

PAPERS FROM THE PROGRAM OF THE CHEMISTRY SECTION

ORGANIC COMPOUNDS OF SELENIUM VI¹

W. E. BRADT, The State College of Washington
Pullman, Washington

SELENIUM COMPOUNDS

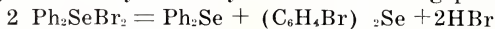
Introduction. In this paper, as in the preceding members of the series, will be found a complete list of the selenium compounds found in the literature, classified according to their general structure, i.e., $RSeX_3$, R_2SeX_2 , etc. The abbreviations used are those commonly used by the American Chemical Society publications. A complete bibliography and a list of the general methods of preparation are tabulated for each compound.

Properties. The following types of selenium compounds were found in the literature: (1) monoalkyl, (2) monoaryl, (3) dialkyl, (4) diaryl, (5) trialkyl, (6) triaryl, (7) tetra-alkyl, (8) alkyl-aryl, (9) alkyl-hetero, (10) dihetero, (11) di-selenium, $R = SeX_2SeX_2 - R$, (12) cyclic selenium, and (13) hexavalent (?) selenium.

The selenium compounds usually contain ionizable inorganic groups. The most outstanding properties are based upon this fact. For example, the inorganic groups are easily replaced by other inorganic groups. Several examples are known in which the selenium monohydroxide exhibits the properties of a strong base. The trihydroxy selenium compounds tend to lose water with the resulting formation of a seleninic acid. This may form an addition product with an inorganic acid (either HCl or HNO_3) to give a mixed inorganic radical ($MeSe(OH)_2Cl$).

Selenium trihydroxides may be reduced by zinc and acid to form selenols. Normally, dihalogen selenium compounds, when treated with alkalis, form the corresponding dihydroxide or the selenoxide. However, naphthalene derivatives when so treated form selenides.

Diaryl selenium dihalides are decomposed by heat to form the selenide and a halogenated selenide with the halogen substituted in the ring. This may occur by the two following parallel reactions:



Dihydroxyselenium compounds are easily dehydrated to form the corresponding selenoxide or reduced to the selenide. Trialkyl selenium halides frequently form crystalline addition compounds with $PtCl_4$ and

¹This paper is the sixth in a series which will ultimately present a classification of the prepared selenium organic compounds, with a resume of the chemistry and literature pertaining to them.

ZnCl_2 (Me_3SeCl \cdot 2PtCl_4). Triaryl selenonium halides are decomposed by heat to form the selenide and an aryl halide.



Numerous examples of tetra-alkyl selenonium compounds were reported but no examples were found of tetra-aryl selenonium compounds.

Although a few compounds are reported as possessing hexavalent selenium, the author is inclined to consider them as "poly halides," without assigning the last two valency bonds to the selenium atom. If this assumption is correct, these formulae should be written $\text{R}_2\text{SeX}_2\cdot\text{X}_2$ instead of R_2SeX_4 .

PREPARATION OF SELENONIUM COMPOUNDS

GENERAL METHODS

Method
No.

Equations

2. Reported but now considered not to have been prepared.
3. Probably prepared but not reported as such in the references.
4. All methods not affecting the selenium atom.
5. $R-SeOOH + HX = RSe(OH)_2X$. (R = Aryl, alkyl; X = Cl, Br, I, NO₃, OH)
6. $RSe(OH)_2X + HY = RSeY_2 + HX$. (X = NO₃; Y = Br, I. R = Alkyl).
7. $RSe-SeR + 3X_2 = 2RX_3$. (X = Br; R = Alkyl).
8. $R_2Se(OH)X + MY = R_2SeY_2 + HX + HOH$.
(X = NO₃; Y = Cl, I, Br; R = Alkyl, aryl; M = K, H)
9. $RSe(OH)_2X + HY = RSeOOH$. HY + HX. (X = Cl, NO₃; Y = Br, I; R = Alkyl)
10. $R_2Se + O_2 + HX = R_2Se(OH)X$.
(O = HNO₃, KMnO₄). (X = NO₃; R = Alkyl.)
11. $R_2SeX_2 + 2MY = R_2SeY_2 + 2MX$.
(X = Cl, OH, Br; Y = SO₄, Br, Cl, I, OH; M = Na, NH₄, Ag, H, K; R = Alkyl, aryl.)
12. $RMgX + SeX_2 = R_2SeX_2$. (X = Cl, Br; R = Alkyl)
13. $RMgX + SeX_2 = R_2SeX_2$. (X = Cl; R = Alkyl)
14. $R_2Se + X_2 + (non\ aq.\ solvent) = R_2SeX_2$.
(X = Cl, Br, I, OH; R = Alkyl, aryl, hetero.)
15. $R_2Se_2 + 3X_2 + (non\ aq.\ solvent)_2 = RSeX_2 + Se_2X_2$.
(R = alkyl; X = Cl, Br.)
16. $2RSeOOH + PX_2 = R_2SeX_2 +$. (X = Cl; R = alkyl)
18. $2R:R + 2Se_2X_2 = (XR-R')_2SeX_2 + 3Se$.
(R:R = Ethylenic hydrocarbon; X = Cl)
19. $2R:R + 2SeO_2 = (XR-R')_2SeX_2 + SeO_2$.
(X = Cl; R:R' = ethylenic hydrocarbon.)

Ref. Nos.

- 32, 31, 24, 14, 68,
22, 61 $\frac{1}{2}$, 72, 61,
74 $\frac{1}{2}$, 61, 13, 14,
53, 72, 21.
45, 11, 53, 49, 54,
5, 19, 35, 30.
80, 2, 71, 74 $\frac{1}{2}$,
76, 18.
74 $\frac{1}{2}$.
18.
31, 32, 33, 71, 15,
37 $\frac{1}{2}$, 42, 22.
80, 2.
31, 32, 22, 37, 45,
81, 39, 25.
31, 33, 7, 26,
40, 1, 18.
77.
77, 24, 7, 41, 39,
37, 22, 14, 18, 78,
66, 25, 81, 46, 48,
49, 50, 61.
77.
44.
6, 8 $\frac{1}{2}$.
23.

20. $R:R+2SeX_4=(XR-R)_2SeX_3+$
(X = Cl, Br; R:R = ethylenic hydrocarbon)
21. $R_2NHCl(=Se)NH_2+R'X=RNH(NH_2)C(=Se(X)R)$
X = I; R = aliphatic; R' = aliphatic.
22. $2RH+SeX_4=R_2SeX_2+2HX$
(X = Cl; RH = ketone, alkyl, aryl, hetero)
23. $2RH+SeO_3+2HX=R_2SeX_2+2H_2O$
(X = Cl; RH = ketone, ether)
24. $2RH+SeOX_2=R_2SeX_2+H_2O+R_2SeX+$
(X = Cl; RH = ketone, phenol, ether).
26. $R_2SeX+MY=R_2SeY+MX$
(X = I, NO₃, OH, Br, Cl, O; Y = OH, Cl, I, Br, C₂O₄, NO₃, HC₄H₄O₆, C₆H₅N₃O₇, d-bromocamphorsulphate, Cr₂O₇, SO₃; M = Ag, H, Et, K, Na; R = alkyl, aryl, d-bromocamphorsulphate)
27. $RX+Se+heat+pressure=R_3SeX+X_2$
(X = I; R = alkyl)
28. $R_2Se_2+5R'X=RR'_2SeX_3+R'_2SeX+RX$
(X = I; R' = alkyl; R = alkyl)
29. $R_2SeR+RX=R_2(X)SeR$. $R_2(X)SeR+MgRX; +H_2O=R_2SeSeH+MgX_2+ROH$
(R = alkyl; X = Br)
30. $2R_2SeX_3+ZnR_2=2R_3SeX \cdot ZnX_2$
(R = alkyl; X = Cl)
31. $R_2Se+R'X=R'R_2SeX$
(R = alkyl, aryl; X = I, Br)
32. $R_2SeX+RH+AlCl_3=R_2SeX+HCl$
(R = aryl; X = Cl)
33. $SeX_4+RH+AlCl_3=R_2Se_2+R_2Se+R_2SeX+$
(R = aryl; X = Cl)
34. $SeO_2+RH+AlX_3=R_2SeX$. (X = Cl; R = ether).
35. $SeO_2+RNH_2+HX=R_2SeX+$
(R = aryl; X = SO₂H)
36. $Se+RNH_2+HX=R_2SeX+$. (R = aryl; X = SO₂H).
37. $2R'SeH+H_2RX_2=R_2Se+R+2HX+H_2Se+$
(R = alkyl; R' = alkyl; X = Br.)

7.

73, 16.

51, 41,

47, 36.

41, 1.

65, 1, 53.

31, 24, 68, 11,

42, 53, 70.

29.

10, 31.

67.

71.

69, 68, 11, 70, 18.

42.

14, 13, 12³/₄.29, 28¹/₂.

20.

20.

24.

<i>Method No.</i>	<i>Equations</i>	<i>Ref. Nos.</i>
38.	$\overbrace{\text{OR}-\text{Se}=\text{Se}-\text{RO}+\text{Heat (or catalyst)}}^{\text{(R = Acylalkyl; R' = acylalkyl)}} = \text{R}'_2 \equiv \text{Se}+$	60.
40.	$2\text{R}(\text{NH}_2)_2 + \text{H}_2\text{SeO}_3 = (\text{R}(\text{NH}-)_2)_2 \equiv \text{Se}.$	30, 72.
41.	$\text{RR}'\text{R}''\text{SeX} + \text{X}_2 = \text{RR}'\text{SeX}_2 + \text{R}''\text{X}_2.$	18.
	$(\text{R} = \text{aryl; R}' = \text{carboxylalkyl; R}'' = \text{alkyl; X} = \text{Br}).$	
42.	$2\text{R}_3\text{SeX}_2 + \text{MOH} = \text{R}(\text{X})\text{Se}-\text{O}-\text{Se}(\text{X})-\text{R}+$ $\overbrace{\hspace{10em}}^{\text{(M = NH}_4; \text{X} = \text{Cl; R} = \text{Alkyl)}}.$	68.
43.	$\text{R}_2\text{Se}_2 + 2\text{X}_2 = \text{RSeX}_2-\text{SeX}_2\text{R}. \quad (\text{R} = \text{aryl, alkyl, hetero; X} = \text{Br, Cl, I}).$	77, 24, 52.
44.	$\text{SeX}_3 + \text{RM} = \text{OR}-\text{Se}=\text{Se}-\text{RO} + \text{RX} + \text{MX}+$ $\overbrace{\hspace{10em}}^{\text{(R = acylalkyl; X = Cl; M = H, Cu)}}.$	58, 59, 60, 63, 62.
45.	$\overbrace{\text{OR}-\text{Se}=\text{Se}-\text{RO} + 2\text{HX} = \text{HORSe} \equiv \text{SeROH} + \text{X}_2.}^{\text{(R = acylalkyl; X = I)}}.$	60, 63, 62.
46.	$4\text{SeX}_4 + 5\text{RM} = 2\text{R}-\text{Se} \equiv \text{Se}-\text{R} + 6\text{RX} + 5\text{MX}_2.$ $\overbrace{\hspace{10em}}^{\text{(R = acylketone; X = Cl; M = Cu)}}.$	60.
47.	$\overbrace{\text{OR}-\text{Se}-\text{Se}-\text{RO}}^{\text{(R = acylalkyl; X = I)}} + 2\text{HX} = \text{HORSe} \equiv \text{SeROH} + \text{Se} + \text{X}_2.$	60.
48.	$\text{R} = \text{SeX}_2 \left\{ \begin{array}{l} \text{or} \\ \text{R} \equiv \text{SeX} \end{array} \right\} + \text{MY} = \text{R} = \text{SeY}_2 + \text{MX}. \quad (\text{R} = \text{Se} = \text{heterocyclic Se compd.})$ $\overbrace{\hspace{10em}}^{\text{(X}_2 = \text{I}_2, \text{Br}_2, \text{Cl}_2, \text{HNO}_3, \text{SO}_2\text{H, OH; Y} = \text{OH, NO}_2; \text{M} = \text{Ag, Na, H)}}.$	56, 54, 55, 19, 27, 5, 17 $\frac{1}{2}$.

49. $R = Se + X_2 = R = SeX_2$. (R = Se = Heterocyclic compd;
 $X_2 = HNO_2, Cl_2, Br_2$, alkyl halide).
50. $R = SeX_2 + R = SeY_2 = 2RSeXY$. (R = hetero).
51. $R_2Se + heat = OR - \overline{Se} = Se - OR +$. (R = acylalkyl).
52. $R = SeO + HX = R = Se(OH)X$. (X = NO₂, OH; R = Se = heterocyclic Se compd.)
53. $RNO + H_2Se; + FeCl_3 + HCl = N \equiv R_2 - SeCl$. (R = hetero).
54. $SeX_4 + 3MIR = \overline{OR - Se - Se - RO} + 4RX + 3MIX_2 + 2HX$.
 (R = acylalkyl; M = Cu; X = Cl).

56, 49, 24, 54, 57,
 27, 35, 57, 55, 17½,
 54.

60.

27, 17½,
 17.

60.

LIST OF SELENONIUM COMPOUNDS

Names (<i>Se</i> ≡) = <i>Selenonium</i>)	Formulas	M. P. or B. P. °C.	Methods of Prep.	Ref. Nos.
1. Methyl- <i>Se</i> ≡dihydroxy chloride	$\text{MeSe(OH)}_2\text{Cl}$	M = 88-90.	5	80,
2. Methyl- <i>Se</i> ≡dihydroxy bromide	$\text{MeSe(OH)}_2\text{Br}$	D = _____	9	80,
3. Methyl- <i>Se</i> ≡dihydroxy iodide	$\text{MeSe(OH)}_2\text{I}$	_____	9	80,
4. Ethyl- <i>Se</i> ≡dihydroxy chloride	$\text{EtSe(OH)}_2\text{Cl}$	M = 106	9, 5	741 ₂ , 2, 71
5. Ethyl- <i>Se</i> ≡dihydroxy bromide	$\text{EtSe(OH)}_2\text{Br}$	M = 73	5,	2,
6. Ethyl- <i>Se</i> ≡dihydroxy nitrate	EtSeBr_3	D = 73	6,	741 ₂ ,
7. Ethyl- <i>Se</i> ≡triiodide	EtSeI_3	_____	3,	741 ₂
MONO-ALKYL-				
MONO-ARYL-				
1. Phenyl- <i>Se</i> ≡Dihydroxy nitrate	$\text{PhSe(OH)}_2\text{NO}_3$	M = 112	5	76, 38,
2. Phenyl- <i>Se</i> ≡trihydroxide	PhSe(OH)_3	M = 122-4	5,	76,
3. <i>p</i> -Tolyl- <i>Se</i> ≡tribromide	$p\text{-MeC}_6\text{H}_4\text{SeBr}_3$	M = 113-4	5, 7, 3,	18, 61
4. <i>p</i> -Bromophenyl- <i>Se</i> ≡tribromide	$p\text{-BrC}_6\text{H}_4\text{SeBr}_3$	D = _____	3,	61, 18,
DI-ALKYL-				
1. Dimethyl = <i>Se</i> = dichloride	Me_2SeCl_2	M = 59.5	8,	31, 32,
2. Dimethyl = <i>Se</i> = dibromide	Me_2SeBr_2	D = 82 = M	8,	31, 32,
3. Dimethyl = <i>Se</i> = diiodide	Me_2SeI_2	D = _____	8,	31, 32,
4. Dimethyl = <i>Se</i> = hydroxynitrate	$\text{Me}_2\text{Se(OH)NO}_3$	M = 90.5	8,	31, 32,
5. Dimethyl = <i>Se</i> = sulfate	Me_2SeSO_4	S = < 100	10,	31, 32,
6. Dibenzyl = <i>Se</i> = dichloride	$(\text{PhCH}_2)_2\text{SeCl}_2$	M = 128	11,	31,
7. Dibenzyl = <i>Se</i> = dibromide	$(\text{PhCH}_2)_2\text{SeBr}_2$	= 134.5	2, 12, 13,	32, 31, 24,
8. Dibenzyl = <i>Se</i> = diiodide	$(\text{PhCH}_2)_2\text{SeI}_2$	M = 84?	14, 8?	77, 44,
9. Dibenzyl = <i>Se</i> = hydroxynitrate	$(\text{PhCH}_2)_2\text{Se(OH)NO}_3$	M = 84?	14?, 2, 12,	77, 32, 24
10. Diethyl = <i>Se</i> = dichloride	Et_2SeCl_2	= 105.5	15, 32?	
11. Diethyl = <i>Se</i> = hydroxylchloride	$\text{Et}_2\text{Se(OH)Cl}$	M = 97.	14?, 2,	24, 31,
12. Diethyl = <i>Se</i> = dibromide	Et_2SeBr_2	M = 88	10?, 2,	32, 31, 24,
13. Diethyl = <i>Se</i> = hydroxybromide	$\text{Et}_2\text{Se(OH)Br}$	M = _____	8,	33, 71,
		M = _____	3, 11,	33,
		_____	8,	33,
		_____	11,	33,

14. Diethyl = Se = diiodide	Et ₂ SeI ₂	B = —————	11,	33,
15. Diethyl = Se = hydroxyiodide	Et ₂ Se(OH)I	—————	11,	33,
16. Diethyl = Se = hydroxynitrate	Et ₂ Se(OH)NO ₃	—————	10,	33
17. Di(<i>B</i> -chloroethyl) = Se = dichloride	(ClCH ₂ CH ₂) ₂ SeCl ₂	M = 121.5	18, 19, 20,	6, 23, 81/2
		= 122.5	8,	7
18. Di(<i>B</i> -chloroethyl) = Se = dibromide	(ClCH ₂ CH ₂) ₂ SeBr ₂	M = D = 117	11,	7
19. Di(<i>B</i> -Bromethyl) = Se = dichloride	(BrCH ₂ CH ₂) ₂ SeCl ₂	M = 98.9	14,	7
20. Di(<i>B</i> -Bromethyl) = Se = dibromide	(BrCH ₂ CH ₂) ₂ SeBr ₂	M = 118	20,	7
21. Compd. of ethyl iodide + allylsecloamcarbamide	EtNHC(NH ₂) = Se(C ₃ H ₅)I	M = 100	21,	73,
22. Di(<i>B</i> -benzoylmethylene) = Se = dichloride	(BzCH ₂) ₂ SeCl ₂	M = 121.5	22, 23, 24,	51, 41, 65,
		= 122	47	41
23. Di(<i>B</i> -benzoylmethylene) = Se = dibromide	(BzCH ₂) ₂ SeBr ₂	M = 102	14,	41
24. Di(<i>B</i> -benzoylmethylene) = Se = diiodide	(BzCH ₂) ₂ SeI ₂	M = 112	—————	41,
25. Di(<i>p</i> -chlorobenzoyl-methylene) = Se = dichloride	(<i>p</i> :ClBzCH ₂) ₂ SeCl ₂	M = 126	24,	65,
26. Di(<i>p</i> -anisoylmethylene) = Se = dichloride	(<i>p</i> :MeOC ₆ H ₄ COCH ₂) ₂ SeCl ₂	M = 122	22,	41,
27. Di(<i>p</i> -toluylmethylene) = Se = dichloride	(<i>p</i> :MeC ₆ H ₄ COCH ₂) ₂ SeCl ₂	M = 129	22, 24,	41, 65
		= 132	—————	—————
28. Di(<i>p</i> -toluylmethylene) = Se = dibromide	(<i>p</i> :MeC ₆ H ₄ COCH ₂) ₂ SeBr ₂	M = 112	14,	41,
29. Di(<i>α</i> -cumylmethylene) = Se = dichloride	(<i>α</i> :Me ₃ CHC ₂ H ₄ COCH ₂) ₂ SeCl ₂	M = 119	22,	41,
30. Di(<i>β</i> -4-xyloylmethylene) = Se = dichloride	(<i>β</i> :4:Me ₂ C ₄ H ₃ COCH ₂) ₂ SeCl ₂	M = 128	22,	41,
31. Di(<i>β</i> -Me-5-isopr-benzoyl-methylene) = Se = dichloride	(<i>β</i> :Me-5:isoprC ₆ H ₃ COCH ₂) ₂ SeCl ₂	M = 133	24,	65,
32. (<i>β</i> -4-6- <i>β</i> -cumylmethylene) = Se = dichloride	(<i>β</i> :4:6:Me ₃ C ₆ H ₃ COCH ₂) ₂ SeCl ₂	M = 139	22,	41,
		= Se = dichloride	—————	—————
33. Di(<i>p</i> -phenyl-benzoylene-methylene) = Se = dichloride	(<i>p</i> :PhC ₆ H ₄ COCH ₂) ₂ SeCl ₂	M = 136	22,	41,
34. Di(<i>α</i> -naphthoylmethylene) = Se = dichloride	(<i>α</i> :C ₁₀ H ₇ COCH ₂) ₂ SeCl ₂	M = 116	—————	41,
35. Di(<i>p</i> -acetylphenylene-carbamylmethylene) = Se = dichloride	(<i>p</i> :AcC ₆ H ₄ NHCOCH ₂) ₂ SeCl ₂	M = 130	22,	41,
36. Di(<i>B</i> -chloropropyl) = Se = dichloride	(CH ₃ CHClCH ₂) ₂ SeCl ₂	M = 80, 81	19, 18, 20,	23, 81/2, 7,
37. Di(<i>A</i> -acetyl-methylene) = Se = dichloride	(CH ₃ COCH ₂) ₂ SeCl ₂	M = 81, 82	22, 24,	51, 65
38. Di(<i>B</i> -benzylethylene) = Se = dichloride	(BzCH ₂ CH ₂) ₂ SeCl ₂	M = 118, 124	22, 24,	41, 65
39. Di(<i>α</i> -naphthoylethylene) = Se = dichloride	(<i>α</i> :C ₁₀ H ₇ COCH ₂ CH ₂) ₂ SeCl ₂	M = —————	22,	41,

LIST OF SELENIUM COMPOUNDS—Continued

	Names (Se \equiv) = Selenium)	Formulas	M. P. or B. P. °C.		Methods of Prep.	Ref. Nos.
			B=	M=		
40.	Di(<i>B</i> -chlorobutyl)=Se = dichloride	(CH ₃ CH ₂ CHClCH ₂) ₂ SeCl ₂			18, 19,	8½, 23,
41.	Di(<i>B</i> -chloroamyl)=Se = dichloride	(CH ₃ CH ₂ CH ₂ CHClCH ₂) ₂ SeCl ₂	B=85-100		18, 19,	23, 8½,
1.	Diphenyl = Se = dihydroxide	(Ph) ₂ Se(OH) ₂	M=182, 142,		2, 14,	14, 42, 12½,
2.	Diphenyl = Se = dichloride	Ph ₂ SeCl ₂	183-3, 5, 181-2, 179-80,		2, 14, 8, 3, 10,	46, 37, 45, 22, 37½, 39, 42, 14
3.	Diphenyl = Se = dichloride diacetone	Ph ₂ SeCl ₂ +2CH ₃ COCH ₃	M=127.8-7.9		4,	45,
4.	Diphenyl = Se = dibromide	Ph ₂ SeBr ₂	M=140, 141, 148, 154, 141-2, 112?		4, 3,	77, 18, 78, 39, 37½, 66, 37, 13, 14, 12, 7½, 65½
5.	Diphenyl = Se = hydroxynitrate	Ph ₂ Se(OH)NO ₃	M=97		10,	22,
6.	Di(β -hydrobromoamyl)= Se = dibromide	(β :HBrH ₂ NC ₆ H ₄) ₂ SeBr ₂	M=115-6		14,	66,
7.	β -Acetaminodiphenyl = Se = dihydroxide	4:AcHNC ₆ H ₄ (Ph)=Se=(OH) ₂	M=147-8		14,	26,
8.	β -Acetaminodiphenyl = Se = dichloride	4:AcHNC ₆ H ₄ (Ph)=Se=Cl ₂	M=131-2		10,	26,
9.	β -Acetaminodiphenyl = Se = dibromide	4:AcHNC ₆ H ₄ (Ph)=Se=Br ₂	M=135-6		14,	26,
10.	β -Acetaminodiphenyl = Se = diiodide	4:AcHNC ₆ H ₄ (Ph)=SeI ₂	M=144-5		14, 11, 10,	26,
11.	Di(β -amyl) = Se = dihydroxide	(4:MeOC ₆ H ₄) ₂ Se(OH) ₂	M=134, 137		11,	1, 40,
12.	Di(β -amyl) = Se = dichloride	(4:MeOC ₆ H ₄) ₂ SeCl ₂	M=163		10,	1, 40,
13.	Di(β -amyl) = Se = dibromide	(4:MeOC ₆ H ₄) ₂ SeBr ₂	M=124, 125		14, 14,	1, 40,
14.	Di(β -amyl) = Se = diiodide	(4:MeOC ₆ H ₄) ₂ SeI ₂	M=		14, 40,	1, 40,
15.	Di(β -Br- β -amyl) = Se = dihydroxide	(β :Br-4:MeOC ₆ H ₄) ₂ Se(OH) ₂	M=150		11,	1,
16.	Di(β -Br- β -amyl) = Se = dichloride	(β :Br-4:MeOC ₆ H ₄) ₂ SeCl ₂	M=180		24,	1,
17.	Di(β -Br- β -amyl) = Se = dibromide	(β :Br-4:MeOC ₆ H ₄) ₂ SeBr ₂	M=87		14,	1,
18.	Di(β -Me- β -amyl) = Se = dihydroxide	(β :Me-4:MeOC ₆ H ₄) ₂ Se(OH) ₂	M=91		11,	1,
19.	Di(β -Me- β -amyl) = Se = dichloride	(β :Me-4:MeOC ₆ H ₄) ₂ SeCl ₂	M=155-8		24,	1,
20.	Di(β -Me- β -amyl) = Se = dibromide	(β :Me-4:MeOC ₆ H ₄) ₂ SeBr ₂	M=136		14,	1,
21.	Di(β -phenetyl) = Se = dihydroxide	(4:EtOC ₆ H ₄) ₂ Se(OH) ₂	M=145, 146-8		11,	1, 40

22.	Di(<i>4</i> -phenetyl) = Se = dichloride				1, 40
23.	Di(<i>4</i> -phenetyl) = Se = dibromide				1, 40
24.	Di(<i>4</i> -phenetyl) = Se = diiodide				40,
25.	Di(<i>4</i> -propoxyphenyl) = Se = dihydroxide				1,
26.	Di(<i>4</i> -propoxyphenyl) = Se = dichloride				1,
27.	Di(<i>4</i> -propoxyphenyl) = Se = dibromide				1,
28.	Di(<i>4</i> -butoxyphenyl) = Se = dihydroxide				1,
29.	Di(<i>4</i> -butoxyphenyl) = Se = dichloride				1,
30.	Di(<i>4</i> -butoxyphenyl) = Se = dibromide				1,
31.	Di(<i>4</i> -phenoxyphenyl) = Se = dihydroxide				1,
32.	Di(<i>4</i> -phenoxyphenyl) = Se = dichloride				1,
33.	Di(<i>4</i> -phenoxyphenyl) = Se = dibromide				1,
34.	Ph-4-Tolyl = Se = dibromide				25,
35.	Di(<i>2</i> -Tolyl) = Se = dichloride				16, 81,
36.	Di(<i>2</i> -Tolyl) = Se = dibromide				46, 81,
37.	Di(<i>4</i> -Tolyl) = Se = dichloride				46, 15, 81,
38.	Di(<i>4</i> -Tolyl) = Se = dibromide				46, 81,
39.	Di(<i>p</i> -cresyl-3-) = Se = dichloride				53,
40.	Di(<i>2</i> -carboxyphenyl) = Se = dihydroxide				43,
41.	<i>4</i> -carboxydiphenyl = Se = dibromide				25,
42.	Di(<i>al pha-naphthyl</i>) = Se = dichloride				46,
43.	Di(<i>al pha-naphthyl</i>) = Se = dibromide				46,
44.	Di(<i>beta-naphthyl</i>) = Se = dichloride				46,
45.	Di(<i>beta-naphthyl</i>) = Se = dibromide				46, 37,
1.	Trimethyl ≡ Se-hydroxide				31,
2.	Trimethyl ≡ Se-chloride				31, 30 ^{1/2} ,
3.	Trimethyl ≡ Se-iodide				29, 10, 31, 74,
4.	Dimethylbenzyl ≡ Se-hydroxide				31
5.	Dimethylbenzyl ≡ Se-iodide				29,
5 ^{1/2} .	Dibenzylmethyl ≡ Se-iodide				30 ^{1/2} ,
6.	Tribenzyl ≡ Se-chloride				24, 31,
7.	Tribenzyl ≡ Se-bromide				31, 24,
8.	Tribenzyl ≡ Se-iodide				26, 3,
TRI-ALKYL-					
	Me ₃ SeOH				26,
	Me ₃ SeCl				26,
	Me ₃ SeI				27, 28,
	Me ₂ (C ₇ H ₇) ₂ SeOH				26,
	Me ₂ (C ₇ H ₇) ₂ SeI				28,
	Me ₂ (C ₇ H ₇) ₂ SeI				29,
	(C ₆ H ₅ CH ₂) ₃ SeCl				30 ^{1/2} ,
	(C ₆ H ₅ CH ₂) ₃ SeBr				26, 3,
	(C ₆ H ₅ CH ₂) ₃ SeI				31, 24,
	M = 139, 140				24,
	M = 117, 123,				14,
	M = 96,				14, 11,
	M = 51-4				1,
	M = 91,				1,
	M = 69,				14,
	M = 58-60,				11,
	M = 93,				1,
	M = 65,				14,
	M = 122-5,				11,
	M = 135-40,				24,
	M = 113,				14,
	M = 149-50,				10,
	M = 152-3,				16, 81,
	M = 84				46, 81,
	M = 177-8				46, 15, 81,
	177, 5-8, 5				8,
	M = 162				14,
	_____				_____
	_____				_____
	_____				_____
	M = 205-7, 208-10				10, 14,
	M = 130,				14,
	M = 183,				14,
	M = 146,				14,
	M = 161,				14,
	_____				_____
	_____				_____
	_____				_____
	M = 92				26, 3,
	_____				31, 24,
	_____				26, 3,

LIST OF SELENONIUM COMPOUNDS—Continued

<i>Names</i> (Se \equiv) = <i>Selenonium</i>)	<i>Formulas</i>	<i>M. P. or B. P. °C.</i> <i>of Prep.</i>	<i>Methods</i>	<i>Ref. Nos.</i>
9. Triphenyl \equiv Se-nitrate	(C ₆ H ₅ CH ₂) ₃ SeNO ₃	M = 88, 102-3	3,	32, 31, 24,
10. Triethyl \equiv Se-hydroxide	Et ₃ SeOH	—	26,	68, 69,
11. Triethyl \equiv Se-hydroselelide	Et ₃ SeSeH	—	29,	67,
12. Triethyl \equiv Se-chloride	Et ₃ SeCl	—	26, 30,	71, 68,
13. Triethyl \equiv Se-bromide	Et ₃ SeBr	—	2,	61 ^{1/2} ,
14. Triethyl \equiv Se-iodide	Et ₃ SeI	D = 80-126	28, 31,	29, 10, 69,
15. Triethyl \equiv Se-acid oxalate	Et ₃ SeC ₂ O ₄ H	—	26,	68, 69, 74,
16. Triethyl \equiv Se-acid tartrate	Et ₃ SeC ₄ H ₄ O ₆ H + 2H ₂ O	—	26,	68, 69,
17. Methyl-diethyl \equiv Se-bromide	Et ₂ (Me)SeBr	—	4,	11,
18. Carboxymethyl-diethyl \equiv Se-hydroxide	Et ₂ (HOCCCH ₂)SeOH	—	26,	11,
19. Carboxymethyl-diethyl \equiv Se-chloride	Et ₂ (HOCCCH ₂)SeCl	—	26,	11,
20. Carboxymethyl-diethyl \equiv SeBr	Et ₂ (HOCCCH ₂)SeBr	M = 74	31	11,
21. Addn. compd. of allylseleno-carbamide and EtH	CH ₂ = CHCH ₂ NH(NH ₂) = Se(Et)I	M = 100	21	16, 73,
22. Addn. compd. of ethylseleno-carbamide and allylbromide	EtNH(NH ₂) = Se(CH ₂ = CHCH ₂)Br	M = 115	21	73,
TRI-ARYL-				
1. Triphenyl \equiv Se-hydroxide	Ph ₃ SeOH	D = 230	32, 33, 3,	42,
2. Triphenyl \equiv Se-chloride	Ph ₃ SeCl	—	26,	42, 9, 14, 13,
3. Triphenyl \equiv Se-bromide	Ph ₃ SeBr	D = 236	26,	121 ^{1/4} , 143 ^{1/4} ,
4. Triphenyl \equiv Se-iodide	Ph ₃ SeI	D = 237.5	26,	42,
5. Triphenyl \equiv Se-nitrate	Ph ₃ SeNO ₃	M = 107.8	26,	42,
6. Triphenyl \equiv Se-picrate	Ph ₃ SeC ₆ H ₂ (NO ₂) ₃ O	M = 141.2	26,	42,
7. Triphenyl \equiv Se-dichromate	(Ph ₃ Se) ₂ Cr ₂ O ₇	D = 238	26	42,
8. Tri- <i>o</i> -hydroxyphenyl \equiv Se-oxide	(<i>o</i> ? : HOC ₆ H ₄) ₃ Se ₂ O	—	26	53
9. Tri- <i>o</i> -hydroxyphenyl \equiv Se-chloride	(<i>o</i> ? : HOC ₆ H ₄) ₃ SeCl	D = 125	3, 24,	53
10. Tri- <i>o</i> -hydroxyphenyl \equiv Se-oxide	(<i>o</i> ? : HOC ₆ H ₄) ₃ Se ₂ O	D = 240	26,	53
11. Tri- <i>o</i> -hydroxyphenyl \equiv Se-chloride	(<i>o</i> ? : HOC ₆ H ₄) ₃ SeCl	M = 232	24,	53
12. Tri- <i>o</i> -hydroxyphenyl \equiv Se-bromide	(<i>o</i> ? : HOC ₆ H ₄) ₃ SeBr	D = 237	26	53
13. Tri- <i>o</i> -hydroxyphenyl \equiv Se-nitrate	(<i>o</i> ? : HOC ₆ H ₄) ₃ SeNO ₃	—	26,	53,

14.	Tri- <i>l</i> -hydroxyphenyl≡Se-sulfate					
15.	Tri- <i>β</i> -bromo- <i>l</i> -hydroxyphenyl ≡Se-oxide					
16.	Tri- <i>β</i> -bromo- <i>l</i> -hydroxyphenyl ≡Se-bromide					
17.	Tri- <i>β</i> - <i>δ</i> -dibromo- <i>l</i> -hydroxyphenyl ≡Se-bromide					
18.	Tri- <i>p</i> -cresyl- <i>β</i> ≡Se-oxide					
19.	Tri- <i>p</i> -cresyl- <i>β</i> ≡Se-chloride					
20.	Tri- <i>δ</i> -bromo- <i>p</i> -cresyl- <i>β</i> ≡Se-bromide					
21.	Tri- <i>o</i> -cresyl- <i>β</i> ≡Se-oxide					
22.	Tri- <i>o</i> -cresyl- <i>β</i> ≡Se-chloride					
23.	Tri- <i>o</i> -cresyl- <i>β</i> ≡Se-nitrate					
24.	Tri- <i>δ</i> -bromo- <i>o</i> -cresyl- <i>β</i> ≡Se-bromide					
25.	Tri- <i>δ</i> - <i>l</i> -dihydroxyphenyl≡Se-chloride					
26.	Tri- <i>δ</i> -amyl≡Se-chloride					
27.	Tri- <i>l</i> -amyl≡Se-hydroxide					
28.	Tri- <i>l</i> -amyl≡Se-chloride					
29.	Tri- <i>l</i> -amyl≡Se-iodide					
30.	Tri- <i>l</i> -amyl≡Se-dichromate					
31.	Tri- <i>m</i> -dimethoxyphenyl- <i>r</i> - =Se-chloride					
32.	Tri- <i>l</i> -phenetyl≡Se-hydroxide					
33.	Tri- <i>l</i> -phenetyl≡Se-chloride					
34.	Tri- <i>l</i> -phenetyl≡Se-iodide					
35.	Tri- <i>p</i> -acetaminophenetyl- <i>r</i> -≡ Se-acid sulfate					
1.	Dibenzyl = Se = ethylene					
2.	Bis dibenzoylmethane≡Se					
3.	Di(<i>l</i> -8-naphthylene- <i>sec</i> -diamine≡Se					
4.	<i>l</i> -8-naphtho- <i>β</i> '-6'-selendi-azine					
	None					

	(<i>l</i> :HOC ₆ H ₄) ₃ Se) ₂ SO ₄	26,	D = 269-70	53,		
	(<i>β</i> :Br: <i>l</i> :HOC ₆ H ₃) ₃ Se) ₂ O	26,	M = 198	53,		
	(<i>β</i> :Br: <i>l</i> :HOC ₆ H ₃) ₃ SeBr	26,	M = 251	53,		
	(<i>β</i> : <i>β</i> :Br: <i>l</i> :HOC ₆ H ₃) ₃ SeBr	4,	D = 261	53,		
	(<i>l</i> :Me: <i>l</i> :HOC ₆ H ₃ : <i>β</i> : <i>β</i> : <i>β</i> : <i>β</i> :SeCl	26,	D = 160	53,		
	(<i>l</i> :Me: <i>l</i> :HOC ₆ H ₃ : <i>β</i> : <i>β</i> : <i>β</i> : <i>β</i> :SeCl	24,	D = 260-5	53,		
	(<i>l</i> :Me: <i>β</i> :Br: <i>l</i> :HOC ₆ H ₃ : <i>β</i> : <i>β</i> : <i>β</i> : <i>β</i> :SeBr	53,	D = 195	53,		
	(<i>l</i> :Me: <i>β</i> :HOC ₆ H ₃ : <i>β</i> : <i>β</i> : <i>β</i> : <i>β</i> :Se) ₂ O	26,	D = 236	53,		
	(<i>l</i> :Me: <i>β</i> :HOC ₆ H ₃ : <i>β</i> : <i>β</i> : <i>β</i> : <i>β</i> :SeCl	24,	D = 231	53,		
	(<i>l</i> :Me: <i>β</i> :HOC ₆ H ₃ : <i>β</i> : <i>β</i> : <i>β</i> : <i>β</i> :SeNO ₂) ₃	26,	D = 224	53,		
	(<i>l</i> :Me: <i>β</i> :Br: <i>l</i> :HOC ₆ H ₃ : <i>β</i> : <i>β</i> : <i>β</i> : <i>β</i> :SeBr	26,	D = 253	53,		
	(<i>β</i> : <i>β</i> :HO) ₃ C ₆ H ₃) ₃ SeCl	24	M = 206	53,		
	(<i>β</i> : <i>β</i> :MeOC ₆ H ₄) ₃ SeCl		M = 54-5			
	(<i>l</i> :MeOC ₆ H ₄) ₃ SeOH	26	B =	29, 28 ¹ / ₂ , 53,		
	(<i>l</i> :MeOC ₆ H ₄) ₃ SeCl	34, 4,	B =	29, 28 ¹ / ₂ , 56		
	(<i>l</i> :MeOC ₆ H ₄) ₃ SeCl	26,	B =	29, 28 ¹ / ₂ , 53,		
	(<i>l</i> :MeOC ₆ H ₄) ₃ SeI	26,	B =	28 ¹ / ₂ ,		
	(<i>l</i> :MeOC ₆ H ₄) ₃ Se) ₂ Cr ₂ O ₇	26,	M = 68-70	29, 28 ¹ / ₂ , 53,		
	(<i>m</i> :MeO) ₃ C ₆ H ₃ : <i>r</i> : <i>r</i> : <i>β</i> :SeCl	34,	B =	29,		
	(<i>l</i> :EtOC ₆ H ₄) ₃ SeOH	26,	B =	29, 28 ¹ / ₂		
	(<i>l</i> :EtOC ₆ H ₄) ₃ SeCl	34,	B =	29, 28 ¹ / ₂ , 53,		
	(<i>l</i> :EtOC ₆ H ₄) ₃ SeI	26,	B =	28 ¹ / ₂ ,		
	(<i>p</i> :AcNH(EtO)C ₆ H ₃) ₃ SeSO ₄ H + HOH	35, 36,	M = 260	20,		
	TETRA-ALKYL-					
	(PhCH ₂) ₂ Se = (-CH = CH-)	37,	M = 68-9	24,		
	(Bz ₂ CH ₂) ₂ Se	38,	M = 190-1	60,		
	(C ₁₀ H ₆ : <i>l</i> :8(NH) ₂) ₂ Se	40, 3,	M = 120	30, 72,		
	C ₁₀ H ₆ : <i>l</i> :8:(N) ₂ ≡Se	2,		72, 30		
	TETRA-ARYL-					
	None					

LIST OF SELENONIUM COMPOUNDS—Continued

Names (Se \equiv) = Selenonium	Formulas	M. P. or B. P. °C.	Methods of Prep.	Ref. Nos.
1. Phenylmethyl = Se = dihydroxide	Ph(Me)Se(OH) ₂	B = —	11,	18,
2. Phenylmethyl = Se = dichloride	Ph(Me)SeCl ₂	M = 122	8, 10,	22,
3. Phenylmethyl = Se = dibromide	Ph(Me)SeBr ₂	M = 115-6	14,	18,
4. Phenylmethyl = Se = bromide	Ph(Me)SeBr	M = 85	11,	18,
5. Phenylmethyl = Se = diiodide	Ph(Me)SeI ₂	M = 69-71	11,	18,
6. Phenylmethyl = Se = hydroxynitrate	Ph(Me)Se(OH)NO ₃	M = 97	10,	22,
7. Phenylethyl = Se = dichloride	Ph(Et)SeCl ₂	M = 64-5	10, 8,	22,
8. Phenylethyl = Se = dibromide	Ph(Et)SeBr ₂	M = 84	14,	18,
9. Phenylethyl = Se = hydroxynitrate	Ph(Et)Se(OH)NO ₃	B = —	10,	22,
10. Phenyl (carboxymethylene) = Se = dibromide	Ph(HOOCCH ₂)SeBr ₂	M = 126	14,	18,
11. 4-Bromophenyl (carboxymethylene) = Se = dibromide	4:BrC ₆ H ₄ (HOOCCH ₂)SeBr ₂	D = 120-30	14,	61,
12. 4-Carboxyphenyl (carboxymethylene) = Se = dibromide	4:HOOC-C ₆ H ₄ (HOOCCH ₂)SeBr ₂	M = 198-9	14,	25,
13. 4-Tolyl (carboxymethylene) = Se = dibromide	4:Me-C ₆ H ₄ (HOOCCH ₂)SeBr ₂	M = 100-1, 103-4, D = 90-100.	14, 41	18, 61,
14. Phenyl <i>iso</i> -amyl = Se = dichloride	Ph(Me ₂ CHCH ₂ CH ₂)SeCl ₂	M = 80	8, 10	22,
15. Phenyl <i>iso</i> -amyl = Se = hydroxynitrate	Ph(Me ₂ CHCH ₂ CH ₂)Se(OH)NO ₃	B = —	10,	22,
16. Phenylmethylcarboxy-methylene ≡Se-Cl	Ph(Me)(HOOCCH ₂)SeCl	—	26,	70
17. Phenylmethylcarboxy-methylene ≡Se-bromide	Ph(Me)(HOOCCH ₂)SeBr	M = 111, 110-1	31,	70, 18
18. Phenylmethylcarboxy-methylene ≡Se-iodide	Ph(Me)(HOOCCH ₂)SeI	—	26,	70,
19. 4-Tolylmethylcarboxy-methylene ≡Se-bromide	4-Me-C ₆ H ₄ (Me)(HOOCCH ₂)SeBr	M = 100	31,	18,
20. <i>d</i> -Phenylmethylcarboxy-methylene ≡Se- <i>d</i> -bromo-camphorsulfonic acid	Ph(Me)(HOOCCH ₂)SeC ₉ H ₁₃ O(Br)SO ₃ H	M = 168	26,	70,
21. <i>L</i> -Phenylmethylcarboxy-methylene ≡Se- <i>d</i> -bromo-camphorsulfonic acid	Ph(Me)(HOOCCH ₂)SeC ₉ H ₁₃ O(Br)SO ₃ H	M = 157	26,	70,

		ALKYL-HETERO-			
1.	Methyl-(1-phenyl- β -methyl-pyrro(<i>a</i>) monazoly-5-) = Se = dichloride	$\text{Me}(\text{NPh}_2\text{N} = \text{CMe-CH} = \text{C-})\text{SeCl}_2$	M = 128	14,	48,
2.	Methyl-(1-phenyl- β -methyl-pyrro(<i>a</i>) monazoly-5-) = Se = dibromide	$\text{Me}(\text{NPh}_2\text{N} = \text{CMe-CH} = \text{C-})\text{SeBr}_2$	M = 110	14,	48,
3.	Methyl-(α -dibromo-1-phenyl- β -methyl-pyrro(<i>a</i>) monazoly-5-) = Se = dibromide	$\text{Me}(\text{NPh}_2\text{N} = \text{CMe-CH} = \text{C-})\text{SeBr}_2 + \text{Br}_2$	M = 191	14, 3,	50,
4.	Methyl-(1-methyl- β -phenyl-pyrro(<i>a</i>) monazoly-5-) = Se = dichloride	$\text{Me}(\text{NMe}_2\text{N} = \text{CPh-CH} = \text{C-})\text{SeCl}_2$	M = 161	14,	49,
5.	Methyl-(1-Methyl- β -phenyl-pyrro(<i>a</i>) monazoly-5-) = Se = dibromide	$\text{Me}(\text{NMe}_2\text{N} = \text{CPh-CH} = \text{C-})\text{SeBr}_2$	M = 177	14,	49,
DI HETERO-					
1.	Di(1-phenyl-2- β -dimethyl-pyrro(<i>a</i>) monazoly-4-) = Se = dichloride	$(\text{CMe-NMe} = \text{NPh-CO-C-})_2\text{SeCl}_2$	M = 225	22,	36
DISELENONIUM					
1.	Diethyl diselenonium* oxydichloride *Abbreviated as Se_2 or = Se \equiv	$\text{Et}_2 = \text{Se-O-Se} = \text{Et}_2$	—	42, 2,	68,
2.	Diphenyl = Se \equiv tetrabromide	$\text{PhSeBr}_2\text{SeCBr}_2\text{Ph}$	M = 111	43,	77,
3.	Dibenzyl = Se \equiv tetrabromide	$\text{PhCH}_2\text{SeBr}_2\text{SeCBr}_2\text{CH}_2\text{Ph}$	M = 134, 137,	43,	77, 24,
4.	Dibenzyl = Se \equiv tetraiodide	$\text{PhCH}_2\text{SeI}_2\text{SeI}_2\text{CH}_2\text{Ph}$	M = 98	43,	24,
5.	Di(1-Phenyl- β -methyl-4-benzoyl-5-) = Se \equiv tetrachloride	$(\text{NPh}_2\text{N} = \text{CMe-CBz} = \text{C-SeCl}_2)_2$	M = 125	43,	52,
6.	Di(1-phenyl- β -methyl-4-Benzoyl-5-) = Se \equiv tetrabromide	$(\text{NPh}_2\text{N} = \text{CMe-CBz} = \text{C-SeBr}_2)_2$	M = 201	43,	52,
7.	Di(1-phenyl- β -methyl-4-Benzoyl-5-) = Se \equiv tetraiodide	$(\text{NPh}_2\text{N} = \text{CMe-CBz} = \text{C-SeI}_2)_2$	M = 78	43,	52,

<i>Names</i> (Se≡) = Selenonium	<i>Formulas</i>	<i>M. P. or B. P. °C.</i>	<i>Methods of Prep.</i>	<i>Ref. Nos.</i>
8. "Dimeric selenium acetylacetonone"	(Cac = CMe-O-Se = Se-O-CMe = CAc) or** (Cac = CMe-O-Se =) ₂	M = 175, 185	44,	58, 59, 64, 60, 63,
**In order to save space this and similar compounds will be represented as:				
9. "Diselenium bisacetylacetonone"	(HOCMe = C(Ac)-Se≡) ₂	—————	45,	60,
10. "Diselenium bis-C-ethyl-acetylacetonone"	(EtC(Ac ₂)Se≡) ₂	M = 117-8	46,	60,
11. "Diselenium bisacetyl-propionylmethane"	(CH ₃ CH ₂ COH = CAc-Se≡) ₂	—————	45,	63,
12. "Diselenium bisbenzoylacetonone"	(MeC(OH)Bz-Se≡) ₂	M = 80-90	45, 47,	60,
13. "Diselenium bisdibenzoyl-methane"	(PhCOH = CBz-Se≡) ₂	M = 116-8	45,	60,
14. "Diselenium bis- <i>o</i> -phenyl-acetylacetonone"	(MeCOH = C(COCH ₂ Ph)-Se≡) ₂	—————	45,	62,
15. "Diselenium bis- <i>B</i> -phenyl-propionylacetonone"	(PhCH ₂ COH = CAc-Se≡) ₂	—————	45,	62,
16. "Compound"	(MeCOH = C(COCH ₂ CH ₂ Ph)-Se≡) ₂ or (PhCH ₂ CH ₂ COH = CAc-Se≡) ₂ or (PhCH ₂ CH ₂ COH = CAc-Se≡) ₂ Ph ₃ Se ₂ C ₆ H ₄ Cl	B ₁₀₀ = 245-50	33	12 ³ / ₄
SELENIUM COMPOUNDS CONTAINING CYCLIC SELENIUM.				
1. Cyclo = Se = propane- <i>l</i> - <i>l</i> -dihydroxide	CH ₂ CH ₂ CH ₂ Se(OH) ₂	—————	48,	56,
2. Cyclo = Se = propane- <i>l</i> - <i>l</i> -diiodide	CH ₂ CH ₂ CH ₂ SeI ₂	M = 98	49,	56,
<i>l</i> -2-Dimethyl-β-phenyl pyrro(<i>a</i>) monazoxy- <i>l</i> -2-5 = Se = dichloride	NMe-NMe = CPh-CH = C-SeCl ₂	M = 163	49,	49,

4.	<i>1-2</i> -Dimethyl- <i>3</i> -phenyl pyrro(<i>a</i>) monazoly- <i>2-5</i> = Se = dibromide	$\overline{\text{NMe-NMe} = \text{CPh-CH} = \text{C-SeBr}_2}$	M = 215	4,	49,
5.	<i>x-x</i> -Dibromo- <i>1-2</i> -dimethyl- <i>3</i> -phenyl- pyrro(<i>a</i>)monazoly- <i>2-5</i> = Se = dibromide	$\overline{\text{NMe-NMe} = \text{CPh-CH} = \text{C-SeBr}_2 + \text{Br}_2}$	M = 108	49,	49,
6.	Cyclo = Se = butane- <i>1-1</i> -dihydroxide	$\overline{\text{CH}_2(\text{CH}_2)_3\text{Se}(\text{OH})_2}$	—	48,	54,
7.	Cyclo = Se = butane- <i>1-1</i> -hydroxy- <i>1</i> - chloride	$\overline{\text{CH}_2(\text{CH}_2)_3\text{Se}(\text{OH})\text{Cl}}$	D = 116	48,	54,
8.	Cyclo = Se = butane- <i>1-1</i> -dichloride	$\overline{\text{CH}_2(\text{CH}_2)_3\text{SeCl}_2}$	M = 88-9	49,	54,
9.	Cyclo = Se = butane- <i>1-1</i> -hydroxy- <i>1</i> - bromide	$\overline{\text{CH}_2(\text{CH}_2)_3\text{Se}(\text{OH})\text{Br}}$	D = 99-100	48, 50,	54,
10.	Cyclo = Se = butane- <i>1-1</i> -dibromide	$\overline{\text{CH}_2(\text{CH}_2)_3\text{SeBr}_2}$	M = 92	49, 3,	54, 21,
11.	Cyclo = Se = butane-per-bromide	$\overline{\text{CH}_2(\text{CH}_2)_3\text{SeBr}_2 + 5\text{Br}}$	D —	4, —	54,
12.	Cyclo = Se = butane- <i>1-1</i> -diiodide	$\overline{\text{CH}_2(\text{CH}_2)_3\text{SeI}_2}$	M = 99-100	49,	54,
13.	Cyclo = Se = butane- <i>1-1</i> -methiodide	$\overline{\text{CH}_2(\text{CH}_2)_3\text{Se}(\text{Me})\text{I}}$	M = 174	—	54,
14.	<i>Alpha-delta</i> -(<i>1-1'</i> -bis-cyclo = Se = butane- <i>1-1'</i> -dibromide)tetramethylene	$\overline{(\text{CH}_2(\text{CH}_2)_3\text{Se}(\text{Br})\text{CH}_2\text{CH}_2)_2}$	M = 95-6	49,	54,
15.	<i>Alpha</i> -Bromo- <i>delta</i> -(<i>1</i> -cyclo = Se = butane- <i>1</i> -bromide)	$\overline{\text{CH}_2(\text{CH}_2)_3\text{Se}(\text{Br})(\text{CH}_2)_4\text{Br}}$	M = 65-6	49,	54,
16.	<i>1-3</i> -Tetrabromo- <i>2</i> -phenyl- <i>4-5</i> - benzoselenen-(b)-monazole	$\overline{\text{CH} = (\text{CH})_3\text{C} = \text{C-NBr}_2 = \text{CPh-SeBr}_2}$	M = 134	49,	24,

LIST OF SELENIUM COMPOUNDS—Continued

<i>Names</i> (Se \equiv) = <i>Selenonium</i>	<i>Formulas</i>	<i>M. P. or B. P. °C.</i>	<i>Methods of Prep.</i>	<i>Ref. Nos.</i>
17. 1-3-Tetraiodo-2-phenyl-4-5-benzoselen(b)monazole	$\text{CH} = (\text{CH})_3\text{-C} = \text{C-NI}_2 = \text{CPh-SeI}_2$	M = 84	49,	24,
18. "Selenium acetylpropionyl-methane"	$(\text{CAc} = \text{CEt-O-Se} =)_2^{**}$			
	OR $(\text{C}(\text{EtCO}) = \text{CMe-O-Se} =)_2^{**}$	M = 137	44,	63,
19. "Dimeric selenium benzoyl acetone"	$(\text{CBz} = \text{CMe-O-Se} =)_2^{**}$	M = 212	44,	60, 58,
20. "Dimeric selenium-omega-phenyl acetyl acetone"	$(\text{CAc} = \text{C}(\text{C}_7\text{H}_7)\text{-O-Se} =)_2^{**}$			
	OR $(\text{C}(\text{PhCH}_2\text{CO}) = \text{CMe-O-Se} =)_2^{**}$	M = 164-5	44,	62,
21. "Dimeric selenium-beta-phenyl propionyl acetone"	$\text{CAc} = \text{C}(\text{C}(\text{CH}_2)_2\text{Ph})\text{-O-Se} =)_2^{**}$			
	OR $(\text{C}(\text{OC}(\text{CH}_2)_2\text{Ph}) = \text{CMe-O-Se} =)_2^{**}$	M = 141-2	44,	62,
22. "Selenium dibenzoylmethane"	$(\text{CBz} = \text{CPh-O-Se} =)_2^{**}$	M = 211	44,	60

23.	"Isoseleniumbenzoylmethane"	$\overbrace{\text{CPh-O-Se}=\overbrace{\text{Se-CBz}}^{\text{CPh-O}}}$	M = 175.6	51,	60,
24.	Cyclo = Se = pentane- <i>l-l</i> -dihydroxide	$\overbrace{\text{CH}_2(\text{CH}_2)_4\text{Se}(\text{OH})_2}$	—	48,	55,
25.	Cyclo = Se = pentane- <i>l</i> -hydroxy- <i>l</i> -chloride	$\overbrace{\text{CH}_2(\text{CH}_2)_4\text{Se}(\text{OH})\text{Cl}}$	D = 110-11	48,	55,
26.	Cyclo = Se = pentane- <i>l-l</i> -dichloride	$\overbrace{\text{CH}_2(\text{CH}_2)_4\text{SeCl}_2}$	M = 103	49,	55,
27.	Cyclo = Se = pentane- <i>l-l</i> -dibromide	$\overbrace{\text{CH}_2(\text{CH}_2)_4\text{SeBr}_2}$	M = 117.8	49,	55,
28.	Cyclo = Se = pentane-perbromide	$\overbrace{\text{CH}_2(\text{CH}_2)_4\text{SeBr}_2+5\text{Br}}$	D ———	49,	55,
29.	Cyclo = Se = pentane- <i>l-l</i> -diiodide	$\overbrace{\text{CH}_2(\text{CH}_2)_4\text{SeI}_2}$	M = 114	49,	55,
30.	Cyclo = Se = pentane- <i>l-l</i> -methiodide	$\overbrace{\text{CH}_2(\text{CH}_2)_4\text{Se}(\text{Me})\text{I}}$	M = 165.6	49,	55,
31.	<i>Alpha</i> -Bromo- <i>beta</i> -(<i>l</i> -cyclo = Se = pentane- <i>l</i> -bromide) dimethylene	$\overbrace{\text{CH}_2(\text{CH}_2)_4\text{Se}(\text{Br})\text{CH}_2\text{CH}_2\text{Br}}$	M = 88	49,	55,
32.	2-Methylcyclo = Se = pentane- <i>l-l</i> -dichloride	$\overbrace{\text{MeCH}(\text{CH}_2)_4\text{SeCl}_2}$	B = ———	49,	57,
33.	2-Methylcyclo = Se = pentane- <i>l-l</i> -dibromide	$\overbrace{\text{MeCH}(\text{CH}_2)_4\text{SeBr}_2}$	—	49,	57,
34.	2-Methylcyclo = Se = pentane- <i>l-l</i> -diiodide	$\overbrace{\text{MeCH}(\text{CH}_2)_4\text{SeI}_2}$	—	49,	57,
35.	2-Methylcyclo = Se = pentane- <i>l-l</i> -methiodide	$\overbrace{\text{MeCH}(\text{CH}_2)_4\text{Se}(\text{Me})\text{I}}$	M = 164	49,	57,

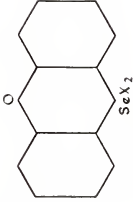
LIST OF SELENIUM COMPOUNDS—Continued

<i>Names</i> (Se \equiv) = <i>Selenonium</i>	<i>Formulas</i>	<i>M. P. or B. P. °C.</i>	<i>Methods of Prep.</i>	<i>Ref. Nos.</i>
36. 3-6-Diaminoselenoxanthene-10-chloride	$3:6:(\text{NH}_2)_2\text{C}_{13}\text{H}_7\text{SeCl}^{***}$	—	48,	19,
*** $\text{C}_{13}\text{H}_9\text{SeX}$ = selen xanthene-10-halide				
37. 3-6-Tetramethyldiaminoselenoxanthene-10-chloride	$3:6:(\text{Me}_2\text{N})_2\text{C}_{13}\text{H}_7\text{SeCl}$	—	—	4,
38. 3-6-Tetramethyldiamino-9-cyanoxanthene-10-nitrate	$3:6:(\text{Me}_2\text{N})_2:9:\text{CN}\text{C}_{13}\text{H}_6\text{SeNO}_3$	—	49,	3,
39. 3-6-Bisdiazoselenoxanthene-10-hydroxide	$3:6:(\text{HONN})_2\text{C}_{13}\text{H}_7\text{SeOH}$	—	48,	19,
40. 3-6-Bisdiazoselenoxanthene-10-chloride	$3:6:(\text{ClNN})_2\text{C}_{13}\text{H}_7\text{SeCl}$	—	4,	19,
41. 3-Dimethylamino-6-ethylamino-selenoxanthene-10-chloride	$3:(\text{Me}_2\text{N})_2:6:(\text{EtHN})\text{C}_{13}\text{H}_7\text{SeCl}$	—	—	4,
42. 2-7-Dimethyl-3-6-diamino-selenoxanthene-10-acid sulfate	$2:7:\text{Me}_2:3:6:(\text{H}_2\text{N})_2\text{C}_{13}\text{H}_5\text{SeSO}_4\text{H}$	—	—	4,
43. 2-7-Dimethyl-3-6-diethylamino-selenoxanthene-10-chloride	$2:7:\text{Me}_2:3:6:(\text{EtHN})_2\text{C}_{13}\text{H}_5\text{SeCl}$	—	—	4,
44. 2-7-Dimethoxy-3-6-diamino-selenoxanthene-10-acid sulfate	$2:7:\text{Cl}_2:3:6:(\text{H}_2\text{N})_2\text{C}_{13}\text{H}_5\text{SeSO}_4\text{H}$	—	—	4,
45. 1-4-5-8-Tetramethyl-2-7-diaminoselenoxanthene-10-acid sulfate	$2:7:(\text{MeO})_2:3:6:(\text{H}_2\text{N})_2\text{C}_{13}\text{H}_3\text{SeSO}_4\text{H}$	—	—	4,
46. 1-4-5-8-Tetramethyl-2-7-diaminoselenoxanthene-10-acid sulfate	$1:4:5:8:\text{Me}_4:3:6:(\text{H}_2\text{N})_2\text{C}_{13}\text{H}_3\text{SeSO}_4\text{H}$	—	—	4,
47. 1-4-Selenoxan dichloride	$\text{CH}_2\text{CH}_2\text{OCH}_2\text{CH}_2\text{SeCl}_2$	M = 127.9	49,	27,
48. 1-4-Selenoxan dibromide	$\text{CH}_2\text{CH}_2\text{OCH}_2\text{CH}_2\text{SeBr}_2$	M = 152	49, 48,	27,
49. 1-4-Selenoxan diiodide	$\text{CH}_2\text{CH}_2\text{OCH}_2\text{CH}_2\text{SeI}_2$	M = 106.7	49,	27,

50.	<i>1-4</i> -Selenoxan hydroxynitrate	$\text{CH}_2\text{CH}_2\text{OCH}_2\text{CH}_2\text{CH}_2\text{Se}(\text{OH})\text{NO}_3$	D = 140-1	52,	27,
51.	<i>1-4</i> -Selenoxan methiodide	$\text{CH}_2\text{CH}_2\text{OCH}_2\text{CH}_2\text{CH}_2\text{Se}(\text{Me})\text{I}$	M = 171	49,	27,
52.	Cyclotetramethylene = Se ₂ ≡ tetrabromide	$\text{CH}_2(\text{CH}_2)_3\text{SeBr}_2\text{SeBr}_2$	—	49,	54,
53.	<i>3</i> -Phenylaminophenselenazine- <i>1</i> -chloride	$3\text{:PhHNC}_{12}\text{H}_7\text{SeCl}$	—	55,	4,

	*****Phenselenazine halide =				
		$\text{C}_{12}\text{H}_8\text{NSeX}$ or			
		$\text{C}_{12}\text{H}_8\text{NSeBr} + \text{Br}_2$		49,	35,
54.	Phenselenazine- <i>1</i> -tribromide	$3\text{:}(3^1\text{:AsO}_3\text{H:C}_6\text{H}_4\text{HN})\text{C}_{12}\text{H}_7\text{NSeC}$	—	4,	35,
55.	<i>3</i> -(Phenylamino)phenselenazine- <i>1-3'</i> -arsonic acid	$3\text{:}(3^1\text{:AsO}_3\text{H}(6^1\text{:OH})\text{C}_6\text{H}_3\text{HN})\text{C}_{12}\text{H}_7\text{NSeC}$	—	4,	35,
56.	<i>3</i> -(6'-Hydroxyphenylamino)- phenselenazine- <i>1-3'</i> -arsonic acid	$3\text{:}(3^1\text{:AsO}_3\text{H}(6^1\text{:OH})\text{C}_6\text{H}_3\text{HN})\text{C}_{12}\text{H}_7\text{NSeC}$	—	4,	35,
57.	<i>3-5</i> -Diaminophenselenazine- <i>1</i> -hydroxide	$3\text{:5:(NH}_2)_2\text{C}_{12}\text{H}_8\text{NSeOH}$	—	48,	5,
58.	<i>3-5</i> -Diaminophenselenazine- <i>1</i> -chloride	$3\text{:5:(NH}_2)_2\text{C}_{12}\text{H}_8\text{NSeCl} + 3\text{H}_2\text{O}$	—	4,	5, 35,
59.	<i>3-5</i> -Diaminophenselenazine- <i>1</i> -nitrate	$3\text{:5:(NH}_2)_2\text{C}_{12}\text{H}_8\text{NSeNO}_3$	—	48,	5,
60.	<i>3-5</i> -Diaminophenselenazine- <i>1</i> -dichromate	$(3\text{:5:(NH}_2)_2\text{C}_{12}\text{H}_8\text{NSe})_2\text{Cr}_2\text{O}_7$	—	48,	5,
61.	<i>3-5</i> -Diacylaminoselenazine- <i>1</i> -chloride	$3\text{:5:(AcHN)}_2\text{C}_{12}\text{H}_6\text{NSeCl}$	—	4,	35,
62.	<i>3-5-2</i> -Diacylamino- <i>9</i> -phenyl- aminophenselenazine- <i>1</i> -chloride	$3\text{:5:(AcHN)}_2\text{:9:(PhHN)}\text{C}_{12}\text{H}_{14}\text{NSeCl}$	—	4,	35,
63.	<i>3-9</i> -Diaminophenselenazine- <i>1</i> -chloride	$3\text{:9:(H}_2\text{N)}_2\text{C}_{12}\text{H}_6\text{NSeCl}$	—	4,	35, 17,
64.	<i>3-9</i> -Dimethylaminoselenazine- <i>1</i> -chloride (Selenomethylene Blue)	$3\text{:9:(Me}_2\text{N)}_2\text{C}_{12}\text{H}_6\text{NSeCl}$	—	53,	17, 79, 34, 35,

LIST OF SELENIUM COMPOUNDS—Continued					
	Names (Se \equiv) = Selenonium	Formulas	M. P. or B. P. °C.	Methods of Prep.	Ref. Nos.
65.	3:3-Dimethylaminophenselenazine- <i>I</i> -bromide	$3:3:(\text{Me}_2\text{N})_2\text{C}_{13}\text{H}_6\text{NSeBr}$	—	4,	35,
66.	3:5-9-Triaminophenselenazine- <i>I</i> -hydroxide	$3:5:9:(\text{H}_2\text{N})_3\text{C}_{12}\text{H}_3\text{NSeOH}$	—	48,	5,
67.	3:5-9-Triaminophenselenazine- <i>I</i> -chloride	$3:5:9:(\text{H}_2\text{N})_3\text{C}_{12}\text{H}_3\text{NSeCl} + 1/2\text{H}_2\text{O}$	—	4,	5,
68.	3:5-9-Triaminophenselenazine- <i>I</i> -nitrate	$3:5:9:(\text{H}_2\text{N})_3\text{C}_{12}\text{H}_3\text{NSeNO}_3$	—	48,	5,
69.	3:5-9-Triaminophenselenazine- <i>I</i> -dichromate	$(3:5:9:(\text{H}_2\text{N})_3\text{C}_{13}\text{H}_5\text{NSe})_2\text{Cr}_2\text{O}_7$	—	48,	5,
70.	"Cyclotriseleniumbisbenzoylacetone"	$\text{BzC} = \text{CMe} - \text{O} - \text{Se} - \text{Se} - \text{O} - \text{CMe} = \text{CBz}$	M = 190-200	54,	60,
71.	Cyclo = Se = hexane- <i>I-I</i> -dichloride	$\text{CH}_2(\text{CH}_2)_3\text{SeCl}_2$	M = 78	49,	57,
72.	Cyclo = Se = hexane- <i>I-I</i> -dibromide	$\text{CH}_2(\text{CH}_2)_3\text{SeBr}_2$	M = 118-9	49,	57,
73.	Dicyclo = Se = hexane- <i>I-I</i> -dibromide	$(\text{CH}_2(\text{CH}_2)_3\text{SeBr})_2$	M = 145	49,	57,
74.	Polycyclo = Se = hexane- <i>I-I</i> -dibromide	$(\text{CH}_2(\text{CH}_2)_3\text{SeBr}_2)_X$	M = 94-5	49,	57,
75.	Cyclo = Se = hexane- <i>I-I</i> -diiodide	$(\text{CH}_2(\text{CH}_2)_3\text{SeI}_2)$	M = 82	49,	57,
76.	Cyclo = Se = hexane- <i>I-I</i> -methiodide	$(\text{CH}_2(\text{CH}_2)_3\text{Se}(\text{Me})\text{I})$	D = 149-50.	49,	57,
77.	Cyclopentamethylene- <i>I-2</i> = Se \equiv tetrabromide	$\text{CH}_2(\text{CH}_2)_4\text{SeBr}_3\text{SeBr}_2$	—	49,	55,

78. Cyclohexamethylene-1-5 = Se \equiv tetrachloride	(CH ₂) ₃ SeCl ₂ (CH ₂) ₃ SeCl ₂	48,	56,
79. Cyclohexamethylene-1-5 = Se \equiv tetraiodide	(CH ₂) ₃ SeI ₂ (CH ₂) ₃ SeI ₂	D = 100	56,
80. Cyclohexamethylene-1-5 = Se \equiv titanitrate	(CH ₂) ₃ Se(NO ₃) ₂ (CH ₂) ₃ Se(NO ₃) ₂	D = 87	56,
81. Phenoxselenine‡ dihydroxide	C ₁₂ H ₈ OSe(OH) ₂	52,	17½
‡Phenoxselenine dihalide =			
82. Phenoxselenine dichloride	C ₁₂ H ₈ OSeCl ₂	49,	17½
83. Phenoxselenine dibromide	C ₁₂ H ₈ OSeBr ₂	49,	17½
84. Phenoxselenine di acid sulfate	C ₁₂ H ₈ OSe(HSO ₄) ₂	48,	17½
	or C ₁₂ H ₈ OSeX ₂		
	HEXA-VALENT SELENIUM		
1. 4-Bromophenyl (carboxymethylene) selenonium tetrabromide	4:BrC ₆ H ₄ (HOOCCH ₂)SeBr ₂ +Br ₂	D = -----	61, 18,
2. 4-Tolyl (carboxymethylene) selenonium tetrabromide	4:CH ₃ C ₆ H ₄ (HOOCCH ₂)SeBr ₂ +Br ₂	D = -----	61, 18,
3. Di- <i>para</i> -naphthaselenen-diazole ^a	7:NHC ₁₀ H ₆ :8:N = Se = 7:N C ₁₀ H ₆ :8:2NH	M > 300	30,

BIBLIOGRAPHY

1. Alquist, F. N. and Nelson, R. E. Organic compounds of selenium. II. Action of selenium oxychloride upon ether. *J. Amer. Chem. Soc.* (1931) 53:4033-7.
2. Backer, H. J. and van Dam, W. Ethaneseleninic Acid. *C. A.* (1930) 24, 2989. Same as *Rec. Trav. Chim.* (1930) 49:479-81.
- 2½. Battegay, M. and Hugel G. Sur la β -6-tetramethyl-diamino-selenopyronine. *Bull. Soc. Chim.* (1920) [4] 27:557-60, and *C. A.* (1921) 15:1498-9.
3. Battegay, M. and Hugel, G. Sur la β -6-tetramethyl-diamino-cyano-selenopyronine. *Bull. Soc. Chim.* (1922), [4] 31:440-4.
4. Battegay, M. and Hugel, G. Les selenopyronines. *Bull. Soc. Chim.* (1923), (4) 33:1103-5.
- 4½. Battegay, M. and Vechot, J. Sur les sels de piaseleazonium. *Bull. Soc. Chim.* (1925) 37:1271-, and *C. A.* (1926) 20:2498-9.
5. Bauer, H. Ueber Selenazine—Farbstoffe. *Ber.* (1914) 47:1873-81.
6. Bauser, H. W., Gibson, C. S. and Pope, W. J. Interaction of ethylene and selenium monochloride, *J. Chem. Soc.* 1920, 117:1453-6.
7. Bell, H. C. and Gibson, C. S. *B-B'*Dichloro- and *B-B'*dibromodiethyl selenides and their simple halogen derivatives. *J. Chem. Soc.* (1925) 127:1877-84.
- 7½. Billows, E. *Zeitschrift fur Krystallographie und Mineralogie.* *J. Chem. Soc.* (1912) 102, AI. 422.
- 7¾. Bogert, M. T. and Andersen, C. N. "Selenium Organic Compounds. VI. Bromine, Sulfo and Mercury Derivatives of 2-4-Diphenyl-selenophene and experiments with some related compounds." *J. Chem. Soc.* (1926) 48:223-231. *C. A.* (1926) 20:592.
8. Boord, C. A. A note. *J. Ind. Eng. Chem.* (1919) 11:101.
- 8½. Boord, C. E. and Cope, F. F. The action of selenium monochloride on propylene, butylene, and amylenes. *J. Am. Chem. Soc.* 44:395-401 (1922).
9. Bradt, W. E. and Crowell, J. H. The preparation of tri-*p*-tolyl selenonium chloride by means of the Friedel-Crafts reaction with selenium dioxide. *J. Am. Chem. Soc.* (1933) 55:1500-02.
10. Cahours, A. Untersuchungen ueber die organischen Radicale. *Ann.* (1865) 135:352-7.
11. Carrara, G. Sulle selenitine. *Nuova serie di composti del selenio.* *Gazz. Chim. Ital.* (1894) 24, II, 173-9.
12. Chabrie, M. C. Premiers essais de synthese de composees organiques selenies dans la serie aromatique. *Bull. Soc. Chim.* (1888), (2), 50:133-7.
- 12¼. Chabrie, M. C. Extrait de Proces-verbaux des seances. Seance du 23 Novembre 1888. *Bull. Soc. Chim.* (1888) [2] 50:657-8.
- 12½. Chabrie, M. C. Extrait des Proces-verbaux des Seances. Seance du Vendredi 8 Mars 1889. *Bull. Soc. Chim.* (1889) [3] 1:403-4.
- 12¾. Chabrie, M. C. Sur la synthese de quelque composees selenies dans la serie aromatique. *Bull. Soc. Chim.* (1889) [3] 2:788-803.
13. Chabrie, M. C. Synthese de quelques composees selenies dans la serie aromatique. *Compt. rend.* (1889) 109:182-5.

14. Chabrie, M. C. Sur la synthese de quelques composés selenies dans la serie aromatique. *Ann. Chim. Phys.* (1890) (6) 20:202-86.

14½. Chabrie, M. C. Sur la synthese des composés aromatiques selenies. *Bull. Soc. Chim.* (1894) [3] 11:1080-3.

15. Challenger, F., Peters, A. T. and Halevy, J. The introduction of the selenocyano-group into aromatic compounds. *J. Chem. Soc.* 1926: 1648-55.

16. Chem. Fabrik von Heyden. Derivatives of alkylselenocarbamides. *C. A.* (1919) 13:325 and *D. R. P.* (1918) 305,263.

17. Cornelius, W. Selenodiarylamine. *J. pr. Chem.* (1913) (II) 88: 395-408.

17½. Drew, H. D. K. Cyclic organo-metallic compounds. Phenoxselenine and phenoxthionine from phenoxtellurine. Selenylium and thionylium compounds. *J. Chem. Soc.* (1928) 511-24.

18. Edwards, O. K., Gaythwaite, W. R., Kenyon, J. and Phillips, H. The quadrivalency of selenium. Part III. The instability of the compounds of quadrivalent selenium derived from phenylmethyl and phenylethyl selenides and phenyl and *p*-tolylselenoglycollic acids. *J. Chem. Soc.* 1928:2293-2303.

19. Ehrlich, P. and Bauer, H. Ueber 3:6—Diaminoseleno-pyronin (3:6—Diaminoxantho-selenonium). *Ber.* (1915) 48:592-7.

20. Farbwerke vorm. Meister, Lucius and Bruning. Production of aromatic selenium compounds. *D. R. P.* 299510 (1917). Same as C. A. (1919) 13:323 and *J. Chem. Soc.* (1918) 114, AI. 218.

21. Foa, I. Di un nova composti del selenio. *Gazz. Chim. Ital.* (1909) 39, II. 527-34.

22. Foster, D. G. and Brown, S. F. Organic selenium compounds. Some derivatives of aromatic seleno-ethers. *J. Am. Chem. Soc.* 50:1182-8 (1928).

23. Frick, C. E. The action of selenium oxychloride upon ethylene, propylene, butylene, and amylene. *J. Am. Chem. Soc.* (1923) 45:1795-1800.

24. Fromm, E. and Martin, K. Versuche zur Einfuhrung von Selen in organische Verbindungen. *Ann.* (1913) 401:177-88.

25. Gaythwaite, W. R., Kenyon, J. and Phillips, H. The quadrivalency of selenium. Part I. 4-carboxydiphenyl and *p*-carboxyphenylmethyl selenoxides. *J. Chem. Soc.* 1928:2280-7.

26. Gaythwaite, W. R., Kenyon, J. and Phillips, H. The quadrivalency of selenium. Part II. The simple halogen derivatives and the dihydroxide of 4-acetamidodiphenyl selenide. *J. Chem. Soc.* 1928:2287-93.

27. Gibson, C. S. and Johnson, J. D. A. Synthesis with *beta-beta'*-dichloro-diethyl ether. Part II. Heterocyclic compounds containing two members of the oxygen group in the ring. 1-4-Selenoxan and its derivatives. *J. Chem. Soc.* (1931) 266-72.

28. Heath, F. H. and Semen, W. L. The reaction between selenium monochloride and ethylene. *J. Ind. Eng. Chem.* (1920) 12:1100-1.

29. Hilditch, T. P. and Smiles, S. Aromatic selenonium bases. *J. Chem. Soc.* (1908) 93:1384-87.

30. Hinsberg, O. *peri*-Naphthylendiamin und selenige Säure. *Ber.* (1919) 52B, 21-8.

- 30½. Jackson, C. D. Ueber einige neue organische Selenverbindungen. Ber. (1874) 7:1277-79.
31. Jackson, C. L. Ueber einige Methyl- und Benzylselenverbindungen. Ann. (1875) 179:1-20.
32. Jackson, C. L. Ueber Methyl und Benzylmonoselenid. Ber. (1875) 8:109-12.
33. Joy, C. A. Ueber das Selenathyl. Ann. (1853) 86:35-9.
34. Karrer, P. Ueber Selenazine-Farbstoffe. Ber. (1916) 49:597-603.
35. Karrer, P. Ueber Selen-methylenblau. Ber. (1918) 51:190-2.
- 35½. Karve, D. D. Acid nature of some derivatives of sulfur, selenium and tellurium. J. Indian Chem. Soc. (1925) 2:128-141, also J. Chem. Soc. (1925) 128:1188.
36. Konek, F. von and Schleifer, O. Ueber neue selenhaltige Derivate des Antipyrins. Ber. (1918), 51:842-55.
37. Krafft, F. and Lyons, R. E. Ueber Diphenylselenid und einige Derivate desselben. Ber. (1894) 27:1761-8.
- 37½. Krafft, F. and Lyons, R. E. Ueber Diphenyltellurid und ein Verfahren zur Darstellung von Sulfiden, Seleniden, und Telluriden. Ber. (1894) 27:1768-73.
38. Krafft, F. and Lyons, R. E. Ueber Diphenylselenon. Ber. (1896) 29:424-8.
39. Krafft, F. and Vorster, W. Ueber Umwandlung des Diphenylsulfons in Diphenylsulfid und Diphenylselenid. Ber. (1893) 26:2813-22.
40. Kunckell, F. Ueber einige Selenderivate des Anisols und Phenetols. Ber. (1895) 28:609-12.
41. Kunckell, F. and Zimmermann, R. Ueber Selenderivate aromatischer Ketone. Ann. (1901) 314:281-295.
42. Leicester, H. M. and Bergstrom, F. W. Salts of triphenylselenonium Hydroxide. J. Am. Chem. Soc. (1929) 51:3587-91.
43. Lesser, R. and Weiss, R. Ueber Selenoxanthon und Selenoxanthoncarbonsaure. Ueber selenhaltige aromatische Verbindungen. V. Ber. (1914) 47:2510-26.
44. Lesser, R. and Weiss, R. Ueber selenhaltige aromatische Verbindungen. Ber. (1924) 57B:1077-1082.
45. Lyons, R. E. and Bradt, W. E. Ueber die Darstellung von Organoselenverbindungen mittels der Friedel-Craftsschen Reaktionen. Ber. (1927) 60B:60-3.
46. Lyons, R. E. and Bush, G. C. Concerning *alpha*-dinaphthylselenide and telluride. J. Am. Chem. Soc. (1908) 30:831-6.
47. Michaelis, A. Ueber einige organische Verbindungen mit anorganischen Radicalen. Ber. (1897) 30:2821-2.
48. Michaelis, A. and Duntze, E. Ueber das Pseudo- und Bisselenopyrin. Ann. (1914) 404:36-45.
49. Michaelis, A. and Hagen, T. von. Untersuchungen ueber das 1-methyl- β -phenyl-5-pyrazolon. 3. Das Isoselenopyrin. Ann. (1907) 352:193-8.
50. Michaelis, A. and Hahn, W. Untersuchungen ueber β -Pyrazolone. 2. Ueber das β -Thiopyrin und das β -Selenopyrin. Ann. (1905) 338:292-310.

51. Michaelis, A. and Kunckell, F. Ueber organische Selenverbindungen. Ber. (1897), **30**:2823-8.
52. Michaelis, A. and Langenkamp, P. Ueber ein Selenopyrazolon und ueber das Selenopyramidon. Ann. (1914) **404**:21-36.
53. Morgan, G. T. and Burstall, F. H. Interactions of selenium oxychloride and phenols. J. Chem. Soc. **1928**:3260-70.
54. Morgan, G. T. and Burstall, F. H. Heterocyclic systems containing selenium. Part I. Cycloselenobutane (Tetrahydroselenophen). J. Chem. Soc. **1929**:1096-1103.
55. Morgan, G. T. and Burstall, F. H. Heterocyclic systems containing selenium. Part II. Cycloselenopentane. J. Chem. Soc. **1929**: 2197-2202.
56. Morgan, G. T. and Burstall, F. H. Heterocyclic systems containing selenium. Part III. Cycloselenopropane. J. Chem. Soc. **1930**: 1495-1502.
57. Morgan, G. T. and Burstall, F. H. Heterocyclic systems containing selenium. Part IV. Cycloselenohexane. J. Chem. Soc. **1931**: 173-80.
58. Morgan, G. T. and Drew, H. D. K. Researches on residual affinity and coordination. Part II. Acetylacetones of selenium and tellurium. J. Chem. Soc. (1920) **117**:1456-65.
59. Morgan, G. T. and Drew, H. D. K. Researches on residual affinity and coordination. Part III. Reactions of selenium and tellurium acetylacetones. J. Chem. Soc. (1921) **119**:610-25.
60. Morgan, G. T., Drew, H. D. K., and Barker, T. V. Researches on residual affinity and coordination. Part XI. Interaction of selenium tetrachloride with *beta*-diketones. J. Chem. Soc. (1922) **121**:2432-73.
61. Morgan, G. T. and Porritt, W. H. Arylselenoglycollic Acids. J. Chem. Soc. **1925**:1755-9.
62. Morgan, G. T. and Porter, C. R. Action of selenium tetrachloride on di- and tri-ketones. Selenium phenylacetyl- and *B*-phenylpropionyl-acetones. J. Chem. Soc. (1924) **125**:1269-77.
63. Morgan, G. T. and Reeves, H. G. Researches on residual affinity and coordination. Part XV. Interactions of acetylpropionylmethane and the tetrachloride of selenium and tellurium. J. C. S. (1923) **123**:444-52.
64. Morgan, G. T. and Smith, J. D. M. Researches on residual affinity and coordination. Part VI. Selenodithionic acid and its metallic salts. J. Chem. Soc. (1921) **119**:1066-70.
65. Nelson, R. E. and Jones, R. N. Organic compounds of selenium. I. The action of selenium oxychloride on ketones. J. Am. Chem. Soc. (1930) **52**:1588-90.
- 65½. Pellini, G. and Vio, G. Contributo allo studio dell' isomorfismo fra il telluro ed el selenio. Gazz. chim. ital. (1906) **36**:II:455-77 and R. A. L. (1906) [5] **15**:I:629-37.
66. Pieroni, A. and Balduzzi, G. The action of selenium bromide on the magnesium bromide derivatives. II. Gazz. chim. ital. (1915) **45**:II:106-111.
67. Pieroni, A. and Coli, C. Azione del bromuro di selenio sui magnesioalchili. Gazz. chim. ital. (1914) **44**:II:349-53.

68. Pieverling, L. von. Beitrag zur Kenntniss der Selenverbindungen. *Ann.* (1877) 185:331-9.
69. Pieverling, L. von. Ein Beitrag zur Kenntniss der Selenverbindungen. *Ber.* (1876) 9:1469-71.
70. Pope, W. J. and Neville, A. Assymmetric optically active selenium compounds and the sexavalency of selenium and sulphur. *d*- and *l*-Phenylmethyl-selenetine salts. *J. Chem. Soc.* (1902), 81:1552-63.
71. Rathke, B. Beitrage zur Kenntniss des Selens. *Ann.* (1869) 152: 181-220.
72. Sachs, F. Ueber Ringschlusse in Peristellung der Naphtalinreike. V. Naphtylendiamin und schwefel- (bezw. selen-) haltige Verbindungen. *Ann.* (1909) 365:142-50.
73. Schmidt, H. Ueber Athyl- und Allyl-selenharnstoff und ihre Halogenalkylate. *Ber.* (1921) 54B:2067-70.
74. Scott, A. Some alkyl derivatives of sulphur, selenium, tellurium. *Proc. Chem. Soc.* (1904) 20:156.
- 74½. Shaw, E. H. Jr. and Reid, E. E. Some derivatives of ethyl selenomercaptan. *J. Am. Chem. Soc.* (1926) 48:520-8.
75. Smiles, S. and Hilditch, T. P. Aromatic Selenonium Bases. *Proc. Chem. Soc.* (1907) 23:12.
76. Stoecker, M. and Krafft, F. Ueber Oxydation von Diphenyldiselenid. *Ber.* (1906) 39:2197-2201.
77. Strecker, W. and Willing, A. Einwirkung von Organomagnesiumverbindungen auf die Halogenide des Selens. *Ber.* (1915) 48:196-206.
78. Taboury, M. F. Contribution a l'etude des composés sulfures et selenies dans la serie aromatique. *Ann. Chim. Phys.* (1908) (8) 15:5-66.
79. Wassermann, A. and Wassermann, E. Preparation of compounds containing selenium. *D. R. P.* 261,793 (Dec. 24, 1911) and *J. Chem. Soc.* (1913) 104:1181-2.
80. Woehler, F. and Dean, J. Versuche ueber Telluramyl und Selenmethyl. *Ann.* (1856) 97:1-9.
81. Zeiser, F. Ueber einige schwefel-selen- und tellurhaltige Ditolylverbindungen. *Ber.* (1895) 28:1670-5.