

ORGANIC COMPOUNDS OF SELENIUM, IV

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HOMO- and HETEROCYCLIC DISELENIDES

Introduction. This paper is the fourth of a series having as its object the furthering of research work in the chemistry of organic selenium compounds. It presents a complete list of the known homo- and heterocyclic diselenides, a résumé of the methods of preparation for each compound, and a complete bibliography for each compound.

Discussion. A consideration of the body of this paper will show that it consists of three parts: general methods for the preparation of diselenides, a classified list of diselenides, and a bibliography. An examination of the methods of preparation will show that to each method is assigned a number, and that with each method are listed reference numbers which correspond to the pertinent reference in the bibliography. In this way, by a consideration of the table of methods, one can ascertain by the reference numbers something of the extent to which that method has been used and can easily obtain detailed information regarding the method by consulting these references. In the same manner, any compound in the list of diselenides will show by number the methods by which that compound has been prepared, and also by number, the references in which that compound is mentioned.

A more detailed consideration of the general methods for the preparation of diselenides will show that in many cases the first equation is not balanced, and is in fact only a listing of reagents and final products. When this is the case, the equation is ended by a plus sign to indicate that it is incomplete. Following this, frequently, will be found balanced equations which endeavor to show the probable mechanism of the reaction. Regarding these equations, it must be remembered that they are often based upon properties reported during the early work in this field, and consequently are in no sense authoritative. Additional information will possibly necessitate the revision of several of these equations. This is well illustrated by preparation method No. 9. In this case the first equation is a list of starting materials and resultant products, while the following equations are merely an effort to explain the presence of these products. Additional information regarding the properties of the compound $(HR)_2SeX_2$ would no doubt necessitate some modification in this instance.

A consideration of the chemistry of the preparation of diselenides will show that the actual preparation of the diselenide is based upon fewer reactions than the 26 listed. This can well be illustrated as follows: any one of several starting materials can be converted into

organic selenols, which can in turn be oxidized to organic diselenides. From this it can be seen that the methods of preparation listed have been classified on the basis of starting material, rather than on the basis of the reaction immediately concerned in the preparation of the diselenide. This is necessary because of the lack of definite information regarding the mechanism of these reactions.

Special notice should be called to methods No. 25 and No. 26. Method No. 25 includes all methods based on chemistry not affecting the selenium atom in the molecules concerned. Here, then, are listed cases of reduction, dehydration, ester formation, and other reactions of like nature. Method No. 26 is actually not a method of preparation, but merely a remark designed to indicate that a diselenide was prepared and reported under an erroneous name.

Nomenclature. In many cases the nomenclature used by the original authors has been modified in order to obtain a uniform system. In the case of the heterocyclic compounds, common names have been replaced by systematic names. In the homocyclic compounds, the name "*propyl-gamma-diselenido-diphthalamate*," ($2\text{-CONH}_2\text{-3-COOC}_3\text{H}_7\text{-C}_6\text{H}_5$)₂Se₂, was changed to "*di(3-propyl ester of 2-3-phthalamic acid) diselenide*". This change was considered desirable since the original name did not indicate the position of the groups and also because it was desired to name all the compounds with the selenium atom as a reference point. Other changes, which have been made for similar reasons, will be noted in the tables. The abbreviations which have been used in the tables are those recommended by Chemical Abstracts, and have been previously (7) described.

Properties. Selenium reacts readily with magnesium alkyl haloids and the complexes formed yield on treatment: (a) with dilute acids, selenophenols and diselenides; (b) with acid chlorides or anhydrides, esters of the series of selenol acids, (R-CO-SeH); and (c) with alkyl iodides, mixed selenides. The compounds formed are strictly analogous with those resulting from the action of sulphur on magnesium alkyl haloids (38).

The usual structure of diselenides is of the type (R-Se-Se-R). However a compound of the type (R₂=Se=Se) called selen-selenide because of the similarity to the selenoxide, (R₂=Se=O), has been prepared. This compound was *B-dinaphthyl-selen-selenide*, (B-(C₁₀H₇)₂=Se=Se), and is an isomer of *B-dinaphthyl diselenide*, (B-(C₁₀H₇)₂Se₂). When (B-(C₁₀H₇)₂SO₂) is heated with metallic selenium, the selen-selenide is formed (28). This has a different melting point from the diselenide and also different physical properties. The selen-selenide reacted with potassium dichromate to form (*di-B-naphthyl*) selenoxide, (B-(C₁₀H₇)₂=Se=O), while the diselenide was unaffected under the same conditions. The selen-selenide reacted with a reducing agent to form *B-dinaphthyl selenide*, (B-(C₁₀H₇)₂Se), while the diselenide reduced to *B-naphthyl-selenol*, (B-(C₁₀H₇)SeH).

Moderate heating of diselenides causes one atom of selenium to drop out of the compound resulting in the formation of the corresponding selenide. The properties of selenides have been previously reported (7).

Intense heating of some diselenides, such as *di-(2-4-dinitrophenyl)-diselenide*, $(2-4-(\text{NO}_2)_2=\text{C}_6\text{H}_3)_2\text{Se}_2$, results in detonation.

Several diselenides have been oxidized by nitric acid and the product formed was the corresponding seleninic acid (29-31-33-34). Concentrated nitric acid apparently does not cause the formation of hexavalent selenium. An alkaline solution of potassium permanganate also gives rise to the seleninic acid (31). An alkaline solution of potassium permanganate has been used with success in the oxidation of diselenides (24-25) to the corresponding selenonic acids. Thirty per cent hydrogen peroxide in glacial acetic acid (30) and also moist chlorine (36) have been used to oxidize diselenides to selenonic acids, $(\text{R}-\text{SeO}_3\text{H})$.

Several diselenides also have been reduced. The product formed is in each case the corresponding selenol. Zinc dust with HCl (1) and zinc dust with acetic acid (5) were used.

Diphenyl diselenide and *di(1-phenyl-3-methyl-4-benzoyl-pyrro-(a)-monazoly-5) diselenide* form the tetrabromide upon the addition of bromine in chloroform solution (30).

It is interesting to note that the color of every diselenide mentioned in the literature was yellow. Diselenides are purified in most cases by crystallization from either alcohol or ether.

THE PREPARATION OF HOMO- AND HETEROCYCLIC DISELENIDES

GENERAL METHODS

(R = homocyclic)

<i>Method No.</i>	<i>Equations</i>	<i>Ref. Nos.</i>
1.	$\text{Se} + \text{R}_2\text{Se} + \text{heat} = \text{R}_2\text{Se}_2.$	26, 20
2.	$\text{Se} + \text{RMgX} + \text{Et}_2\text{O}; + \text{H}_2\text{O} + \text{HCl} = \text{R}_2\text{Se} +$ $\text{R}_2\text{Se}_2 + \text{RSeH} +$ $\text{Se} + \text{RMgX} = \text{RSeMgX}; + \text{HCl} = \text{RSeH} + \text{MgXCl}.$ $2\text{Se} + 2\text{RMgX} = \text{R}_2\text{Se} + \text{Se}(\text{MgX})_2.$ $3\text{Se} + 2\text{RMgX} = \text{R}_2\text{Se}_2 + \text{Se}(\text{MgX})_2.$ $(\text{X} = \text{Br})$	4, 38, 39
3.	$\text{Se} + \text{M}_2\text{Se} + \text{RX} + \text{heat} = \text{R}_2\text{Se}_2 + \text{MX} +$ $\text{M}_2\text{Se} + 2\text{RX} = \text{R}_2\text{Se} + 2\text{MX}.$ $\text{R}_2\text{Se} + \text{Se} + \text{heat} = \text{R}_2\text{Se}_2.$ $(\text{M} = \text{Na}; \text{X} = \text{Cl};)$	2, 5, 6
4.	$\text{Se} + \text{R}_2\text{SO}_2 = \text{R}_2\text{Se}_2 +$ $\text{R}_2\text{SO}_2 + 2\text{Se} = \text{R}_2\text{Se}_2 + \text{SO}_2.$	20, 28
5.	$\text{Se}_2\text{X}_2 + \text{RH} = \text{R}_2\text{Se} + \text{R}_2\text{Se}_2 +$ $\text{Se}_2\text{X}_2 + 2\text{RH} = \text{R}_2\text{Se}_2 + 2\text{HX}.$ $(\text{R} = \text{heterocyclic})$	18
6.	$\text{Se}_2\text{X}_2 + \text{RMgX}' = \text{R}_2\text{Se} + \text{R}_2\text{Se}_2 +$ $\text{Se}_2\text{X}_2 + 2\text{RMgX}' = \text{R}_2\text{Se}_2 + 2\text{MgXX}'.$ $(\text{X} = \text{Cl}, \text{Br}; \text{X}' = \text{Br};)$	32, 37
7.	$\text{Se}_2\text{X}_2 + \text{RH} + \text{Al}_2\text{X}_6' + \text{CS}_2 = \text{R}_2\text{Se} + \text{R}_2\text{Se}_2 + \text{RX} +$ $\text{Se}_2\text{X}_2 + 2\text{RH} + (\text{Al}_2\text{X}_6') = \text{R}_2\text{Se}_2 + 2\text{HX}.$ $\text{Se}_2\text{X}_2 + \text{RH} + (\text{Al}_2\text{X}_6') = \text{RX} + \text{HX} + 2\text{Se}.$ $\text{R}_2\text{Se}_2 + \text{heat} = \text{R}_2\text{Se} + \text{Se}.$ $(\text{X} = \text{Br}; \text{X}' = \text{Br};)$	27
8.	$\text{SeX}_4 + \text{RH} + (\text{Al}_2\text{X}_6) = \text{R}_2\text{Se}_2 + \text{R}_2\text{SeX}_2 + \text{HX} + \text{RX} +$ $(\text{X} = \text{Cl})$	3, 8, 19
9.	$\text{SeO}_2 + \text{H}_2\text{R} + (\text{Al}_2\text{X}_6) + \text{heat} = (\text{HR})_2\text{Se}_2 + (\text{HR})_2\text{Se} +$ $(\text{HR})_2\text{SeX}_2 + (\text{XR})_2\text{Se} + \text{HX} +$ $\text{SeO}_2 + 2\text{H}_2\text{R} + (\text{Al}_2\text{X}_6) = (\text{HR})_2\text{SeO} + \text{H}_2\text{O}.$ $(\text{HR})_2\text{SeO} + 2\text{HX} + (\text{Al}_2\text{X}_6) = (\text{HR})_2\text{SeX}_2 + \text{H}_2\text{O}.$ $2\text{H}_2\text{O} + \text{Al}_2\text{X}_6 = 2\text{Al}(\text{OH})\text{X}_2 + 2\text{HX}.$ $2(\text{HR})_2\text{SeX}_2 + \text{heat} = (\text{HR})_2\text{Se} + (\text{XR})_2\text{Se} + 2\text{XH}.$ $(\text{HR})_2\text{Se} + \text{Se} + \text{heat} = (\text{HR})_2\text{Se}_2.$ $(\text{X} = \text{Cl};)$	29
10.	$\text{K}_2\text{Se}_2\text{O}_3 + 2\text{RX} = \text{R}_2\text{Se}_2 + 2\text{KX} +$ $(\text{X} = \text{Br}, \text{Cl};)$	40
11.	$\text{M}_2\text{Se} + \text{RNXX} = \text{R}_2\text{Se} + \text{R}_2\text{Se}_2 + \text{MX} + \text{N}_2 +$ $\text{M}_2\text{Se} + 2\text{RNXX} + \text{HX} + \text{heat} = \text{R}_2\text{Se} + 2\text{MX} + 2\text{N}_2.$ $\text{M}_2\text{Se}_2 + 2\text{RNXX} = \text{R}_2\text{Se}_2 + 2\text{N}_2 + 2\text{MX}.$ $(\text{M} = \text{H}, \text{Na}, \text{K}; \text{X} = \text{Cl};)$ $(\text{M}_2\text{Se}_2 \text{ is a common impurity in } \text{M}_2\text{Se}.)$	24, 25

<i>Method No.</i>	<i>Equations</i>	<i>Ref. Nos.</i>
12.	$MSeCN + M'OH + RNNX = RSeCN + MX + N_2 +$ $R_2Se + R_2Se_2 +$ $MSeCN + RNNX = RSeCN + MX + N_2.$ $RSeCN + M'OH = RSeH + M'OCN.$ $2RSeH + O = R_2Se_2 + H_2O.$ $2RSeCN = R_2Se + Se + (CN)_2.$ (O = CCl_3NO_2 , H_2O_2 , Br water, or by electrolysis in alkaline solution)	1, 9, 10 13, 15 16, 17 22, 23 31
13.	$MSeCN + RNNX + HX' = RSeCN + MX + N_2 + R_2Se_2 +$ $MSeCN + RNNX = RSeCN + MX + N_2.$ $RSeCN + H_2O + (HX') = RSeH + HOCN.$ $2RSeH + O = R_2Se_2 + H_2O.$ (M = K; X = Cl; X' = NO_3 ; O = air, HX')	9, 10 23
14.	$MSeCN + XRCOONa + Cu + H_2O = MX + HOCN +$ $MCN + Cu_2Se + (RCOONa)_2Se_2 +$ $XRCOONa + (Cu) + MSeCN = NaOOCRSeCN + MX.$ $NaOOCRSeCN + H_2O = NaOOCRSeH + HOCN.$ $2NaOOCRSeH + O = (NaOOCR)_2Se_2 + H_2O.$ $2Cu + MSeCN = Cu_2Se + MCN.$ (M = K; X = Br; O = air;)	35
15.	$2RSeH + O = R_2Se_2 + H_2O.$ (O = air, H_2O_2 ;)	1, 3, 14 17, 28, 30 38, 39
16.	$R_2SO_2 + Se = R_2Se_2 + SO_2 +$ $R_2SO_2 + Se = R_2Se + SO_2.$ $R_2Se + Se = R_2Se_2.$	7, 21
17.	$2RSeOOH + 3H_2 = R_2Se_2 + 4H_2O.$ (H = $NaHSO_3$;)	34
18.	$H_2N-R-SeH + HCOOH; + R'X; + MOH = (R'HN-RSe-)_2 +$ $\underbrace{N-R-Se-CH} + \underbrace{R'XN-R-Se-CH} + R'HN-R-SeH +$ $H_2N-R-SeH + HCOOH = \underbrace{N-R-Se-CH} + 2H_2O;$ $+ R'X = \underbrace{R'XN-R-Se-CH}; + H_2O + MOH = MX +$ $HCOOH + R'HN-R-SeH; + O = (R'HN-RSe-)_2 + H_2O.$ (R = C_6H_4 ; R' = CH_3 ; X = I; M = NH_4 ; O = air;)	12
19.	$H_2N-R-SeH + R'COOH; + R''X; + MOH = (R'-CO-NR''-RSe-)_2$ $+ \underbrace{N-R-Se-CR'} + \underbrace{R''XN-R-Se-CR'} + HSeR-NR''-CO-R' +$ $H_2N-R-SeH + R'COOH = \underbrace{N-R-Se-CR'} + 2H_2O; +$ $R''X = \underbrace{R''XN-R-Se-CR}; + MOH = HSeR-NR''-CO-R' +$ $MX; + O = (R'-CO-NR''-RSe-)_2 + H_2O.$ (R = C_6H_4 ; R' = H, C_6H_5 , CH_3 ; R'' = CH_3 ; M = Na, H; X = I; O = $K_3Fe(CN)_6$, I;)	12

- | <i>Method No.</i> | <i>Equations</i> | <i>Ref. Nos.</i> |
|-------------------|--|------------------------|
| 20. | $\begin{aligned} & \text{H}_2\text{N-R-SeH} + (\text{CH}_3\text{CO})_2\text{O}; + \text{R}'\text{X}; + \text{MOH} = \\ & (\text{CH}_3\text{-CO-NR'-R-Se-})_2 + \text{N-R-Se-CCH}_3 + \text{CH}_3\text{CHO} + \\ & \text{R}'\text{XN-R-Se-CCH}_3 + \text{HSe-R-NR'-CO-CH}_3 + \\ & \text{H}_2\text{N-R-SeH} + (\text{CH}_3\text{CO})_2\text{O} = \text{N-R-Se-C-CH}_3 + \\ & \text{CH}_3\text{CHO} + \text{H}_2\text{O}; + \text{R}'\text{X} = \text{R}'\text{XN-R-Se-C-CH}_3; + \text{MOH} = \\ & \text{MX} + \text{HSe-R-NR'-CO-CH}_3; + \text{O} = (\text{CH}_3\text{-CO-NR'-R-Se-})_2 + \text{H}_2\text{O}. \\ & (\text{R} = \text{C}_6\text{H}_4; \text{R}' = \text{CH}_3; \text{M} = \text{Na}; \text{X} = \text{I}; \text{O} = \text{air};) \end{aligned}$ | 11 |
| 21. | $\begin{aligned} & \text{Se-R-CO-CO} + \text{MOH}; + \text{HX} = (\text{HOOC-CO-R-Se-})_2 + \\ & \text{HSe-R-CO-COOM} + \\ & \text{Se-R-CO-CO} + \text{MOH} = \text{HSe-R-CO-COOM}. \\ & \text{HSe-R-CO-COOM} + \text{O} = (\text{MOOC-CO-R-Se-})_2 + \text{H}_2\text{O}. \\ & (\text{MOOC-CO-R-Se-})_2 + 2\text{HX} = (\text{HOOC-CO-R-Se-})_2 + 2\text{MX}. \\ & (\text{R} = \text{C}_6\text{H}_4; \text{M} = \text{Na}, \text{CH}_3, \text{C}_2\text{H}_5; \text{X} = \text{Cl}; \\ & \text{O} = \text{air}; \text{when M} = \text{alkyl, the final step was omitted.}) \end{aligned}$ | 23 |
| 22. | $\begin{aligned} & \text{Se-R-COH=CH} + \text{HNO}_2; + (\text{NaOH}) + \text{H}_2\text{O} = \\ & (\text{COOH-R-Se-})_2 + \text{HOCN} + \text{Se-R-CO-C=N-OH} + \\ & \text{HOOC-R-SeH} + \\ & \text{Se-R-COH=CH} + \text{O=N-OH} = \\ & \text{Se-R-CO-C=N-OH} + \text{H}_2\text{O}; + \text{H}_2\text{O} + (\text{NaOH}) = \\ & \text{HOOC-R-SeH} + \text{HOCN}; + \text{O} = (\text{COOH-R-Se-})_2 + \text{H}_2\text{O}. \\ & (\text{O} = \text{air}) \end{aligned}$ | 23 |
| 23. | $\begin{aligned} & \text{R-CO-CO-Se} + \text{R}'(\text{NH}_2)_2 = (\text{COH=N-R'-N=C-R-Se-})_2 + \\ & \text{COH=N-R'-N=C-R-SeH} + \\ & \text{R-CO-CO-Se} + \text{R}'(\text{NH}_2)_2 = \text{COH=N-R'-N=C-R-SeH} + \text{H}_2\text{O}. \\ & 2\text{COH=N-R'-N=C-R-SeH} + \text{O} = (\text{COH=N-R'-N=C-R-Se-})_2 \\ & + \text{H}_2\text{O}. \\ & (\text{R}' = o\text{-substituted benzene or 1-2} \\ & \text{substituted naphthalene; O} = \text{air};) \end{aligned}$ | 23 |
| 24. | $\begin{aligned} & \text{RN-CH}_3\text{N-CH}_3\text{C=C(N(CH}_3)_2\text{)-C=Se} + \text{I}_2 = \\ & (\text{RN-CH}_3\text{IN=CH}_3\text{C-C(N(CH}_3)_2\text{)=C-SeC-})_2. \end{aligned}$ | 30 |
| 25. | All methods not affecting the selenium atom. | 17, 23
24, 25
33 |
| 26. | Methods of preparing diselenides which are erroneously reported in the literature as other compounds. | 8 |

LIST OF HOMO- AND HETEROCYCLIC DISELENIDES

<i>Disele- nides</i>	<i>Formulas</i>	<i>M.P., °C</i>	<i>Methods of Prep.</i>	<i>Ref. Nos.</i>
Diphenyl-	(C ₆ H ₅) ₂ Se ₂	62	1, 2, 7	8, 9
		62.5	6, 8, 9	17, 20
		60	12, 15	21, 19
		63	16	26, 29
		62.5	27, 32	38, 39
		65	37	
Di-4-bromophenyl-	(4-Br-C ₆ H ₄) ₂ Se ₂	107-108	12	3, 9
		106-107	15	10, 38
Di-4-chlorophenyl-	(4-Cl-C ₆ H ₄) ₂ Se ₂	85-86	12, 13	9, 10
		85-87	15	31, 38
		89		
Di-4-hydroxyphenyl-	(4-OH-C ₆ H ₄) ₂ Se ₂	134	12	17
Di-2-nitrophenyl-	(2-NO ₂ -C ₆ H ₄) ₂ Se ₂	206		
		209	3, 12	1, 5
			15	6, 14
Di-3-nitrophenyl-	(3-NO ₂ -C ₆ H ₄) ₂ Se ₂	83	17	33, 34
Di-4-nitrophenyl-	(4-NO ₂ -C ₆ H ₄) ₂ Se ₂	..	15	14
Di-4-acetoxyphe- nyl-	(4-CH ₃ OC-C ₆ H ₄) ₂ Se ₂	90.5	12	17
Di-2-carboxyphenyl-	(2-HOOC-C ₆ H ₄) ₂ Se ₂	296-297	11, 14	23, 24
		294-295	22	25, 35
Di-4-carboxyphenyl-	(4-HOOC-C ₆ H ₄) ₂ Se ₂	314-315	11	16, 25
		297	12	
Di-methyl ester of di-2-carboxyphenyl-	(2-CH ₃ OOC-C ₆ H ₄) ₂ Se ₂	M-2HCl-ide = 74-75	12	22, 25
			25	

<i>Diselenides</i>	<i>Formulas</i>	<i>M. P., °C</i>	<i>Methods Ref. of Prep. Nos.</i>
Di-ethyl ester of di-2-carboxyphenyl-	$(2-C_2H_5OOC-C_6H_4)_2Se_2$	129-130	25 25
Di-amide of di-2-carboxyphenyl-	$(2-H_2NOC-C_6H_4)_2Se_2$	265-266	25 24
Di-4-ethoxyphenyl-	$(4-C_2H_5O-C_6H_4)_2Se_2$	65	2, 15 4, 38
Di-4-tolyl-	$(4-CH_3-C_6H_4)_2Se_2$	47	12, 15 9, 38
Di-2-aminophenyl-	$(2-H_2N-C_6H_4)_2Se_2$	81	15 1
Di-3-aminophenyl-	$(3-H_2N-C_6H_4)_2Se_2$	M-2HCl-ide = 291-292	6 32, 33 25
Di-3-acetylaminophenyl-	$(3-CH_3CONH-C_6H_4)_2Se_2$	185-6	25 33
Di-2-methylaminophenyl-	$(2-CH_3NH-C_6H_4)_2Se_2$	89	18 12
Di-2-formylaminophenyl-	$(2-CHONH-C_6H_4)_2Se_2$	174	19 12
Di-2-formylmethylaminophenyl-	$(2-CHONCH_3-C_6H_4)_2Se_2$	104	19 12
Di-2-benzoylmethylaminophenyl-	$(2-C_6H_5CONCH_3-C_6H_4)_2Se_2$	170	19 12
Di-2-acetylmethylaminophenyl-	$(2-CH_3CONCH_3-C_6H_4)_2Se_2$	141	20 11
Di-acid chloride of di-2-carboxyphenyl-	$(2-ClOC-C_6H_4)_2Se_2$	173-174	25 25
Di-2-carboxyphenyl-chloride of di-2-carboxyphenyl-	$(2-ClOC-C_6H_4)_2Se_2 \cdot 2HCl$	65-66	25 22, 25
Di-2-(glyoxalic acid) phenyl-	$(2-HOOC-CO-C_6H_4)_2Se_2$	...	21 23
Di-methyl ester of "-	$(2-CH_3OOC-CO-C_6H_4)_2Se_2$	157-8	21 23
Di-ethyl ester of "-	$(2-C_2H_5OOC-CO-C_6H_4)_2Se_2$	125-6	21 23
Di-propyl ester of "-	$(2-C_3H_7OOC-CO-C_6H_4)_2Se_2$	111-2	21 23

Di-phenyl hydrazone of di-methyl ester of di-2-(glyoxalic acid) phenyl-	$(2\text{-CH}_3\text{OOC-C-C}_6\text{H}_4)_2\text{Se}_2$	72-3	25	23
Di-2-(4-dinitrophenyl)-	$\text{N-NH-C}_6\text{H}_5$			
Di-2-nitro-4-chloro-phenyl-	$(2\text{-4-(NO}_2)_2\text{-C}_6\text{H}_3)_2\text{Se}_2$	264-5	10, 12	15, 19
Di-2-nitro-4-tolyl-	$(2\text{-NO}_2\text{-4-Cl-C}_6\text{H}_3)_2\text{Se}_2$	127	13	10
Di-3-nitro-4-tolyl-	$(2\text{-NO}_2\text{-4-CH}_3\text{-C}_6\text{H}_3)_2\text{Se}_2$	69	13	10
Di-3-hydroxy-6-methylphenyl-	$(3\text{-NO}_2\text{-4-CH}_3\text{-C}_6\text{H}_3)_2\text{Se}_2$	150	13	10
Di-(3-propyl ester of 2-3-phthalamic acid)-	$(3\text{-OH-6-C}_6\text{H}_3)_2\text{Se}_2$	47	2	39
Di-(2-ethyl ester of 3-2-phthalamic acid)-	$(2\text{-CONH}_2\text{-3-COOC}_3\text{H}_7\text{-C}_6\text{H}_3)_2\text{Se}_2$	84	12	13
Di-2-naphthyl-	$(2\text{-COOC}_2\text{H}_5\text{-3-CONH}_2\text{-C}_6\text{H}_3)_2\text{Se}_2$	118-9	12	13
Di-(2-hydroxy-3-o-Quinoxaly) phenyl-	$(1\text{-C}_{10}\text{H}_7)_2\text{Se}_2$	87-8	2	38
Di-(2-hydroxy-3-o-naphthoquinoxaly) phenyl-	$(2\text{-C}_{10}\text{H}_7)_2\text{Se}_2$	126-7	12	28
Di-(2-hydroxy-3-o-naphthoquinoxaly) phenyl-	$(\text{HOC}=\text{N-C}_6\text{H}_4\text{-N}=\text{C-C}_6\text{H}_4\text{-Se-})_2$	320-5	23	23
Di- <i>alpha</i> -anthraquinone	$(\text{HOC}=\text{N-C}_{10}\text{H}_6\text{-N}=\text{C-C}_6\text{H}_4\text{-Se-})_2$	352-5	23	23
Di-(1-phenyl-2-methiodo-3-methyl-4-dimethylamino-pyrro-(a)-monazoly)l-5-)-	$\text{A}(\text{C}_{14}\text{H}_7\text{O}_2)_2\text{Se}_2$	..	3	2
Di-(1-phenyl-3-methyl-4-benzoyl-pyrro-(a)-monazoly)l-5-)-	$(\text{CH}_3\text{-C}=\text{CH}_3\text{IN-C}_6\text{H}_5\text{-N-C}=\text{C-N}(\text{CH}_3)_2)_2$	190	24	30
Di-(1-phenyl-2-3-dimethyl-pyrro-(a)-monazolonyl-4-)-	$(\text{CH}_3\text{C}=\text{N-C}_6\text{H}_5\text{-N-C}=\text{C-COC}_6\text{H}_5)_2$	141	15	30
	$(\text{CH}_3\text{C-CH}_3\text{-N-C}_6\text{H}_5\text{-N-CO-C-Se-})_2$	215-6	5	18

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