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# NOTE ON SOME AZOMETHINES FROM *p*-DIALKYLAMINOBENZALDEHYDES

R. STUART TIPSON AND MARY A. CLAPP

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During the course of other work, it recently became necessary to prepare some azomethines of *p*-dialkylaminobenzaldehydes. Werner (1) states that, on treatment with *p*-dimethylaminobenzaldehyde, "no reaction occurs with . . . heterocyclic amino compounds," presumably in the presence of mineral acid at room temperature. We find that, on heating, this aldehyde reacts with 2-aminopyridine and with 6-methoxy-8-aminoquinoline to give the corresponding Schiff bases.

As mentioned in the experimental section, our observations do not agree with Werner's in several particulars.

## EXPERIMENTAL

*p-Dimethylaminobenzylidene p'-carboxyanil.* A solution of 10 g. of *p*-dimethylaminobenzaldehyde in 50 cc. of absolute ethanol was filtered into a filtered solution of 9.2 g. of *p*-aminobenzoic acid in 100 cc. of warm absolute ethanol. After 10 minutes at room temperature, separation of golden-yellow crystals commenced spontaneously. After standing overnight at room temperature, the crystals were filtered off, washed with two 25-cc. portions of absolute ethanol, and dried; wt. 14.3 g. (79.5%); m.p. 264–265° [Wayne and Cohen (2) gave m.p. 261–262°; Werner (1), m.p. 245°]. Werner (1) stated that it crystallizes as dark red rosettes and that "in ethyl alcohol . . . the reaction proceeds very slowly."

*Anal.* Calc'd for $C_{16}H_{16}N_2O_2$: C, 71.60; H, 6.0; N, 10.45.
Found: C, 71.91; H, 6.1; N, 10.32.

*p-Diethylaminobenzylidene p'-carboxyanil.* A solution of 10 g. of *p*-diethylaminobenzaldehyde in absolute ethanol was added to a solution of 7.8 g. of *p*-aminobenzoic acid in absolute ethanol as in the previous experiment. Crystallization of the product commenced after 30 minutes at room temperature; after standing overnight at room temperature, the product was filtered off and dried; wt. 11.2 g. (67%); m.p. 241–242°. It was recrystallized from chloroform (65 volumes), giving yellow crystals; m.p. 242–243°.

*Anal.* Calc'd for $C_{18}H_{20}N_2O_2$: C, 72.93; H, 6.8; N, 9.46.
Found: C, 72.74; H, 6.6; N, 9.31.

*p-Dimethylaminobenzylidene p'-sulfoanil.* Sulfanilic acid (11.6 g.) was suspended in 200 cc. of absolute ethanol, a solution of 10 g. of *p*-dimethylaminobenzaldehyde in 50 cc. of absolute ethanol was added, and the mixture boiled under reflux during four hours.

After standing overnight at room temperature, the insoluble, orange-colored material was filtered off and dried; wt. 17.2 g.; m.p. above 360°. This was recrystallized from 150 volumes of water, giving 12 g. of orange-colored crystals; m.p. above 360° [Werner (1) reports m.p. 300°]. It was dried at 134° at 20 mm. for analysis.

*Anal.* Calc'd for $C_{15}H_{16}N_2O_3S$: N, 9.21; S, 10.54.
Found: N, 9.22; S, 10.34.

*p-Diethylaminobenzylidene p'-sulfoanil.* A solution of 10 g. of *p*-diethylaminobenzaldehyde in absolute ethanol was added to a suspension of sulfanilic acid (9.8 g.) in absolute ethanol and the mixture treated as in the previous experiment. After standing overnight at room temperature, the insoluble, red material was filtered off and dried; wt. 17 g.; m.p. 252–253° (decomp.). This was recrystallized from 150 volumes of water, giving 11.2 g. of red crystals; m.p. 252° (decomp.). It was dried at 134° and 20 mm. for analysis.

*Anal.* Calc'd for $C_{17}H_{20}N_2O_3S$: C, 61.40; H, 6.1; N, 8.43; S, 9.65.
Found: C, 61.10; H, 6.1; N, 8.83; S, 9.64.

*p-Dimethylaminobenzylidene p'-dimethylaminoanil.* A mixture of 9.2 g. of *p*-dimethylaminoaniline with 10 g. of *p*-dimethylaminobenzaldehyde was heated under reflux in a boiling water-bath during 15 minutes. It rapidly set to a solid, golden-yellow mass. It was stirred with absolute ethanol and filtered, giving 12.2 g. of yellow crystals; m.p. 231–232°. [Bender (3) and Moehlau (4) give m.p. 229–230°.]

*Anal.* Calc'd for $C_{17}H_{21}N_3$: C, 76.35; H, 7.9; N, 15.73.
Found: C, 76.43; H, 8.0; N, 16.15.

The mother liquor was evaporated to dryness, dissolved in 65 cc. of boiling chloroform, cooled, and the solution diluted with 105 cc. of heptane, giving a second crop; wt. 4.4 g. (total yield, 93%).

*p-Diethylaminobenzylidene p'-diethylaminoanil.* A mixture of 9.3 g. of *p*-diethylaminoaniline with 10 g. of *p*-diethylaminobenzaldehyde was heated in an open flask in a bath at 110° during 30 minutes. The brown, crystalline product was dissolved in 54 cc. of boiling 95% ethyl alcohol under reflux, and the solution cooled, yielding 14.2 g. (78%) of yellowish-brown crystals having m.p. 118–120°. It was recrystallized twice from 3 volumes of 95% ethyl alcohol, giving orange-colored crystals; m.p. 120–122°. [Doja and Mokeet (5) gave m.p. 147–149°.]

*Anal.* Calc'd for $C_{21}H_{29}N_3$: C, 77.96; H, 9.0; N, 13.00.
Found: C, 77.93; H, 8.8; N, 13.08.

*p-Dimethylaminobenzylidene p'-amidosulfoanil.* A mixture of 10 g. of *p*-dimethylaminobenzaldehyde with 11.5 g. of sulfanilamide was heated under reflux (Stark and Dean trap) at 130–135° (bath temp. 150–154°) during 45 minutes. The yellow, semi-crystalline reaction mixture was then cooled to room temperature and extracted with a boiling mixture of 160 cc. of absolute ethanol plus 30 cc. of acetone under reflux. The yellow, insoluble solid was filtered off and dried; wt. 10.6 g.; m.p. 208–210°. [According to Gray *et al.* (6), their alcohol-acetone insoluble material "consisted of the anil in a pure state, m.p. 229°."] In a repetition of the preparation, the initial product had m.p. 210–212°.

*Anal.* Calc'd for $C_{15}H_{17}N_3O_2S$: N, 13.86; S, 10.57.
Found: N, 13.97; S, 10.60.

On recrystallizing the anil from 80 volumes of acetone plus 40 volumes of pentane [as suggested by Kolloff and Hunter (7)] the melting point remained unchanged (208–210°). On the other hand, recrystallization of the crude anil (9.3 g.; m.p. 210–212°) from 400 volumes of absolute ethanol gave 3.1 g. of yellow crystals; m.p. 228°. [Werner (1) gives m.p. 212–214°; Kolloff and Hunter (7), m.p. 226–227°; Gray *et al.* (6), m.p. 228°.]

*Anal.* Calc'd for $C_{15}H_{17}N_3O_2S$: C, 59.36; H, 5.65; N, 13.86; S, 10.57.
Found: C, 59.71; H, 5.61; N, 14.20; S, 10.54.

*p-Diethylaminobenzylidene p'-amidosulfoanil.* A mixture of 10 g. of *p*-diethylaminobenzaldehyde with 9.7 g. of sulfanilamide was treated as in the previous experiment, the semi-crystalline reaction mixture dissolved in 70 volumes of boiling chloroform, filtered hot and the filtrate cooled, giving 0.8 g. of yellow crystals, m.p. 164–166°, which had an analysis agreeing with that calculated for sulfanilamide. The mother liquor was diluted with 70 volumes of pentane, giving 6.6 g. of yellow crystals; m.p. 154–156°. On recrystallization from 70 volumes of chloroform plus 70 volumes of pentane, it had m.p. 156°.

*Anal.* Calc'd for $C_{17}H_{21}N_3O_2S$: N, 12.69; S, 9.68.
Found: N, 12.87; S, 9.45.

*2-(p-Dimethylaminobenzylidene) aminopyridine.* A mixture of 25 g. of *p*-dimethylaminobenzaldehyde with 15.8 g. of 2-aminopyridine was heated under reflux (Stark and Dean trap), the bath temperature being gradually raised from 182° to 240° during 1 hour; 2 cc. of water collected in the trap. The mixture was then cooled to room temperature, treated with 125 cc. of absolute ethanol, and filtered, giving 10.5 g. of pale brown crystals; m.p. 118–120°. This was recrystallized from 5 volumes of absolute ethanol, yielding 6.8 g. of pale brown crystals; m.p. 122–124°.

*Anal.* Calc'd for $C_{14}H_{15}N_3$: C, 74.62; H, 6.7; N, 18.67.
Found: C, 74.71; H, 6.6; N, 19.08.

*6-Methoxy-8-aminoquinoline.* A suspension of 10 g. of recrystallized 6-methoxy-8-nitroquinoline (m.p. 162–163°) plus 0.2 g. of Adams' platinum catalyst in 100 cc. of absolute methanol was reduced with hydrogen at room temperature in the Burgess-Parr apparatus. The initial pressure was approximately 40 lb. per sq. inch; as hydrogenation proceeded the nitro derivative dissolved. After absorption was complete (45 minutes), the catalyst was filtered off, washed with methanol, and the filtrate plus washings evaporated to dryness (yield, quantitative). The product was purified by distillation under high vacuum; it boiled at 115–121° at 0.05 mm. (bath temp. 130–135°) and had m.p. 50–51° (colorless crystals). Schulemann *et al.* (8) gave b.p. 137–138° at 1 mm., m.p. 41°; Magidson *et al.* (9), b.p. 160–161° at 4 mm., m.p. 51°; Crum and Robinson (10), b.p 162° at 0.2 mm., m.p. 41°; Misani and Bogert (11), b.p. 165° at 6 mm., m.p. 50°.

*6-Methoxy-8-(p-dimethylaminobenzylidene)aminoquinoline.* A mixture of 10 g. of distilled, crystalline 6-methoxy-8-aminoquinoline (m.p. 50–51°) with 8.6 g. of *p*-dimethylaminobenzaldehyde plus 10 drops of piperidine in 25 cc. of toluene was boiled gently under reflux (Stark and Dean trap full of toluene) for 10 hours. A total of 0.8 cc. of water (80% of theoretical) was collected in the trap (bath temperature 141–149°; reaction temperature 119–122°). The brown reaction solution was chilled and scratched, with spontaneous crystallization into an almost solid mass. The crop of yellow crystals was filtered off, washed on the filter with two 10-cc. portions of ether, and dried in the vacuum desiccator over $P_2O_5$; wt. 11 g. (63%); m.p. 184–189°. It was recrystallized from 5 volumes of chloroform diluted with 10 volumes of hexane, giving yellow crystals, m.p. 189–191°. These crystals were recrystallized from 15 volumes of toluene, giving 5.8 g. of yellow crystals; m.p. 192–194°.

*Anal.* Calc'd for $C_{19}H_{19}N_3O$: C, 74.71; H, 6.3; N, 13.77.
Found: C, 74.52; H, 6.3; N, 13.49.

The residue from the combined mother liquors of the crude, crystalline product (from three such preparations) was reheated with piperidine plus toluene, as described above, yielding a further 9.5 g. of crude, crystalline product.

*6-Methoxy-8-(p-dimethylaminobenzyl)aminoquinoline.* A suspension of 5 g. of recrystallized 6-methoxy-8-(*p*-dimethylaminobenzylidene)aminoquinoline (m.p. 192–194°) plus 0.2 g. of Adams' platinum catalyst in 150 cc. of absolute methanol was reduced with hydrogen as described for 6-methoxy-8-aminoquinoline. After absorption was complete (25 minutes), the reaction mixture was diluted with 50 cc. of chloroform (with the dissolution of the yellow solid present), the catalyst was filtered off, washed with chloroform and methanol, and the filtrate plus washings evaporated to dryness. The brown-green, semicrystalline residue was suspended in 5 volumes of cold absolute methanol and kept overnight at room temperature. The insoluble, brown-green crystals were filtered off and dried in the vacuum desiccator; wt. 2.1 g. (42%); m.p. 127–129°). This solid was dissolved in boiling absolute ethanol (15 volumes) and filtered hot through a fluted filter with spontaneous crystallization. The yellow-tan crystals were filtered off and dried; wt. 1.3 g.; m.p. 123–125°. The yellow-tan crystals were recrystallized from 150 volumes of hexane giving yellow crystals melting at 125–126°. On mixture of a sample with pure starting material, it gave a partial melt at 125–128° and a complete melt at 142–144°.

*Anal.* Calc'd for $C_{19}H_{21}N_3O$: C, 74.22; H, 6.9; N, 13.68.
Found: C, 74.24; H, 6.7; N, 13.74.

## SUMMARY

A number of new azomethines of *p*-dialkylaminobenzaldehydes are described, and several previously reported in the literature have been reinvestigated.

PITTSBURGH 13, PA.

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