0.00009 molecular equivalent. In 10 *N* hydrochloric acid the values are 0.00023 and 0.00012.

The importance of the phosphate precipitation for the qualitative and quantitative determination of the two elements is discussed.

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[CONTRIBUTION FROM THE HAVEMEYER CHEMICAL LABORATORY, NEW YORK UNIVERSITY]

THE BINARY SYSTEM CONSISTING OF ORTHO-CRESOL AND PARA-CRESOL

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In a study of the methods of purifying organic compounds by fractional crystallization, the three cresols have been under investigation in this Laboratory. The freezing-point curves for the mixture of *o*-cresol and *p*-cresol are given below, with the evidence of the formation of a 1:1 molecular compound.

The *p*-cresol used was a Kahlbaum preparation; m. p., 33.5°. After fractional crystallization, rapid centrifuging and drying over phosphorus pentoxide for seven days it was not found possible to raise the melting point above 34.2°, which is 0.2° below that given by Kendall and Carpenter.[2] In the belief that the principal impurity in the cresols, after crystallization, is water absorbed because of their extreme hygroscopicity, an apparatus was devised in which the sample could be dried in the same tube in which the melting-point determinations were made. The inner tube of a Beckmann freezing-point apparatus was fitted with an inlet tube through which air, dried over phosphorus pentoxide, was aspirated; the glass stirrer was fitted with a mercury seal. This apparatus was used for the pure cresols and for the various mixtures investigated, the weights of the two components being determined directly in the apparatus. With its use the purified *p*-cresol rose to a maximum freezing point of 34.80° after 24 hours' drying, and that of the purified *o*-cresol rose to 30.08°.

TABLE I

FREEZING POINTS OF *o*-CRESOL-*p*-CRESOL MIXTURES

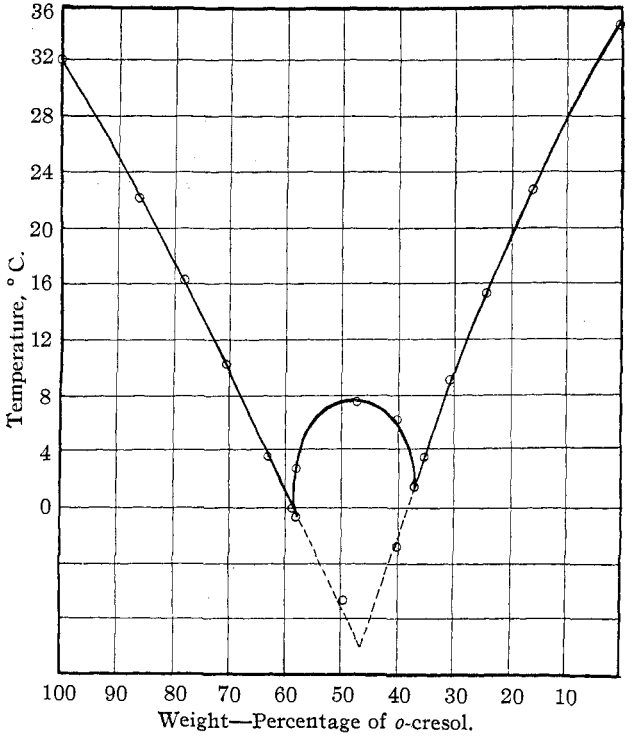
o-Cresol, % by wt.	100	86.01	77.97	70.36	62.89	57.80	57.80	49.30
F. p., °C.	30.08	22.20	16.41	10.27	3.70	−0.58	+2.88	−6.62
o-Cresol, % by wt.	47.02	39.83	39.83	34.99	30.31	23.95	15.59	0
F. p., °C.	+7.65	6.40	−2.70	+3.70	9.28	15.67	22.94	34.80

In Table I and Fig. 1 are shown the data on the freezing points of mixtures of the two components. The usual technique of freezing-point

[1] The material of this paper is part of a thesis presented by Irving Mosbacher for the degree of Master of Science at New York University.

[2] Kendall and Carpenter, THIS JOURNAL, 36, 2498 (1914).

determinations was observed with the added feature of complete drying by aspirated air. The thermometer was compared with a standard, and corrected for emergent stem. On account of the high viscosity which the binary solutions show near their freezing points, seeding with the appropriate solid component was usually necessary; on the portions of the curve where the solid phase is the compound, vigorous stirring and good luck in conjunction proved the only means of obtaining the solid phase. The eutectic between compound and *p*-cresol was found by the method of



cooling curves to be at 1.57°; the congruent melting point of the compound is, by graphic extrapolation, about +7.8° and the eutectic between *o*-cresol and the compound, by graphic extrapolation, is at 0°. Samples of *m*-cresol obtained were brought to crystallization with such difficulty that the substance has not yet been investigated.

Summary

o-Cresol and *p*-cresol form a solid 1:1 compound with a congruent melting point of +7.8° existing between the limits of 37% and 59% of *o*-cresol. The eutectics of the compound with *o*-cresol and *p*-cresol, respectively, are at 0° and 1.57°.

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