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CLEAVAGE OF O-ACYLATES OF ISATIN 3-OXIMES IN THE PRESENCE OF ALCOHOLS

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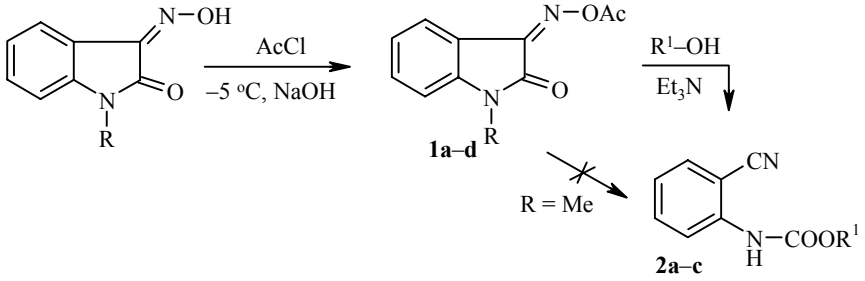
In continuing our study of the reaction of O-acyl derivatives of isatin 3-oximes with nucleophilic agents, we have established that no structural changes occur when oximes **1a-d** are heated with alcohols. However, when fairly small amounts of triethylamine are added to hot alcoholic solutions of O-acylates of isatin 3-oximes **1a,c**, an exothermic reaction occurs and in most cases, we were able to isolate the corresponding N-(2-cyanoaryl)carbamates **2a-c** in good yields; but in the case of *tert*-butyl alcohol, the yields were only up to 11%. The cleavage of heterocyclic nucleus is catalyzed by pyridine, too, but the yields are by half lower. The nature of the acyl group almost exerts no influence on the yield of carbamate.



1 a, c R = H, **b, d** R = Me; **a**, **b** Ac = MeCO, **c**, **d** Ac = 4-$MeC_6H_4SO_2$;
2 a R^1 = Et, **b** R^1 = CMe_3, **c** R^1 = CH_2Ph

O-acyl derivatives of 1-substituted isatin 3-oxime do not enter into this reaction, and are recovered unchanged.

2,3-Indoledione-3-oxime O-Acetate (1a). 2,3-Indoledione 3-oxime (3.24 g, 20 mmol) was dissolved in acetone (30 ml) and cooled; then acetic anhydride (2.24 g, 22 mmol) was added, and stirring and cooling was continued (so the temperature did not rise above -5°C) while solution of NaOH (0.96 g, 24 mmol) in water (10 ml) was added dropwise. The mixture was stirred for a few minutes and diluted with water (~50 ml). The precipitate was filtered by suction and washed with water. Obtained 3.63 g (89%) of O-acetate; mp 130°C (trichloromethane), R_f 0.17 (Silufol UV-254, trichloromethane–acetone, 9:1). Mass spectrum, *m*/*z* (*I*, %): 204 $[M]^+$ (3), 162 (20), 144 (100), 116 (20), 91 (3), 90 (4), 89 (11), 65 (4), 63 (5), 62 (65), 60 (12). ^{1}H NMR spectrum (Hitachi R-22, 90 MHz, acetone-d_6, internal standard HMDS), δ, ppm: 6.78-8.00 (m, 4H arom.); 2.30 (3H, s, CH_3).

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1-Methyl-2,3-indoledione 3-Oxime O-Acetate (1b) was obtained as in the previous experiment from of 1-methyl-2,3-indoledione 3-oxime (1.76 g, 10 mmol), acetic anhydride (1.12 g, 10 mmol), acetone (20 ml), NaOH (0.48 g, 12 mmol) in water (5 ml). Yield 2.02 g (93%); mp 154°C (trichloromethane), R_f 0.38 (Silufol UV-254, trichloromethane–acetone, 9:1). Mass spectrum, *m*/*z* (*I*, %): 218 $[M]^+$ (19), 176 $[M–CH_2CO]^+$ (100), 159 $[M–CH_3CO_2]^+$ (25), 144 (3), 131 (6), 117 (3), 104 (3), 102 (3), 90 (4), 76 (4), 43 $[CH_3CO]^+$ (47).

2,3-Indoledione 3-Oxime O-Tosylate (1c) was obtained as in the previous experiment from 2,3-indoledione 3-oxime (1.62 g, 10 mmol), *p*-toluenesulfonyl chloride (2.1 g, 11 mmol), acetone (30 ml), solution of NaOH (0.46 g, 12 mmol) in water (5 ml). Yield 2.1 g (67%) [1]; mp 210-211°C (trichloromethane). Mass spectrum, *m*/*z* (*I*, %): 316 [residual $M]^+$, 145 $[M–TosO]^+$ (18), 144 $[M–TosOH]^+$ (100), 118 $[M–TosOH–CN]^+$ (14), 116 $[M–TosOH–CO]^+$ (40), 102 $[C_6H_4CN]^+$ (2), 91 $[C_7H_7]^+$ (8), 89 (23), 76(7), 64 $[SO_2]^+$ (15), 62 (18).

1-Methyl-2,3-indoledione 3-Oxime O-tosylate (1d) was obtained as in the previous experiment from 1-methyl-2,3-indoledione 3-oxime (1.76 g, 10 mmol) and *p*-toluenesulfonyl chloride (2.06 g, 11 mmol), acetone (20 ml), NaOH (0.48 g, 12 mmol) in water (5 ml). Yield 2.98 g (90%); mp 177-178°C (ethyl acetate). Mass spectrum, *m*/*z* (*I*, %): 330 $[M]^+$ (19), 159 $[M–TosO]^+$ (45), 155 $[Tos]^+$ (25), 144 $[M–TosO–CH_3]^+$ (11), 133 $[M–TosO–CN]^+$ (20), 131 $[M–TosO–CO]^+$ (15), 103 (5), 102 (8), 91 (100), 76 (5), 65 (19).

Ethyl N-(2-Cyanophenyl)carbamate (2a). Mixture of oxime **1a** (2.04 g, 10 mmol), ethanol (10 ml), and triethylamine (1.5 ml) was carefully heated until onset of an exothermic reaction, and then boiling was maintained for another 15 min. The solution was cooled down to room temperature and then diluted with water (50 ml); the precipitate was filtered by suction and washed with cold water. After crystallization from hexane, 1.24 g (65%) of carbamate were obtained; mp 107°C [2], R_f 0.37 (Silufol UV-254, tetrachloromethane–ethyl acetate, 4:1). Mass spectrum, *m*/*z* (*I*, %): 190 $[M]^+$ (35), 162 $[M–C_2H_4]^+$ (20), 145 $[M–OC_2H_5]^+$ (64), 144 $[M–C_2H_5OH]^+$ (48), 118 $[M–C_2H_4–CO_2]^+$ (100), 117 $[M–CO_2C_2H_5]^+$ (20), 91 (8), 90 (12), 65 (13), 64 (7), 46 (11).

***tert*-Butyl N-(2-Cyanophenyl)carbamate (2b)** was obtained as in the previous experiment. Yield 11%; mp 76-78°C (hexane), R_f 0.52 (Silufol UV-254, trichloromethane–benzene, 4:1). Mass spectrum, *m*/*z* (*I*, %): 218 $[M]^+$ (14), 203 $[M–CH_3]^+$ (5), 162 $[M–C_4H_8]^+$ (37), 145 $[M–C_4H_9O]^+$ (51), 144 $[M–C_4H_9OH]^+$, 118 $[M–C_4H_8–CO_2]^+$ (100), 117 (15), 90 (17), 65 (21), 57 (45), 56 (28).

Benzyl N-(2-Cyanophenyl)carbamate (2c) was obtained similarly from compound **1a** (2.04 g, 1 mmol), benzyl alcohol (5 ml), and triethylamine (1.5 ml) after cooling. The precipitate was suction-filtered and recrystallized from a mixture of benzene–hexane, 1:1. Yield 1.07 g (43%); mp 112-113°C. R_f 0.44 (Silufol UV-254, tetrachloromethane–ethyl acetate, 4:1). Mass spectrum, *m*/*z* (*I*, %): 252 $[M]^+$ (29), 145 $[M–C_6H_5CH_2O]^+$ (100), 144 $[M–C_6H_5CH_2OH]^+$ (68), 117 $[M–CO_2CH_2C_6H_5]^+$ (37), 108 (7), 107 (23), 91 $[C_7H_7]^+$ (45), 90 (18), 77 (15), 65 (19), 64 (12).

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