esters which were liquid at room temperature; for instance, the melting point of the dipentyl ester of the 1,6-dicarboxylic acid is −29° to −26°, while the melting point of the corresponding 2,3-diacid ester is −14° to −12°. The same relationship holds true for the other normally liquid 1,6- and 2,3-diacid esters. The melting points of these liquid esters were not considered accurate enough to record in the tables.

The fact that the 2,6-dicarboxylic acid derivatives are always the highest melting may be attributable to the higher degree of symmetry of the molecule. This isomer is the only one of the three di-β-isomers which possesses a point of symmetry.

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m-Dibenzylbenzene

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SOME CONFUSION exists in the literature with respect to physical properties of the isomeric dibenzylbenzenes and also with respect to their identification as products of acid catalyzed condensations with benzene.

We have repeated the reaction of benzene with:

A. Benzyl chloride and $TiCl_4$ according to Stadnikow (*6*).
B. Benzyl alcohol and *p*-toluenesulfonic acid according to Pratt (*4, 5*).

The reaction products were easily analyzed by gas chromatography. Table I compares present results with those previously reported.

Chromatographic separations were made on an Aerograph Model A-100-C instrument equipped with a 0.25-inch inner diameter asphalt-on-fire-brick column, 10 feet long, temperature = 285° C., flow rate = 30 cc./minute of helium. Under these conditions, retention times for the pure compounds were as follows: diphenylmethane, 5 minutes; *o*-dibenzylbenzene, 35.5 minutes; *m*-dibenzylbenzene, 38 minutes; *p*-dibenzylbenzene, 51 minutes:

Both Stadnikow and Pratt have reported a melting point of 58° C. for *m*-dibenzylbenzene, while a recent report (*1*) indicated that it was a liquid. Accordingly, all three isomeric dibenzoylbenzenes were synthesized unequivocally and subsequently converted to the corresponding dibenzylbenzenes by the previously unreported copper chromite catalyzed hydrogenation technique at 2000 p.s.i. and 200° C. The data are summarized in Table II.

Table I. Product Ratios of Dibenzylbenzenes from Alkylation of Benzene

Reaction Type	Stadnikow (*6*)	Pratt (*4, 5*)	Present Results	
A	mainly meta-	...	40 ortho- 10 meta- 50 para-	Total = 20%
B	...	17% meta-exclusively	35 ortho- 20 meta- 45 para-	Total = 17%

Table II. Properties of Dibenzoyl-and Dibenzylbenzenes

Product	Yield, % Found	Yield, % Lit. Ref.	Melting Point Found	Melting Point Lit. Ref.
		Dibenzoylbenzene		
o-	47[a]	32	147	148
m-	66		100	99.5-100
p-	70[d]		160	158-159
		Dibenzylbenzene		
o-	73[e]	66	78-79	78.7-79.4
m-[b]	81[c]		16.9-17.0	58
p-	73		86	86

[a] Method Preparation, Jensen (*2*). [b] b.p. 175°/1 mm. (223° C./13 mm.); N_D^{20} = 1.6037 (Lit. = 1.6038). [c] Method of preparation, Buu-Hoi (*1*). [d] Method of Preparation, Munchmeyer (*3*). [e] Method of preparation, Cat. hydrogenation of dibenzoylbenzene.

CONCLUSION

The acid catalyzed alkylation of benzene with benzyl-chloride and benzyl alcohol is not an exception to the general pattern; secondary alkylation occurs 80 to 90%, *ortho and para*.

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