TABLE I

REACTANTS, PROPERTIES AND ANALYSES OF THE ADDITION COMPOUNDS

No.	Phthalein	Metal chloride and mole ratio to one of phthalein	Solvent (and precipitant)	Description: Color and crystal form	M. p., °C.	Formula P = phthalein	Analyses (M. and H. = analyzed by Meyer and Hantzsch) * indicates atomic ratio rather than % analysis: Metal, % Calcd.	Metal, % Found	Chlorine, % Calcd.	Chlorine, % Found	Calcd.	Found
1		1 $SnCl_4$	Nitrobz. (CS_2)	Red	78–79	P·$SnCl_4$·$BzNO_2$			M. and H.			
2	Phenol	1 $SnCl_4$	Anisole (CCl_4)	Pale red		P·$SnCl_4$·BzOMe	Sn, 17.28	17.36			OCH_3, 4.52	4.28
3		1 $SnCl_4$	Benzonitrile (CCl_4)	Pale red		P·$SnCl_4$·BzCN	Sn, 0.83*	0.77*	1.00*	1.00*	N, 0.10*	0.11*
4	Phenol	1 $SnCl_4$	Nitrobz. (CS_2)	Red	128	P·$SnCl_4$			M. and H			
5	dimethyl	1 $SnCl_4$	Nitrobz. (CS_2)	Pink		2P·$SnCl_4$	Sn, 12.46	11.67	14.89	15.18		
6	ether[a]	2 $SbCl_5$	CCl_4	Carmine		P·$SbCl_5$	Sb, 0.69*	0.69*	1.00*	1.00*	OCH_3, 0.35*	0.33*
7		1 $SnCl_4$	CCl_4	Yellow		P·$SnCl_4$	Sn, 20.16	21.35	21.28	24.10	24.39	24.01
8		1 $SnCl_4$	Anisole	Red rhombic and prism		P·$SnCl_4$·BzOMe	Sn, 17.03	17.88	17.59	20.36	20.50	20.30
9	3,6-Dimethyl-	20 $SnCl_4$	Anisole	Irregular lamina	139, dec.	2P·3$SnCl_4$·2BzOMe	Sn, 21.53	22.53	23.51	25.73	25.17	
10	fluoran[b]	1 $SbCl_5$	CCl_4	Yellow	203	P·$SbCl_5$	Sb, 19.42	19.80		28.27	29.32	
11		2 $SbCl_5$	CH_3COOH	Or.-yel. needles recryst. from Me_2CO or $CHCl_3$	203	P·$SbCl_5$·HCl·AcH	Sb, 16.82	17.27	17.02	29.42	29.43	29.37
12		0.5 $SnCl_4$	Nitrobz. (CCl_4)	Yel.-brown		2P·$SnCl_4$	Sn, 12.84	12.27	11.96	15.34	16.58	
12a	Fluorescein	1 $SnCl_4$	Nitrobz. (CCl_4)	Yel.-brown		2P·$SnCl_4$	Sn, 12.84	11.75		15.34	16.33	
13	Fluorescein di-	0.5 $SnCl_4$	CCl_4	Yellow		P·$SnCl_4$	Sn, 19.13	18.95		22.86	23.61	
13a	methyl ether[c]	1 $SnCl_4$	CCl_4	Yellow		P·$SnCl_4$	Sn, 19.13	19.24		22.86		

[a] E. Grande, *Gazz. chim. ital.*, **26**, I, 222 (1896); R. Meyer and O. Spengler, *Ber.*, **38**, 1328 (1905). [b] F. Kehrmann and J. Knop, *ibid.*, **44**, 3510 (1911). [c] H. v. Liebig, *J. prakt. Chem.*, **88**, 26 (1913).

of the acid, $HSbCl_6$, all the compounds listed are included in four different classes: (A) $SnCl_4$·2P, substances (5), (12); (B) $SnCl_4$·P, substances (4), (7), (13); (C) $SnCl_4$·P·Solvent, substances (1), (2), (3), (8); (D) $SbCl_5$·P, substances (6), (10).

The chemical nature of the classes A, C and D seems to be clear. They are complex compounds of coördinated hexavalent tin or antimony, one molecule of the phthalein occupying a single coördination valence. The substances of class B may be interpreted by the hypothesis that the phthalein occupies two coördinated valences or they may be considered as bimolecular compounds with two coördination centers. They are mostly less deeply colored and are mainly formed if solvents lacking secondary valences are used.

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The Condensation of Phenol and Ethylene Oxide

BY RICHARD A. SMITH

The monophenyl ether of ethylene glycol was first prepared by the reaction between phenol and ethylene oxide in a sealed tube.[1] In this way, by heating at 180° for eight hours, we obtained an 85% yield based on the phenol.

More frequently, however, it has been prepared by the reaction of ethylene chlorohydrin with a phenol salt.[2] We find that using this latter method and refluxing the mixture for eight hours gives, after distillation through a 6-foot column and collection within 0.5°, 1.10 moles of phenoxy glycol (b. p. 165° at 80 mm.), or a 55% yield, from 2 moles of phenol. This same reaction, carried on in a sealed tube for eight hours, gives a 62.5% yield of the same purity.

We now find that by heating, without rocking, molar equivalents of phenol and ethylene oxide in an autoclave charged with hydrogen at tank pressure for four hours until the temperature reaches 200°, the pressure at that time being in excess of 2500 pounds per sq. in., and then allowing it to cool and redistilling the product in a vacuum, a yield of 94% of phenoxy glycol of the same purity is obtained.

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(1) Roithner, *Monatsh.*, **75**, 674 (1894).

(2) Bentley, Haworth and Perkin, *J. Chem. Soc.*, **69**, 164 (1896); Smith and Niederl, THIS JOURNAL, **53**, 808 (1931); Bellman, U. S. P. 1,841,431 (1932).