CLXXXVI.—*The Molecular Conductivity of some Sulphonium Compounds in Acetone.*

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IN recent years one of the authors has prepared a large number of new sulphonium compounds which are insoluble in water but are generally soluble in acetone. The acetone solutions of these compounds are fairly good conductors, indicating that the substances behave as salts. An investigation of the conductivity of these compounds was therefore undertaken, with results which are tabulated below. The molecular conductivity increases regularly with dilution and its magnitude is similar to that observed for potassium iodide. These compounds appear, therefore, to be true salts having molecular weights represented by their respective chemical formulæ, and dissociating as uni-univalent electrolytes, possibly into a negative iodine ion and a complex positive ion containing the sulphur chain.

The sulphonium compounds used in the present investigation have already been described (T., 1916, **109**, 1, 135, 606; 1919, **115**, 551, 1152).

Merck's chemically pure acetone was used. It was further purified by rectification over anhydrous calcium chloride, and had the constant b. p. 55.8° ; its specific conductivity was 3.3×10^{-6} reciprocal ohms at 27° . The temperatures of the different experiments were between 26.8° and 28.8° , and the results are expressed for the temperature 27.8° .

The results obtained in the conductivity experiments are tabulated below, where V is the volume in litres containing a gram-molecular weight of the salt.

Conductivity of Sulphonium Compounds in Acetone Solution at 27.8° .

Compound.	$V=64$.	$V=128$.	$V=256$.	Remarks.
(1) $\text{EtMeS}_2, \text{MeI}, 2\text{HgI}_2$	—	168.1	181.9	One hexad and one tetrad sulphur atom.
(2) $\text{Et}_2\text{S}_2, \text{EtI}, 2\text{HgI}_2$...	114.5	135.4	144.3	
(3) $\text{Et}_2\text{S}_2, \text{MeI}, \text{HgI}_2$	124.2	133.6	142.4	One hexad sulphur atom.
(4) $\text{Et}_2\text{S}_2, \text{EtI}, \text{HgI}_2$	—	125.1	139.4	
(5) $\text{Et}_2\text{S}_2, \text{PrI}, \text{HgI}_2$	113.3	121.7	136.9	
(6) $\text{Et}_2\text{S}_2, \text{BuI}, \text{HgI}_2$	113.0 *	120.5	132.3	* At $V=63.8$.
(7) $\text{Me}_2\text{S}_2, \text{MeI}, \text{HgI}_2$...	—	140.4	149.0	Chain compound with two tetrad sulphur atoms.
(8) $\text{Me}_2\text{S}_2, \text{EtI}, \text{HgI}_2$...	126.9	140.3	—	
(9) $\text{MeEtS}_2, \text{EtI}, \text{HgI}_2$...	127.0	139.0	—	
(10) $\text{Et}_2\text{S}_2, \text{EtI}, \text{HgI}_2$	119.7	132.4	142.8	
(11) $\text{Pr}_2\text{S}_2, \text{MeI}, \text{HgI}_2$...	117.6	129.3	140.3	
(12) $\text{Et}_2\text{S}_2, \text{PrI}, \text{HgI}_2$	112.2	125.3	133.6	
Potassium Iodide	—	115.5	130.5	At 25°

Discussion.

The disulphonium chain compounds with one hexad and one tetrad sulphur atom give the best conducting solutions in acetone. They are followed by the monosulphonium hexad compounds, whilst the disulphonium compounds with two tetrad sulphur atoms give the smallest conductivities, comparable with the values for potassium iodide in acetone solution.

The conductivities of similar compounds diminish, without exception, with increasing molecular weight, for example, on comparing the compounds numbered (1) and (2) it will be found that the replacement of two methyl groups by two ethyl groups lowers the conductivity from 168.1 to 135.4. This relation between conductivity and molecular weight is borne out by the values for the compounds (3), (4), and (5), and those for the compounds (9), (10), and (11).

The compounds (11) and (12) have identical molecular weights, but show an appreciable difference in their conducting power. This is probably due to the relative difference in the magnitude of the aliphatic radicles of the two compounds. Thus the methyl and propyl radicles differ by two methylene groups, whereas ethyl and propyl differ by only one.

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