

## Preparation of Some Acylated Methylhydrazines

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During an investigation on thiosemicarbazides<sup>1</sup> it was desired to use some derivatives of methylhydrazine which had been acylated at the methyl-bearing nitrogen with a group which could easily be split off. For this purpose the reaction of methylhydrazine with ethyl formate, ethyl trifluoroacetate, isopentyl nitrite, and some alkyl carbonates, was investigated.

The methylhydrazinolysis of esters of carboxylic acids has been studied in detail by Hinman and Fulton.<sup>2</sup> They found that both isomers were formed, but the symmetrical isomer was the predominant product. The yield of the unsymmetrical isomer decreased when the size of the acyl group increased. They found the greatest yield (23 %) of the unsymmetrical isomer in the case of methyl acetate. A greater yield of unsymmetrical isomer should be expected in the case of esters of formic acid, as in this case the unsymmetrical isomer should be favoured by both sterical and inductive effects. In agreement with this, we found this

isomer to be the predominant product in the reaction with ethyl formate. This predominance was shown by infrared spectroscopy, paper chromatography according to Hinman,<sup>3</sup> and the ability to form a benzylidene compound with benzaldehyde or *p*-nitrobenzaldehyde (Table 1). These benzylidene compounds were isolated in all cases and their IR spectra recorded. Except for the nitroso compound, they all show a strong absorption band around 1700  $\text{cm}^{-1}$ , showing that the carbonyl group in the ester has not reacted.

Also in the reaction with ethyl trifluoroacetate, diethyl carbonate and diphenyl carbonate only the 1-substituted 1-methylhydrazine was isolated. From dibenzyl carbonate, however, both 1-benzyloxycarbonyl-1-methylhydrazine and the isomer could be isolated, the latter as the predominant reaction product.

We did not succeed in preparing a benzylidene or *p*-nitrobenzylidene derivative of 1-trifluoroacetyl-1-methylhydrazine. However the IR and NMR spectra of this compound indicated with certainty that it is a 1,1-substituted hydrazine.

The nitroso compound was also prepared by Thiele,<sup>4</sup> but the method described in this paper shows definite advantages over Thiele's method.

*Experimental.* *N*<sup>1</sup>-Formyl-*N*<sup>1</sup>-methylhydrazine Methylhydrazine (9.0 g) and ethyl formate (14.2 g) were mixed in ethanol (15 ml) (a slightly exothermic reaction took place) and the mixture refluxed for 6 h. The reaction mixture was evaporated on a water bath at

Table 1. Benzylidene- and *p*-nitrobenzylidene derivatives,  $\text{CH}_3\text{NR}'\text{N} = \text{CHR}^2$ .

| R <sup>1</sup>     | R <sup>2</sup>        | Yield % | M.p. °C             | Formula   | Analysis |       |       |       |       |       |
|--------------------|-----------------------|---------|---------------------|---|----------|-------|-------|-------|-------|-------|
|                    |                       |         |                     |   | C        |       | H     |       | N     |       |
|                    |                       |         |                     |   | Found    | Calc. | Found | Calc. | Found | Calc. |
| Formyl             | <i>p</i> -Nitrophenyl | 78      | 221-22 <sup>a</sup> | C <sub>9</sub> H <sub>9</sub> N <sub>3</sub> O <sub>3</sub>   | 52.35    | 52.17 | 4.14  | 4.38  | 20.34 | 20.28 |
| Ethoxycarbonyl     | <i>p</i> -Nitrophenyl | 66      | 155-56 <sup>a</sup> | C <sub>11</sub> H <sub>13</sub> N <sub>3</sub> O <sub>4</sub> | 52.60    | 52.58 | 5.20  | 5.20  | 16.77 | 16.73 |
| Phenoxycarbonyl    | Phenyl                | 80      | 99-100 <sup>b</sup> | C <sub>15</sub> H <sub>14</sub> N <sub>2</sub> O <sub>2</sub> | 70.80    | 70.85 | 5.30  | 5.55  | 11.07 | 11.02 |
| Benzyloxy-carbonyl | <i>p</i> -Nitrophenyl | 95      | 131-32 <sup>a</sup> | C <sub>16</sub> H <sub>15</sub> N <sub>3</sub> O <sub>4</sub> | 61.14    | 61.33 | 4.69  | 4.83  | 13.40 | 13.41 |

Solvents used for recrystallisation: a) ethanol; b) 50 % ethanol.

50°C *in vacuo*, the residue being a yellow oil, b.p. 80°C at 0.8 mm Hg. Yield 10 g (68 %), (Found: C 33.08; H 8.27; N 37.62. Calc. for  $C_2H_8N_2O$ : C 32.42; H 8.16; N 37.82).

*N*<sup>1</sup>-Methyl-*N*<sup>1</sup>-trifluoroacetylhydrazine. Methylhydrazine (11.5 g) and ethyl trifluoroacetate (35.5 g) were mixed in ethanol (30 ml) as described for the formyl compound. Yield after distillation *in vacuo* 16 g (45 %), b.p. at 1 mm Hg 110–111°C. The compound crystallised on cooling, and was recrystallised from a mixture of butanol and cyclohexane, m.p. 65–66°C. (Found: C 25.45; H 3.88; Calc. for  $C_2H_5F_3N_2O$ : C 25.36; H 3.55).

*N*<sup>1</sup>-Ethoxycarbonyl-*N*<sup>1</sup>-methylhydrazine. Methylhydrazine (13.6 g) and diethyl carbonate (35.4 g) were mixed, and the solution was refluxed for 24 h. The mixture was distilled *in vacuo*, and the fraction boiling at 80–84°C at 14 mm Hg was collected. Yield 10 g (30 %). (Found: C 40.60; H 8.72; N 23.58; Calc. for  $C_4H_{10}N_2O_2$ : C 40.66; H 8.53; N 23.71).

*N*<sup>1</sup>-Phenoxyacetyl-*N*<sup>1</sup>-methylhydrazine. Methylhydrazine (9.2 g) and diphenyl carbonate (42.4 g) were dissolved in ethanol (50 ml) and the mixture refluxed for 11 h. The ethanol was distilled *in vacuo* at 70°C, and the residue dissolved in dry ether (0.5 l) and then dry hydrogen chloride was bubbled through until no further precipitation occurred. The hydrochloride was recrystallised from propanol m.p. 165–67°C. Yield 19 g (47 %). (Found: C 47.30; H 5.31; N 13.90; Calc. for  $C_8H_{11}N_2O_2Cl$ : C 47.46; H 5.49; N 13.87).

*N*<sup>1</sup>-Benzyloxycarbonyl-*N*<sup>2</sup>-methylhydrazine. Methylhydrazine (4.6 g) and dibenzyl carbonate (24.2 g) were dissolved in ethanol (25 ml) and refluxed for 26 h. Ethanol and benzylalcohol were removed *in vacuo* at 1 mm Hg at 90°C. On cooling, the product settled to a semisolid mass which became crystalline after washing with 3 portions of hexane each of 25 ml. The product was recrystallised from cyclohexane, m.p. 81–82°C. Yield 5 g (31 %). (Found: C 59.90; H 6.79; N 15.50. Calc. for  $C_9H_{12}N_2O_2$ : C 59.98; H 6.91; N 15.55). Hydrochloride, recrystallised from abs. ethanol m.p. 167–69°C. (Found: C 49.85; H 6.16; N 13.07. Calc. for  $C_9H_{13}N_2O_2Cl$ : C 49.86; H 6.07; N 12.93).

*N*<sup>1</sup>-Benzyloxycarbonyl-*N*<sup>1</sup>-methylhydrazine. The hexane solution from *N*<sup>1</sup>-benzyloxycarbonyl-*N*<sup>2</sup>-methylhydrazine was evaporated. To the oily residue 10 ml of 4 N hydrochloric acid were added, and the acidic solution

extracted with 40 ml of ether to remove benzylalcohol. After removing the dissolved ether, the solution was made basic with sodium hydroxide, when an oil separated, which was extracted twice with 25 ml of ether. The ethereal solution was first dried over sodium sulfate and then evaporated, leaving 2 g of an oil. By making the *p*-nitrobenzylidene derivative it could be concluded that the oil contained at least 95 % of the isomer with a free  $NH_2$  group. The oil was dissolved in 25 ml of dry ether and dry hydrogen chloride bubbled through. The hydrochloride was recrystallised from butanol. M.p. 161.0–162.5°C. (Found: C 50.05; H 6.08; N 12.95. Calc. for  $C_9H_{13}N_2O_2Cl$ : C 49.86; H 6.07; N 12.93).

*N*<sup>1</sup>-Nitroso-*N*<sup>1</sup>-methylhydrazine. To methylhydrazine (4.6 g), cooled in water, was added isopentyl nitrite (16 ml, calc. amount 14 ml) during a period of  $\frac{1}{2}$  h, and a very vigorous reaction took place. The mixture was extracted with 100 ml of light petroleum (b.p. 30–60°C) to remove isopentylalcohol and unreacted isopentyl nitrite. This left a yellow oil which solidified on cooling. The petroleum ether contained a little of the nitroso compound which could be removed on cooling. The compound was purified by dissolving in ether and precipitating with light petroleum, m.p. 44–45°C (Ref.<sup>4</sup>, 45°C). Yield 4 g (55 %). The benzylidene compound was also prepared. M.p. recryst. from methanol 77–78°C (Ref.<sup>4</sup> 78°C).

*Benzylidene and p*-nitrobenzylidene derivatives (Table 1) were prepared by condensation of the hydrazines with aldehydes in ethanolic solution.

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