These classes correspond roughly to the three stages of a typical complete evaporation curve.

It is hoped that a more detailed report of this work will shortly be published.

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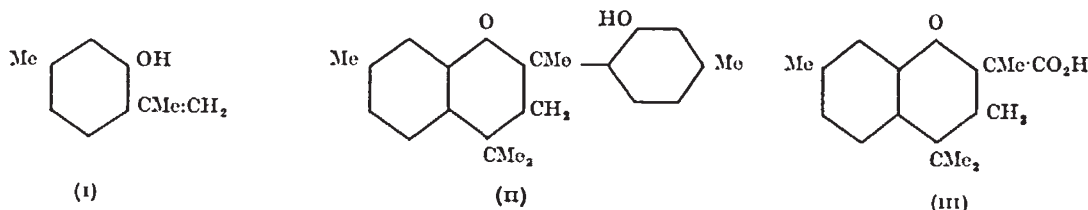   Oct. 12.

[1] Beibl, *Ann. Phys. Chem.*, 7, 888 (1883).
[2] Morse, *Proc. Amer. Acad. Arts and Sci.*, 45, 363 (1910).
[3] Langmuir, *Phys. Rev.*, 12, 368 (1918).
[4] Bechhold, *B.P.*, 472,623.

Structure of the Dimeric Forms of o-Isopropenyl-phenols

o-HYDROXY*iso*PROPENYL compounds, for example (I), readily polymerize to dimeric forms on long

standing or on treatment with hydrogen chloride[1]. These dimerides can be distilled under diminished pressure and are generally resinous at ordinary temperature, but they yield well crystalline *monoacetyl* derivatives, and contain only *one* free hydroxyl group. They exhibit only extremely feeble phenolic properties, are saturated, and depolymerize when distilled under atmospheric pressure. A study of the dimeric form of *isopropenyl-m*-cresol (I)[2] has shown that it yields on vigorous oxidation with potassium permanganate a stable carboxylic acid, $C_{13}H_{17}O.CO_2H$, by degradation of a *m*-cresyl group to a carboxyl group.

Only one very improbable structure has been proposed for these dimerides[3]; this contained an olefinic link, and was based on a formula for a condensation product of *m*-cresol and acetone now known to be incorrect[4]. There appears to be only one structure consistent with the above facts and with theoretical requirements. Solely on valency considerations, there are fourteen monohydric phenols (excluding those containing a 4-membered ring fused to an aromatic nucleus) which could be produced from two molecules of an *o*-hydroxy*iso*propenyl compound such as (I) by the mutual addition of the two *iso*propenyl groups and ring closure to a saturated cyclic ether. Of these structures, four may be rejected on stereochemical grounds as they contain 7- or 8-membered oxygen rings, and seven because they do not involve the unsymmetrical addition of the two *iso*propenyl groups, as occurs in the polymerization of styrenes and related compounds; the first step in the condensation is regarded as the formation of a

$$.CMe_2.CH:CMe. \overset{(+)}{\quad} \text{ or less probably } .CMe_2.CH_2.C(:CH_2). \overset{(+)}{\quad}$$

bridge between the two aromatic nuclei[5]. Finally, two of the remaining three possibilities may be eliminated because in ring closure an oxygen atom must unite with the more cationoid of the two unsaturated carbon atoms (marked with (+)), the double bonds being polarized owing to the adjacent phenolic group. In the case of either

intermediate the ring closure, therefore, leads to 2′-hydroxy-2 : 4 : 4 : 7 : 4′-pentamethylflavano (II), which must represent the dimeride of *iso*propenyl-*m*-cresol.

This structure adequately accounts for the cryptophenolic properties by the presence of the grouping .C(O.)Me.CH₂.CMe₂. in the *ortho* position to the hydroxyl; the group .CMe₂.CH₂.CMe₂ even para to a phenolic hydroxyl group renders it extremely feebly phenolic. The acid, 2 : 4 : 4 : 7-tetramethylflavane 2-carboxylic acid (III), would not be expected to undergo further ready oxidation.

The structures of the dimeric forms of other *o*-hydroxy*iso*propenyl compounds must be analogous to (II), and there can be little doubt that the dimeric forms of cyclohexenyl-*m*- and *p*-cresols[6] are similarly constituted.

A full account of this work will later be published elsewhere.

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[1] Fries, K., and Fickewirth, G., *Berichte*, 41, 368 (1908); idem, *Annalen*, 362, 42 (1908); Fries, K., Gross-Selbeck, W., and Wicke, O., *Annalen*, 402, 306 (1913); Schering-Kahlbaum A.-G., Eng. Pat., 273,684 (1927); Jordan, H., Eng. Pat., 279,856 (1929). There is some doubt as to whether the substances described by G. Guillaumin, *Bull. Soc. Chim.*, [4], 7, 378 (1910), and by J. B. Niederl, R. A. Smith and M. E. McGreal, *J. Amer. Chem. Soc.*, 53, 3390 (1931), as the dimeric form of *iso*propenyl-*m*-cresol are really this compound.
[2] Eng. Pat., 273,684 (1927); Baker, W., and Besly, D. M., *J. Chem. Soc.*, 199 (1939).
[3] Jordan, H., Eng. Pat., 279,856 (1929). This structure has been accepted by F. Boettcher, Dissertation, Berlin (1930).
[4] Baker, W., and Besly, D. M., *J. Chem. Soc.*, 199 (1939).
[5] Compare structure of a dimeric form of anethole, Goodall, G. D., and Haworth, R. D., *J. Chem. Soc.*, 2482 (1930).
[6] Boettcher, F., Dissertation, Berlin (1930).

Comparing Resistances of Four-Terminal Resistors

IN a letter in NATURE of September 30, Mr. Arvon Glynne describes an elegant and simple method for the comparison of four-terminal resistors. In it, as he points out, two of the 'potential' leads have to carry a small current. I would like to direct attention to another method, almost as economical in apparatus, in which no current passes in any of these leads. Resistors of about 1/1000 ohm can be compared in this way with an accuracy of one part per thousand, using apparatus ordinarily available in a laboratory. The principle will be evident from the accompanying diagram.

A low-resistance storage cell E supplies current to the circuit R, S; and R is adjusted so as to obtain zero deflection of the galvanometer G, first with the resistor r_1 and then with r_2 in circuit. If good storage cells are used in both circuits, steady balances are