Using of Intramolecular Condensation Reaction In Synthesis of Heterocyclics of (Se ,S,N,O)- Atoms

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Abstract

In this paper ,synthesis of five and seven-membered ring which containing hetroatom (Se ,S ,N, O) via several steps, the first step in this reaction, 2,2-methylene-bis(4-nitro phenol) reacts with (selenium ,sulphur ,nitrogen ,oxygen)-compounds to yield cyclic derivatives of (Se ,S ,N,O) which cyclized via intramolecular condensation reaction in the second step.

The formated compounds [1-9] have been investigated by using various chemical techniques ,such as:(H-NMR–Spectra,(C.H.N)-analysis ,FT.IR-spectra) & Melting points .

Keyword : selenium ,Intramolecular Condensation, hetrocyclic.

الخلاصة

تم في هذا البحث , تحضير مركبات حلقية خماسية وسباعية غير متجانسة محتوية ضمن تركيبها ذرات (السلينيوم, الكبريت , النتروجين , الاوكسجين) بعدة خطوات,تضمنت الخطوة الأولى تفاعل المركب 2,2-مثيلين-ثنائي(5-نايترو فينول) مع مركبات(سلينيوم,كبريت,أوكسجين,نايتروجين) ليعطي مشتقات حلقية ل-(Se,S,O,N) والتي تتحولق عن طريق تفاعل التكاثف الضمني للجزيئة في الخطوة الثانية للتفاعل .المركبات المحضرة [1-9] شخصت باستخدام تقنيات متنوعة منها (التحليل الكمي الدقيق للعناصر , طيف الرنين النووي المغناطيسي , طيف الأشعه تحت الحمراء) و درجات الإنصهار .

كلمات مفتاحية:السلينيوم ,التكاثف الضمني ,حلقية غير متجانسة

Introduction

About one century ago selenium was incorporated in the table, selenium shares with sulphur and tellurium some phesical and chemical properties.Selenium ,sulphur and nitrogen-compounds act as active nucleophiles which able to react with electrophiles(alkyl halides ,carbonyl compounds such as aldehydes, carboxylic acids) to yield intermediats ,which give variouse heterocyclic compounds from(Se,S,N,O) ,this compounds have biological activity[1,2].

Heterocycles are found as construction units through several biological molecules ,since these compounds have (Selenium , sulphur, nitrogen, oxygen) , atoms in their contents which make it has many pharmaceutical interest [3,4] ,dyestuffs industry[5] ,& other applications such as anticancer[6,7] ,antioxidant[8,9] ,physiology importance[10,11] , in synthesis of organic compounds[12] ,in toxicological studies[13-18] for this reasons many methods [19-20] for preparation of different heterocyclic compounds have been developed .

Experimental

*All chemicals used where supplied from Merck & BDH-chemical company.

*All measurement where carried out by :

- Melting points :Electro thermal 9300 , melting point Engineering LTD ,U.K.

- FT.IR-spectra: fourrier transform infrared shimadzu (8300) , (FT.IR) , KBr-disc was performed by CO.S.Q. Iraq .

- H.NMR-Spectra &(C.H.N)-Analysis:in centre lab-Institute of earth & environmental science,Al-Bayt University ,Jordan .

Synthesis of Compound [1]:

Amixture of (0.02 mole , 2.7 g) of 4-nitrophenol with formaldehyde(0.01 mole) were reacted in presence of (4ml) of sulphuric acid (98%) & (50ml) distilled water, the precipitate formed ,filtered off to give(3.4g) 82% of compound[1] .

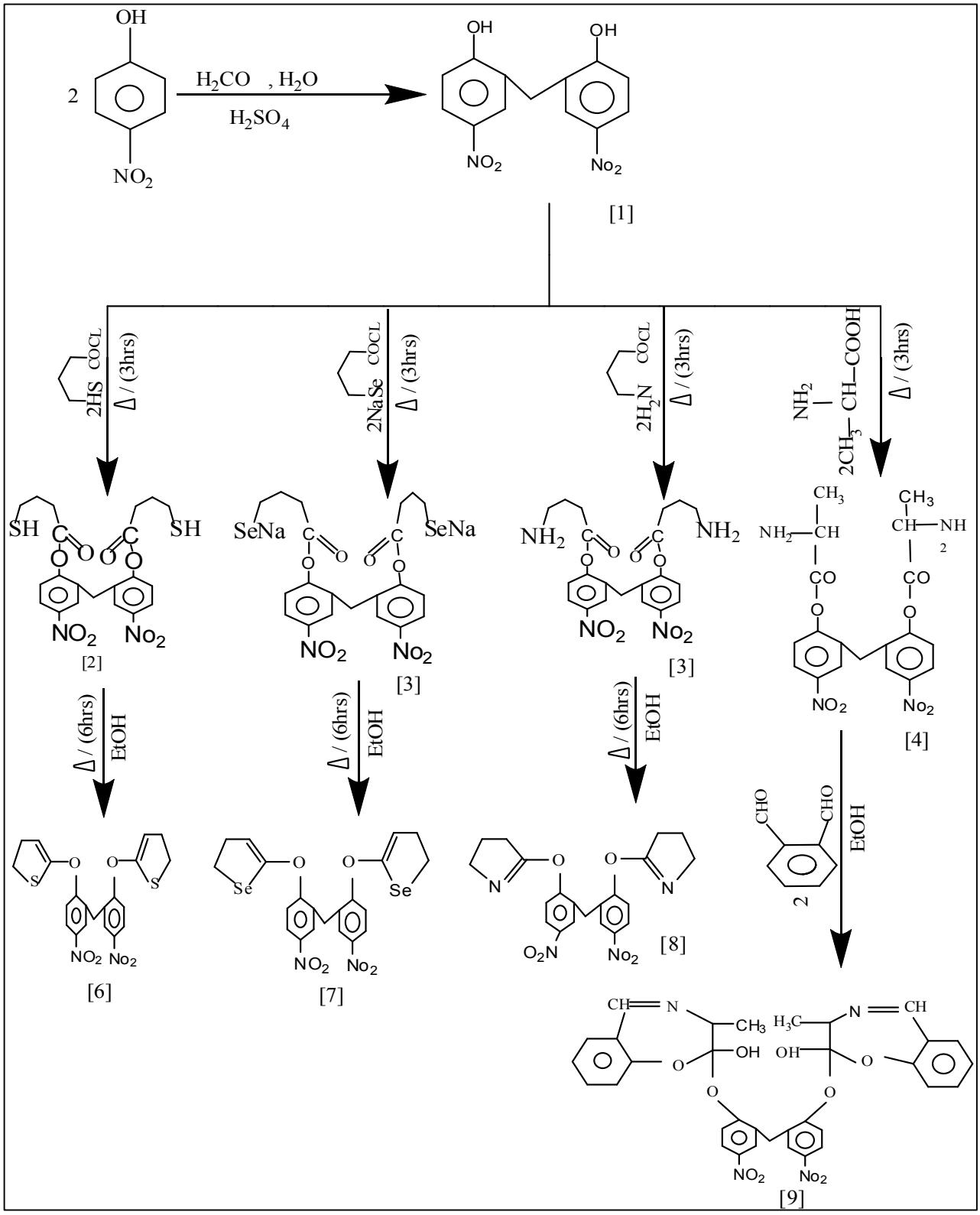
Synthesis of compounds [2-5]:

Amixture of compound[1] (0.01mole ,2.9g) and(0.02mole) of mercaptobutoyl chloride or sodium selenobutoyl chloride or aminobutoyl chloride or alanine) respectively were heated for (3 hrs) in presence of ethanol , the precipitate was filtered off & recrystallized to give (80-84)% of compounds[2-5] respectively .

Synthesis of compounds [6-9]:

Amixture of salicyldehyde (0.02mole) and (0.01mole) of compound [1] or compound[2] or compound[3] or compound[4] or compound[5]respectively were heated under reflux for six hours in presence of ethanol ,the precipitate as filtered off & recrystallized from abs.ethanol to give(82-87)% of compounds [6-9]respectively.

Reaction Scheme :



Results and Discussion

Most of the reactions employed in this work are intramolecular condensation reactions which involve several steps to give finally products of compounds [6-9].

Indeed ,seleno compounds is stronger nuleophile than sulphur compounds.

All synthesized compounds [1-9] have been characterized by their melting points and spectroscopic methods(FT.IR- spectra, (C.H.N)-analysis H.NMR-spectra).

FT.IR-Spectra:

In FT.IR spectra ,the reaction is followed by appearance of hydroxyl group (-OH) absorption band of phenol at (3500)cm^{-1} in compound [1] ,while this band disappears & other band appears at (1705-1690)cm^{-1} due to carbonyl group of ester ($-\overset{O}{\overset{\|}{C}}-O-$) in compounds [2-5] ,which also disappear so that another band appear at (1230-1271)cm^{-1} due to (C-O-C) of ether in compound [6-9], other data of functional groups shown in the following table (1).

H^1.NMR- Spectrum :

Appearance of peaks and disappearance of other peaks is evidence of formatted compounds such as disappearance of (O-H)band in compound[1] and appearance other peak(O-CO-)band of ester due to formation of compounds[2-5].

H^1.NMR- Spectrum of compounds [1-9] showed : singlet signal at £(s, 10.7)ppm for proton of hydroxyl group (-OH) ,of phenol in compound [1] , while this signal disappears &other signals appear :

- Signals at £(m,3.9),(t,3.4)ppm for protons of ($-CH_2CH_2CH_2-S$) & signal at £ (s,4.25)ppm for proton of (SH) in compound[2].

-Signals at £ (m,4.2) ,(t,3.95)ppm for proton($-CH_2CH_2CH_2-Se$)in compound [3] .

- Signals at £ (m,3.5),(t,3.2)ppm for protons of ($-CH_2CH_2CH_2-N$) & signal at £ (3.85) for protons of ($-CH-NH_2$) in compound [4] .

- Signal at £ (d,3.80),(m,3.40)ppm for protons of ($-CH-CH_3$) & signal at £(3.98) for protons of ($-CH-NH_2$) in compound [5] .

- Signal at £ (t ,4.5),(t ,3.98)ppm for protons of ($\overset{CH_2-CH}{\underset{CH_2-S}{|}}$) endocyclic in compound [6].

- Signal at £ (t,4.07),(t,3.72) for protons of ($\overset{CH_2-CH}{\underset{CH_2-Se}{|}}$) endocyclic in compound [7].

- Signal at £ (t,3.88),(t,2.97) for protons of ($\overset{CH_2-CH}{\underset{CH_2-Se}{|}}$) endocyclic in compound [8].

- Signal at £ (s ,8.72) for protons of (CH=N)azomethine in benzoxazepine cycle , signal at £ (s ,2.63) for protons of methyl group ($-CH_3$) in compound [9] & signal at £ (s,5.03) for proton of (C-OH) hydroxyl group in compound [9]

(C.H.N) – Analysis :

(C.H.N) – analysis , it was found from compared the calculated data with found data of these compounds , the results were compactable , the data of analysis , M.F, names and melting points are listed in table (2) .

All these results are strong evidence for synthesized compounds[1-9] .

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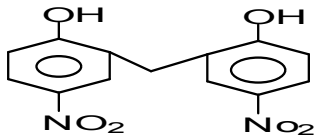
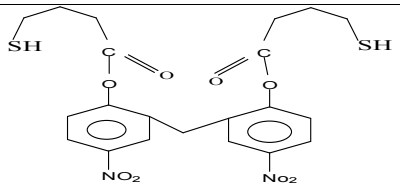
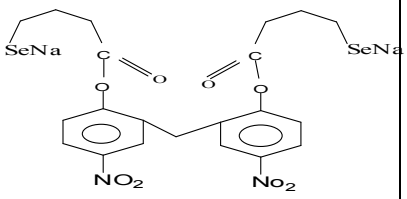
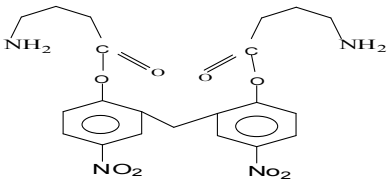
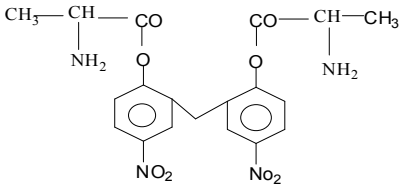
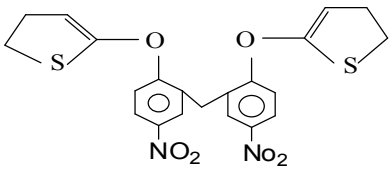
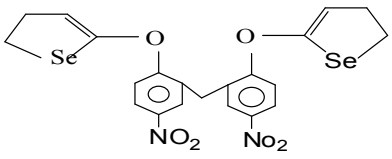
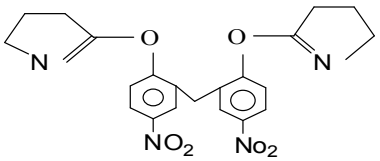
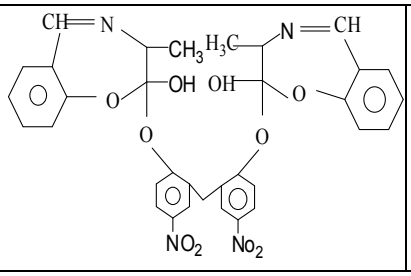
Table (1):FT.IR data (cm^{-1}) of compounds[1-9].

Comp. No.	Structural formula	(C=O) of ester	ν (C-O) , ν ($-NO_2$)	Other Bands
[1]		----	---- 1340,1530s	ν (O-H): 3500S (C=C)aromatic:1587 (CH)aliphatic:2955
[2]		1705s	----- 1445,1550	(S-H): 2460M (C=C)aromatic:1568 (CH)aliphatic:2930
[3]		1700s	---- 1370,1555s	(C-Se): 740S (C=C)aromatic:1588 (CH)aliphatic:2935
[4]		1695s	---- 1340,1560s	ν ($-NH_2$): 3320 (C=C)aromatic:1593 (CH)aliphatic:2940
[5]		1690vs	---- 1370,1554	ν ($-NH_2$): 3250b (C=C)aromatic:1596 (CH)aliphatic:2955
[6]		----	1230 1378,1535	(C-S)endocyclic: 682 (C=C)aromatic:1584 (C-O-C)ether:1160
[7]		----	1271 1325,1512	(C-Se) endocyclic: 1635 ($-NO_2$):1442S (C-O-C)ether:1144
[8]		----	1234 1373,1533	(C-N)endocycic: 1460,1569 (C=C)aromatic:1590 (C-O-C)ether:1152

[9]		**----**	**1230** **1359,1537**	**ν (O-H):3425m** **(CH=N)azomethine: 1620** **(C=C)aromatic:1589** **(C-O-C)ether:1153**

S=strong, m=medium, w=weak, b=broad

Table(2): Melting points, M.F, Nams and (C.H.N)-Analysis of compounds[1-9]

Comp. No.	M.F, Name	M.P (C°)	Calc. /Found. C%	H%	N%
[1]	$C_{13}H_{10}N_2O_6$ 2,2′–methylene –bis (4-nitro phenol)	139-140	53.793 53.517	3.448 3.266	9.655 9.424
[2]	$C_{21}H_{22}N_2O_8S_2$ 2,2 –methylene–bis (4-nitro phenyl mercapto butanoate)	186-187	51.012 50.897	4.453 4.237	5.668 5.484
[3]	$C_{21}H_{20}N_2O_8Se_2Na_2$ 2,2′–methylene–bis (4-nitro phenyl sodium seleno butanoate)	173-174	39.878 39.687	3.164 3.093	4.430 4.318
[4]	$C_{21}H_{24}N_4O_8$ 2,2′ –methylene –bis (4-nitro phenyl-amino butanoate)	171-172	54.782 54.635	5.217 5.089	12.173 12.047
[5]	$C_{19}H_{20}N_4O_8$ 2,2′–methylene–bis (4-nitro phenyl -2-amino prapanoate)	197-198	52.777 52.542	4.629 4.408	12.962 12.878
[6]	$C_{21}H_{19}N_2O_6S_2$ 2,2′–methylene–bis(2-(4-nitro phenoxy)-4,5-dihydro thiophene	215-216	55.021 54.917	3.930 3.812	6.113 6.027
[7]	$C_{21}H_{18}N_2O_6Se_2$ 2,2′-methylene bis(2-(4-nitro phenoxy)-4,5-dihydro selenole).	224-226	45.658 45.469	3.261 3.197	5.073 4.955
[8]	$C_{21}H_{20}N_4O_6$ 2,2′–methylene–bis(2-(4-nitro phenoxy)-3,4,5-trihydro pyrrole)	219-220	59.433 59.317	4.716 4.575	13.207 13.119
[9]	$C_{33}H_{28}N_4O_{10}$ 2,2′-methylene–bis(2-(4-nitro phenoxy)-2-hydroxy-3-methyl-benzoxazepine)	247-248	61.875 61.693	4.375 4.227	8.75 8.608

References

1. Dhiman .A, Wadodkar . K and Patai ., ***J . Ind.Chem*** ., 2001,**40** , 636.
2. Mohan .J and Kumer.A ., ***Ind .J. Heterocyclic .Chem*** ., 2001 , **11**,71.
3. Wujec .M, Pitucha .M, Dobosz .M and Malm.A., ***Acta . Pharm*** ., 2004, **54** , 251.
4. Onkol. T, Cakir.B and Sahin .M., Turk ., ***J.Chem***., 2004, **28**,461.
5. Zhong .X, Fang .J, Gang. S and Lin .L., Chin ., ***J .Chem*** ., 2004, **22** ,11,1308.
6. Clemons .M, Coleman. R and Verma .S., ***Cancer. Treat .Rev*** ., 2004, ,**30**,325.
7. Lei .L, Leilei . Z, Gang .L and Jiaxi .X .,***Arkivoc ,*** 2008 , **(XVI)**, 318-326.
8. Kiyota .H. ,***Topics Heterocycle .Chem*** , 2006 ,**6**,181.
9. Zhanel .G ,Wiebe .R. Dilay .L, Thombson .K ,Rubinstein .E, Hoban .D, Noreddin .A and Karlowsky .J., ***Drugs*** , 2007 ,**67**,1027.
10. Cremonesi .G, Croce . P and Rosa. L ., ***Helv -Chin .Acta*** ., 2005 ,**88**,1580.
11. Sinh .G.S., ***Tetrahedron***, 2003, **59**,761.
12. Nagham.Aljamali ,Iman.H , Miad.M .,***J.Kerbala.Univ.Sci.,*** 2009, **1(7),**135-143
13. Xu.J., ***Arkivoc*** , 2009**,(IX)** ,21 .
14. Jiao . L , Liany . Y and Xu . J ., ***J . Am . Chem. Soc*** , 2006 ,**128** , 6060.
15. Nikolai . M , Artem . S , Andrey . A , Mikhail . Y and Igor . M ., ***J . Org . Chem*** ., 2007 ,**72(9)** , 3443 – 3453.
16. Joachim . P , Lars . V and Marina . B ., ***Acta . Cryst*** , 2006 ,**E62** , 3401 – 3402.
17. Xu –J , Wang . C and Zhang . Q ., ***Chin . J . Chem*** , 2004, **22** , 1012.
18. Huang . X and Xu . J . , ***Hetero at . Chem***. , 2003 ,**14** , 564
19. Katritzky. A ,Jiang . Y and Ying .H ., First Published as an Advance Article on the web 11th February (2002) .
20. Stockman . R ., ***Annu . Rep . Prog . Chem. ,*** sect . B , 2003, **99** , 161 –182.