

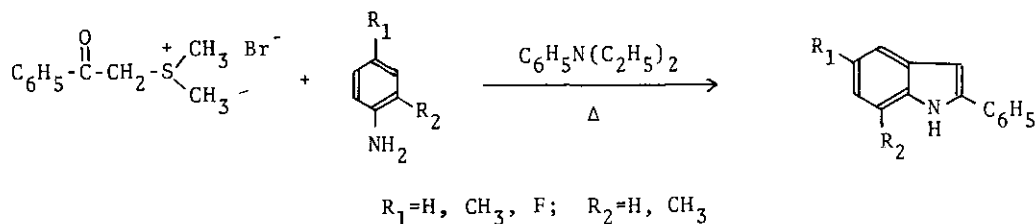
REACTION OF PHENACYLDIMETHYLSULFONIUM IODIDE WITH o-PHENYLENE-DIAMINES

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The reaction of o-phenylenediamine with phenacyldimethylsulfonium iodide gave 2-phenylquinoxaline. The same reaction by use of 3,4-diaminotoluene and 1,2-diamino-4-chlorobenzene instead of o-phenylenediamine afforded a mixture of the corresponding 6- and 7-substituted 2-phenylquinoxalines. In the case of 1,2-diamino-4-nitrobenzene, 6-nitro-2-phenylquinoxaline was obtained. On the other hand, the reaction of 1,2-diamino-4-methoxybenzene and phenacyldimethylsulfonium iodide gave 7-methoxy-2-phenylquinoxaline. Furthermore, condensation of maleonitrile with phenacyldimethylsulfonium iodide gave 2,3-dicyano-6-phenylpyrazine.

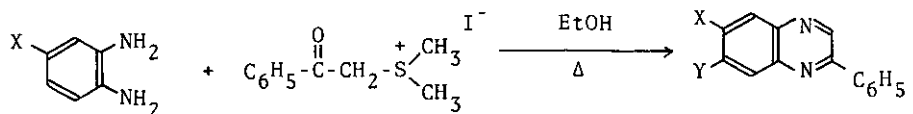
Sulfonium salts are widely used as one of significant and versatile intermediates in organic synthesis¹. The reaction of phenacyldimethylsulfonium bromide with primary aromatic amines provides the useful method for the synthesis of 2-phenylindoles² (Scheme 1). We examined the similar reaction by use of o-phenylene-



Scheme 1

diamine ($R_2=NH_2$ in Scheme 1) and phenacyldimethylsulfonium iodide in the expectation that 2-phenylquinoxaline would be formed instead of 7-aminoindole. We wish to report these results in this paper.

o-Phenylenediamine (1a) was heated in ethanol under reflux in the presence of one equiv. of phenacyldimethylsulfonium iodide (2)³ for 2 hr to afford 2-phenylquinoxaline (3a) in 27 % yield, mp 75-77 °C (lit.⁴ mp 77 °C) as expected, though in low yield. It is of interest to examine whether 6-substituted 2-phenylquinoxaline or the corresponding 7-isomer would be obtained on treatment of 4-substituted 1,2-diaminobenzene with 2. Treatment of 3,4-diaminotoluene (1b) with 2 in ethanol as above yielded a mixture of 6-methyl-2-phenylquinoxaline (3b; 14 %) ^{5,6}, mp 77-79 °C (lit.⁵ 79 °C) and 7-methyl-2-phenylquinoxaline (3c; 14 %), mp 133-136 °C (lit.⁵ 136 °C) without positional selectivity. The structures of these products were confirmed by conversion to the corresponding N_4 -oxides (4a) and (4b), respectively by oxidation with m-chloroperbenzoic acid (m-CPBA) as Mannore⁷ and Kano⁸ reported. These position isomers were easily distinguished by the observation of the aromatic proton signals in their ¹HNMR spectra^{7,8}. The reaction of 1,2-diamino-4-chlorobenzene (1c) with 2 under the similar conditions gave a mixture of 6-chloro-2-phenylquinoxaline (3d)^{6,7} and 7-chloro-2-phenylquinoxaline (3e)^{6,7} in 27 % yield; this has led to a mixture of the corresponding N_4 -oxides (4c) and (4d)⁸ by oxidation with m-CPBA to determine the structures and the ratio of 3d and 3e, since it was difficult to distinguish the isomers of these parent bases from their ¹HNMR spectra. The ratio of 3d and 3e was easily confirmed as 1:2 by the observation of the aromatic proton signals in the ¹HNMR spectra of 4c and 4d as above. In the case of 1,2-diamino-4-nitrobenzene (1d) and 1,2-diamino-4-methoxybenzene (1e), the reaction proceeded with the positional selectivity. Condensation of 1d with 2 as above gave 6-nitro-2-phenylquinoxaline (3f)⁸ in 30 % yield without formation of the corresponding 7-isomer, mp 208-210 °C (lit.⁸ mp 209-210 °C). On the other hand, the reaction between 1e and 2 afforded 7-methoxy-2-phenylquinoxaline (3g)⁸, mp 86-88 °C (lit.⁸ mp 86-88 °C). These products were easily distinguished from alternative possible isomers by oxidation to N_4 -oxides (4e) and (4f) with m-CPBA, respectively. The positionally selective synthesis of disubstituted quinoxaline derivatives (3f) and (3g) most probably proceeds by preferential reaction of the α -methylene carbon of the sulfonium salt with more basic amino group in 1d and 1e (Scheme 2).



1a X=H

b X=CH₃

c X=Cl

d X=NO₂

e X=OCH₃

2

3a X=Y=H

b X=CH₃, Y=H

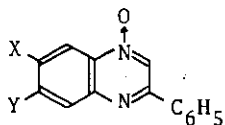
c X=H, Y=CH₃

d X=Cl, Y=H

e X=H, Y=Cl

f X=NO₂, Y=H

g X=H, Y=OCH₃



4a X=CH₃, Y=H

b X=H, Y=CH₃

c X=Cl, Y=H

d X=H, Y=Cl

e X=NO₂, Y=H

f X=H, Y=OCH₃

Scheme 2

Successively we examined the condensation of diaminomaleonitrile (5) with 2. Diaminomaleonitrile was heated with 2 in ethanol for 2 hr to yield 2,3-dicyano-6-phenylpyrazine (6) in 72 % yield, mp 168-169 °C (lit.⁹ 170 °C) (Scheme 3).



6

Scheme 3

References and Notes

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