁶: In a 250 ml one-necked round bottomed flask (0.02 mole) of selenocarbonyl compounds were placed and a solution of 15gm of anhydrous CaCl_2 with added 30 ml of absolute ethanol was added. The solution was stirred and warmed to 50 °C and a solution of (0.02mol) of [(N-phenyl hydroxylamine) in 30 ml of absolute ethanol was added, to synthesis the compounds (N_1 , N_2 , N_3 and N_4) while the compound N_5 was synthesized by added N-benzyl hydroxylamine]²⁵. 3 drops of benzene sulfonic acid was added to the mixture. After the addition was completed the reaction mixture was kept with stirring in dark, overnight at room temperature. The reaction was followed by TLC, the mixture was cooled and then the

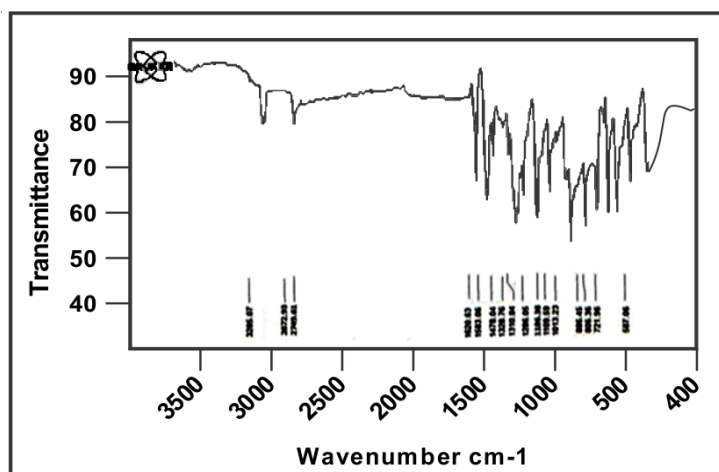
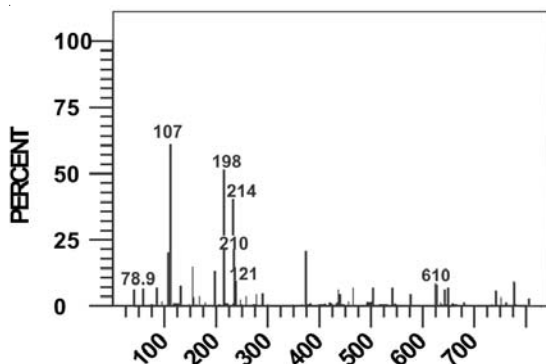


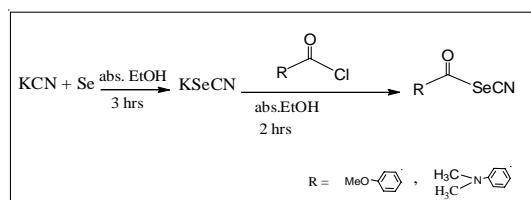
Fig.1. IR spectrum of compound (N_4)

Fig.2. Mass spectrum of compound (N_4)

precipitated was filtered by suction filtration and the product was recrystallized by abs. ethanol. All the synthesized compounds were characterized by FTIR, ^1H NMR, ^{13}C NMR, mass spectroscopy and Elemental analysis (CHN) and all the results were in agreement with the theoretical calculation. For example the spectra are represented in the figures (1 – 4) for compound (N_4). Chemical structure and some physical properties of nitrones are represented in Table (1).

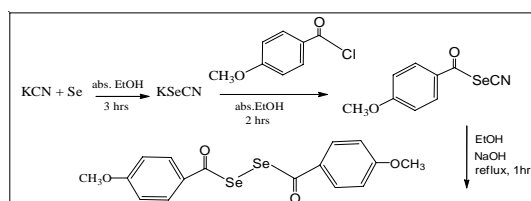
The carbonyl selenonitril compounds was prepared by the reaction of potassium cyanide with

benzoylchloride as explain in equation (a).



Equation (a)

Dicarbonyl diselenide can be prepared by the alkaline hydrolysis of carbonyl selenonitrile compounds, as explain in equation (b).



Equation (b)

N-phenylhydroxylamine were synthesized by the reduced of nitro aromatic compounds with zinc dust and using water as a solvent while N-benzylhydroxylamine was prepared by the reaction between hydroxyl amine hydrochloride and benzyl chloride, in the presence of sodium carbonate.

Table. 1: Chemical structure and some physical properties of nitrones

Symbols	Time of reflux	Color	Yield%	Solution of TLC	Rf	Structures
N_1	9	Orange	55	Ethylacetate hexane 2.5:7.5	0.54	
N_2	9	Yellow	57	Ethylacetate hexane 6.5:3.5	0.66	
N_3	11	Orange	70	Ethylacetate hexane 5.0:5.5	0.61	
N_4	10	Yellow	61	Ethylacetate hexane 7.5:2.5	0.59	
N_5	9	Orange	69	Ethylacetate hexane 5.0:5.0	0.66	

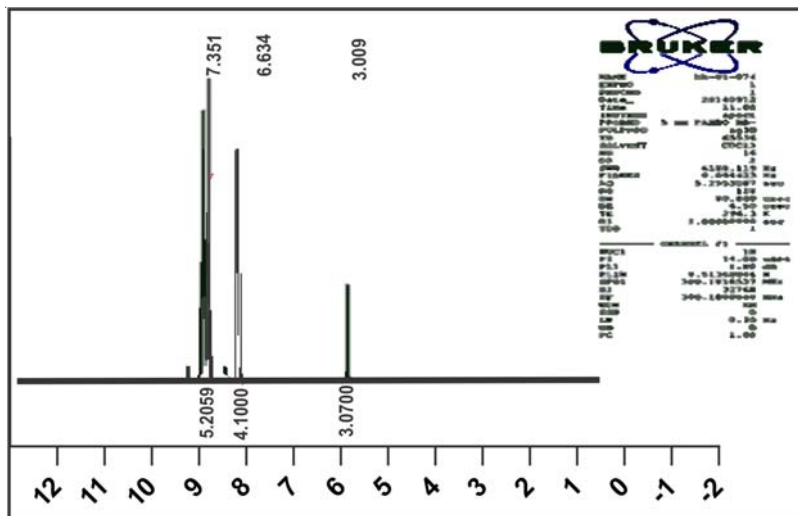


Fig.3. ¹H NMR spectrum of compound (N₄)

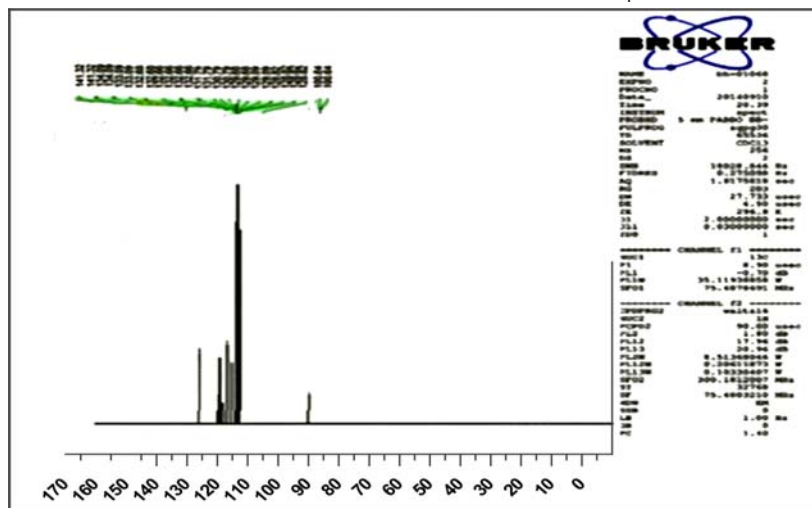
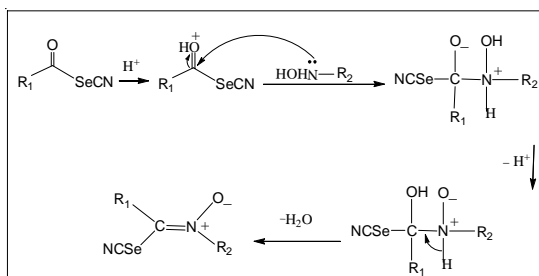


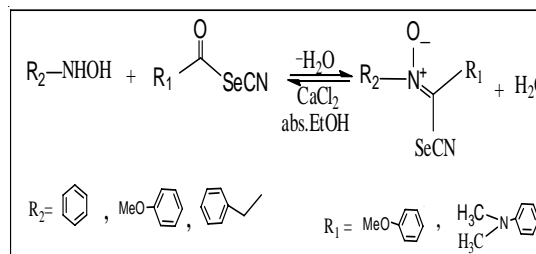
Fig.4. ¹³C NMR spectrum of compound (N₄)

Nitrones were synthesized by the condensation of substituted caronyl selenonitrile with N-phenylhydroxylamine and N benzylhydroxylamine as explain in equation (c) and scheme (1).



Scheme (1)

The mechanism of synthesis nitrone compounds



Equation (c)

RESULTS

The resulting data were obtained for the synthesized compounds from analysis data as following:

N-(1,1-(4-methoxyphenyl) selenonitrile methylene) aniline oxide (N₁)

Yield: 55 %. M.p. 100-99°C. FTIR ν /cm⁻¹: 1600 (C=N), 1394 (C=C), 1377 (C-N), 588 (C-Se), 2101 (C≡N), 1199 (N-O), 2988 (C-H aliph), 3099 (C-H arom.). ¹H NMR [300MHz, (DMSO), δ (ppm)]; 6.6 (4H-ph), m 7.9 (5H-ph), 3.6 (CH₃). ¹³C NMR [300MHz, (DMSO), δ (ppm)]; 50.6(CH₃), 123.4, 123.6, 129.0, 129.7, 129.9, 149.0 (ph-N), 130.5, 130.6, 130.8, 131, 131.7, 160.4 (ph-O), 165 (C=N), 110 (CN). For C₁₅H₁₂N₂OSe. (Found) 54.11 % C, 3.50 % H and 8.55 % N. MS: m/z: 330.9 (M⁺).

N-(1,1-(N,N-dimethylamino phenyl) selenonitrile methylene) aniline oxide (N₂)

Yield: 57 %. M.p. 80-82°C. FTIR ν /cm⁻¹: 1605 (C=N), 1390 (C=C), 1380 (C-N), 589 (C-Se), 2110 (CN), 1188 (N-O), 2998 (C-H aliph), 3100 (C-H arom.). ¹H NMR [300MHz, (DMSO), δ (ppm)]; 6.4 (4H-ph), m 7.7 (5H-ph), 2.9 (CH₃). ¹³C NMR [300MHz, (DMSO), δ (ppm)]; 50.6, 50.9 (CH₃-N), 121.4, 121.6, 122.9, 123.3, 126.9, 147.0 (ph-N), 129.5, 129.9, 130.4, 130.5, 131.8, 161.0 (ph-O), 162 (C=N), 115 (CN). For C₁₆H₁₅N₃OSe. (Found) 55.30 % C, 4.30 % H and 12.30 % N. MS: m/z: 344(M⁺).

N-(1,1-(N,N-dimethylamino phenyl) selenonitrile methylene)-4-methoxy aniline oxide (N₃)

Yield: 70 %. M.p. 83-82°C. FTIR ν /cm⁻¹: 1590 (C=N), 1375 (C=C), 1385 (C-N), 590 (C-Se), 2111 (CN), 1180 (N-O), 2988(C-H aliph), 3110 (C-H arom.). ¹H NMR [300MHz, (DMSO), δ (ppm)]; 6.7 (4H-ph-O), 7.9 (4H-ph-N), 3.9 (CH₃-N), 2.7 (CH₃-O). ¹³C NMR [300MHz, (DMSO), δ (ppm)]; 49.8, 50.1 (CH₃-N), 50.4 (CH₃-O), 122.6, 122.8, 122.9, 124.3, 124.6, 166.9 (ph-O), 127.1, 127.9, 131.4, 131.1, 133.7, 147.7 (ph-N), 162.5 (C=N), 113 (CN). For C₁₇H₁₇N₃O₂Se. (Found) 54.57 % C, 4.90 % H and 11.22 % N. MS: m/z: 373.9(M⁺).

N, N'-(diselanediyil bis (4-methoxyphenyl) methan-1-yl-1-ylidene) bis (aniline oxide). (N₄)

Yield: 61%. M.p. 90-92°C. FTIR ν /cm⁻¹: 1620 (C=N), 13710 (C=C), 1328 (C-N), 587 (C-Se), 1186 (N-O), 2872 (C-H aliph), 31285 (C-H arom.). ¹H NMR [300MHz, (DMSO), δ (ppm)]; 3.0 (CH₃), 7.3 (ph-N) 6.6 (ph-O). ¹³C NMR [300MHz, (DMSO), δ (ppm)]; 161.0, 160.5 (C=N), 30.3, 31.2 (CH₃), 121.8, 121.9, 122.3, 122.9, 123.3, 123.9, 123.6, 124.5, 124.6, 124.7, 166.3, 166.9 (ph-O), 124.8, 124.6, 124.9, 125.4, 125.9, 127.3, 127.9, 128.6, 129.0, 129.2, 147.0, 146.5 (ph-N), For C₂₈H₂₄N₂O₄Se₂. (Found) 55.30 % C, 3.86 % H and 4.44 % N. MS: m/z: 610 (M⁺).

N, N'-(diselanediyil bis ((4-methoxyphenyl) methan-1-yl-1-ylidene)) bis(1-(3-methoxy phenyl) methanamine oxide) (N₅)

Yield: 69%. M.p. 90-92°C. FTIR ν /cm⁻¹: 1589 (C=N), 1378 (C=C), 1378 (C-N), 581 (C-Se), 2976 1187 (N-O), (C-H aliph), 3108 (C-H arom.). ¹H NMR [300MHz, (DMSO), δ (ppm)]; 1.7 (CH₃), 7.6 (ph-N) 7.3 (ph-O). ¹³C NMR [300MHz, (DMSO), δ (ppm)]; 161.0, 161.5 (C=N), 34.9, 35.1, 35.4, 35.9 (CH₃), 60.4, 60.7 (CH₂), 121.5, 122.4, 122.9, 123.9, 124.3, 124.9, 125.6, 125.5, 127.6, 128.7, 162.5, 163.9 (ph-O), 1298, 130.6, 130.9, 131.4, 1329, 133.3, 133.9, 134.0, 134.6, 134.8, 135.0, 146.5 (ph-N), For C₃₂H₂₈N₂O₆Se₂. (Found) 55.38 % C, 4.20 % H and 4.12 % N. MS: m/z: 693.8 (M⁺).

DISCUSSION

Five new nitron compounds were synthesized by using the condensation method between carbonyl group (carbonyl selenonitril and dicarbonyl diselenide) and N-(phenyl and benzyl)hydroxylamine group. Various substituted carbonyl selenonitrile compounds were synthesized by the reaction of potassium selenocyanate as inorganic reagent with benzoyl chloride. This method was easier than other methods to synthesis organoselenium compounds. The chemical structures of new selenonitrone compounds were characterized by identification methods.

All IR spectra of nitron compounds showed the disappearance of (C=O) of carbonyl selenonitrile band in the region (1700) cm⁻¹ and the appearance of (C=N), (N-O) and (C-N) bands in the regions (1589-1607) cm⁻¹, (1180-1199) cm⁻¹ and (1377-1388) cm⁻¹ respectively. The IR spectra of compounds (N₄, N₅) showed the disappearance of (Ca=N) band due to the alkali hydrolysis of (Ca=N) group to synthesis diselenide group, while the other synthesized nitron compounds containing (Ca=N) band in the region (2101-2111) cm⁻¹. Mass spectroscopy gives the molecular ion and other fragments which indicated the structure of synthesized nitron compounds. The nitron compounds have been diagnosed by elemental analysis, and all the results were in agreement with the theoretical. The yield of products depends on the type of substituted groups. The presence of the both electron donating and drawing groups in the nitron compound (N₃) increases the yield of products more than the donating group as in compound (N₁) or drawing group as in compound

(N₂). The diselane nitron containing four donating groups as in compounds (N₅) is more yield than the diselenide nitron containing two donating groups as in compound (N₄). Anhydrous CaCl₂ was using as a drying agent to removed the water from the product and shifted the reaction to the right director.

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