mixed benzoins. Benzoin itself as starting material gave benzoin as the end product.

2. An expeditious method for the preparation of α-aminobenzylphenylcarbinols is the catalytic reduction of the oximes of benzoins.

3. α-Aminobenzyl phenyl ketones are produced by the oxidation of α-aminobenzylphenylcarbinols.

4. α-Acetaminobenzyl phenyl ketones are produced by the oxidation of α-acetaminobenzylphenylcarbinols. The acetyl group may be removed by hydrolysis.

5. In the catalytic reduction of 2-chloro-α-hydroxybenzyl-4-methoxyphenyl ketoxime, the chlorine is largely split from the nucleus.

TUCKAHOE, NEW YORK

RECEIVED JULY 13, 1933
PUBLISHED OCTOBER 6, 1933

[CONTRIBUTION FROM KEDZIE CHEMICAL LABORATORY, MICHIGAN STATE COLLEGE]

Action of Aromatic Alcohols on Aromatic Compounds in the Presence of Aluminum Chloride. VI. Condensation of Phenylpropylcarbinol and α-Chlorobutylbenzene with Phenol

BY RALPH C. HUSTON AND HAROLD W. STRICKLER

The work here described may be considered a continuation of that with Lewis and Grotemut[1] on the condensation of secondary alcohols with phenols.

The phenylpropylcarbinol used was prepared from propyl bromide and benzaldehyde by the Grignard reaction. A yield of 81% was obtained when the reactants were used in the proportion of one of propyl bromide to one of magnesium to four-fifths of benzaldehyde[2,3] and when the reaction mixture was cooled to a slight visible reaction during the preparation of the Grignard reagent and in ice during the addition of the benzaldehyde.[4] Because of the lack of agreement[5] as to the boiling point and density of this compound these constants were carefully redetermined: b. p. 94–96° (6 mm.), sp. gr. 18/4°, 0.974.

Condensation of one mole of phenylpropylcarbinol (or α-chlorobutylbenzene) with one mole of phenol in petroleum ether at 20–25°, by means of one-half mole of aluminum chloride,[6] gave a 20% yield of 4-(α-phenylbutyl)-phenol and a 6% yield of 2-(α-phenylbutyl)-phenol. These were separated by repeated fractionation at reduced pressure. Solution of the crude

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(1) Huston, Lewis and Grotemut, THIS JOURNAL, **49**, 1365 (1927).

(2) Meisenheimer, *Ann.*, **442**, 180 (1925).

(3) Gilman and McCracken, THIS JOURNAL, **45**, 159 (1923).

(4) Rheinboldt and Roleff, *J. prakt. Chem.*, **109**, 175 (1925).

(5) Marshall and Perkin, *J. Chem. Soc.*, **59**, 885 (1891); Grignard, *Chem. Centr.*, 11, 7622 (1901); Klages, *Ber.*, **37**, 2312 (1904); Puyal and Montague, *Bull. soc. chim.*, **27**, 857 (1920); Strauss and Grindel, *Ann.*, **439**, 276, 312 (1924).

(6) Huston, THIS JOURNAL, **46**, 2777 (1924).

product in Claisen's alcoholic potassium hydroxide and extraction with petroleum ether gave no evidence of the formation of α-phenylbutyl phenyl ether (see table).

Condensation of α-chlorobutylbenzene[7] with phenol by Claisen's method[8] gave a 13% yield of 2-(α-phenylbutyl)-phenol, a 12% yield of phenylbutylene[9] and a 10% yield of α-phenylbutyl phenyl ether. The last two products were obtained by fractionation of the petroleum ether extract of the alcoholic potassium hydroxide solution.

Bromination of 4-(α-phenylbutyl)-phenol in cold chloroform with two moles of bromine gave 4-(α-phenylbutyl)-2,6-dibromophenol. This was also produced by condensing phenylpropylcarbinol with 2,6-dibromophenol by means of aluminum chloride.

The preparation of 2-(α-phenylbutyl)-4,6-dibromophenol was effected either by bromination of the substituted phenol or from 2,4-dibromophenol by the Claisen reaction.

Esters were prepared by the pyridine method.[10]

TABLE I

Compound	Physical appearance	Empirical Formula	M. p. or b. p., °C.	Carbon, % Calcd.	Carbon, % Found		Hydrogen, % Calcd.	Hydrogen, % Found	
4-(α-Phenylbutyl)-phenol	Mats of fine silky threads from pet. ether. (Shows tendency to swell and retain solvent)	$C_{16}H_{18}O$	M 49–50; B 154–155 (6 mm.)	84.91	84.89	84.64	8.02	7.97	7.94
2-(α-Phenylbutyl)-phenol	Viscous oil	$C_{16}H_{18}O$	B 144–146 (6 mm.)	84.91	84.61	84.70	8.02	8.025	8.065
α-Phenylbutyl phenyl ether	Mobile colorless liquid (sp. gr. at 25°/4° 1.0067, n_{20} 1.5507)	$C_{16}H_{18}O$	B 123–125 (6 mm.)	84.91	84.77	84.76	8.02	8.01	7.96
4-(α-Phenylbutyl)-2,6-dibromophenol	Viscous oil	$C_{16}H_{16}OBr_2$	B 188–189 (6 mm.)	Br, 41.63	41.49				
2-(α-Phenylbutyl)-4,6-dibromophenol	Viscous oil	$C_{16}H_{16}OBr_2$	B 184–185 (6 mm.)	Br, 41.63	41.36				
Benzoyl ester of 4-(α-phenylbutyl)-phenol	Monoclinic crystals	$C_{23}H_{22}O_2$	M 70–71	83.58	83.4		6.71	6.76	

The benzoyl, benzene sulfonyl and *p*-toluene sulfonyl esters of 2-(α-phenylbutyl)-phenol were heavy oils which failed to crystallize.

EAST LANSING, MICHIGAN

RECEIVED JULY 17, 1933
PUBLISHED OCTOBER 6, 1933

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(7) This was prepared from the pure alcohol. It boiled at 73–75° (6 mm.) and had a sp. gr. at 18/4° 1.0182. *Cf.* Klages, *Ber.*, **37**, 2312 (1904).

(8) Claisen, *Ann.*, **442**, 210 (1925).

(9) Radziszewski, *Ber.*, **9**, 260 (1876).

(10) Einhorn and Holland, *Ann.*, **301**, 95 (1898).