XLIV.—*Contribution to the Characterisation of Racemic Compounds.*

By A. LADENBURG.

THE question whether an inactive substance is a mixture of the active components (*d*, *l*, mixture) or a racemic compound (*r*), has for a long time been open to discussion. I was certainly one of the first who occupied myself with this question, and during the past ten years

VOL. LXXXVI,

I I

have frequently taken the opportunity to discuss it (*Annalen*, 1888, 247, 66; *Ber.*, 1894, 27, 3065; 1895, 28, 163 and 1991; and 1897, 30, 485). Many others have examined and studied thoroughly this problem, however, without being able to arrive at a complete solution.*

Messrs. Kipping and Pope also have lately been studying this problem, and have come to the following conclusion.

"Only one method is at present of really practical use for characterising solid racemic compounds, that, namely, which is based on the determination of the crystalline forms of the optically active and externally compensated materials." This appears to me to be an attack on the views held by myself, and which I have already expressed as follows:—A mixture of enantiomorphic substances may be distinguished from a racemic compound by treating the substance in question, which must contain at least a small surplus of one or the other of the optically active modifications, with inactive substances. If this causes the substance to separate into fractions of different optical activity, it is a racemic compound.

The above-named investigators have tested my statement by experiment, but could not verify it; I, therefore, do not feel capable of maintaining it, but believe that the principle involved in it is correct, and has only been expressed in a misleading manner.

I give my previous statement, therefore, the following form:—To characterise an inactive substance, that is, whether it is a racemic compound, or a mixture of its active components, determine the solubility of the substance without and with the addition of a small quantity of one or the other of its optically active components at the same temperature and with the same solvent. If the solubilities are different, the substance in question is a racemic compound; if the same, it is an enantiomorphic mixture. (Mr. Pope's reply to Professor Ladenburg's statement will be found in the Proceedings, 1899, 15, 73.—[EDITOR.]

The correctness of this statement seems to me to be indisputable. I have verified it up till now by several examples which I shall continue to augment.†

1.—*Racemic acid.* Solubility in 100 parts of water at 18°.

* E. Fischer, *Ber.*, 1894, 27, 1525 and 3224; 1896, 29, 2927; Wallach, *Ann.*, 286, 140; Marchlewski, *Ber.*, 1892, 25, 1561; 1895, 28, 1611; Winther, *Ber.*, 1895, 28, 3000; I. Traube, *Ber.*, 1896, 29, 1394; Kipping and Pope, *Trans.*, Chem. Soc., 1897, 71, 989, and 1899, 75, 36; Landolt, *Optisches Drehungsvermögen*; Walden, *Ber.*, 1896, 29, 1692; Van't Hoff, *Ber.*, 1893, 31, 533; Küster, *Ber.*, 1898, 31, 1847.

† I desire to expressly state that Van't Hoff ("Bildung und Spaltung von Doppelsalzen") employed the solubility determination with success in the investigation of similar problems (see also Küster).

ETHERIFICATION CONSTANTS OF SUBSTITUTED ACETIC ACIDS. 467

I. and II. pure racemic acid. III. Racemic acid with an addition of tartaric acid.

I. 16·590. II. 16·591. III. 18·95.

2.—*Pyrotartaric acid*. Solubilities in 100 parts of water at 13°.

I. and II. pure pyrotartaric acid. III. The same with an addition of *d*-pyrotartaric acid.

I. 34·83 II. 34·88. III. 38·27.

3.—Mixture of *d*- and *l*-sodium ammonium tartrate. Solubilities in 100 parts of water at 12·3°.

I. Inactive mixture of equal quantities of the two salts.

II. The same, with the addition of about 8 per cent. of *d*-sodium ammonium tartrate.

I. 43·53. II. 43·41.

By these experiments, it seems to be proved that racemic and pyrotartaric acids are racemic compounds, whilst *d*- and *l*-sodium ammonium tartrate remain uncombined in the solution at 12·3°, which is quite in accord with previous experiments.