NITROBENZALDEHYDES IN THE REFORMATSKY REACTION

1958

SovietRxiv

Abstract

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CHEMISTRY

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NITROBENZALDEHYDES IN THE REFORMATSKY REACTION

(Presented by Academician B. A. Kazanskii, 23 V 1958)

Attempts to introduce carbonyl compounds containing a nitro group into the Reformatsky reaction have hitherto been unsuccessful (^{1}). The use of these compounds in the Grignard reaction likewise did not give satisfactory results (^{2}). However, the reasons for these failures are not the same in the two cases.

In the Grignard reaction, the obstacle was reduction of the nitro group by the Grignard reagent. This difficulty was overcome by carrying out the reaction at low temperature (^{2}). Consequently, the presence of a nitro group does not prevent the reaction of organometallic compounds with the carbonyl group.

In the Reformatsky reaction, however, with carbonyl compounds containing a nitro group, practically all of the zinc remains unchanged. Since the mixed organozinc compound must here be formed in the presence of the carbonyl compound, it should be assumed that the nitro group contained in it prevents the interaction of zinc with the halo ester. This could be confirmed by the fact that the readily proceeding reaction of acetophenone with bromoacetic ester is completely stopped by the addition of 0.05 mole of nitrobenzene, even if it is carried out in tetrahydrofuran in the presence of mercuric chloride, which, as is known, facilitates the course of the reaction (^{3}).

Obviously, the Reformatsky reaction involving carbonyl compounds containing a nitro group should be carried out in two stages: first preparing the "Reformatsky reagent" from zinc and the halo ester, and then allowing it to act on the carbonyl compound.

For this purpose we used the method of Siegel and Keckeis (^{4}), developed by them for carrying out the Reformatsky reaction with quinones, where it was necessary to exclude reduction of the quinones by zinc. In this way we succeeded in obtaining, from *o*-, *m*-, and *p*-nitrobenzaldehydes and bromoacetic ester, the corresponding esters of β-hydroxy-β-nitrophenylpropionic acids. The successful performance of these reactions confirms the assumption stated above, namely that the nitro group prevents the formation of mixed organozinc compounds.

Experimental Part

To 8 g of zinc shavings, washed with a mixture of acetone and 2% aqueous hydrochloric acid, then with acetone and dried with a drying lamp, in 100 ml of dry ether, 5 drops of an ethereal solution of $MgJCH_3$ are added, followed by 10 g (0.06 mole) of bromoacetic ester, and the mixture is boiled for 2–2.5 hours with stirring. The resulting solution of the "Reformatsky reagent" is decanted from the unreacted zinc (~5.5 g) onto 4.5 g (0.03 mole) of *o*-, *m*-, or *p*-nitrobenzaldehyde, boiled for 1 hour, cooled, stirred for 30 min with 50 ml of 10% acetic acid, the aqueous layer is separated, extracted with ether, and the extract is combined with the ethereal layer. The ethereal solution is shaken

30 min with 5 ml of a 40% solution of sodium bisulfite, washed with water, with 10% sodium carbonate solution, again with water, dried over anhydrous magnesium sulfate, the ether is distilled off, and the residue is distilled in vacuum.

Table 1

Starting nitrobenzaldehyde	Product obtained	Yield, g	Yield, %*	b.p.	m.p., our data	m.p., literature data
Ortho-	Ethyl β-hydroxy-β-(o-nitrophenyl)propionate	3.0	41.9	170–175°/5 mm	Liquid**	Amide, m.p. 197° (5)
Meta-	Ethyl β-hydroxy-β-(m-nitrophenyl)propionate	3.5	48.9	179–182°/2.5 mm	58° (from alcohol)	55° (6)
Para-	Ethyl β-hydroxy-β-(p-nitrophenyl)propionate	3.6	50.3	184–186°/3 mm	46.5–47° (from ether)	45–46° (6)

* Based on the aldehyde charged.
** 0.5 g of ethyl β-hydroxy-β-(o-nitrophenyl)propionate, 1 ml of 25% aqueous ammonia, and 0.5 ml of methanol are left for 48 h, filtered, and 0.35 g of the amide of β-hydroxy-β-(o-nitrophenyl)propionic acid is obtained, m.p. 197° (from alcohol).

The characteristics of the products obtained are given in Table 1. From the bisulfite extract, about 1 g of unreacted aldehyde is isolated with soda.

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named after K. E. Voroshilov

Received
16 IV 1958

REFERENCES CITED

1. C. R. Hauser, W. H. Puterbaugh, *J. Am. Chem. Soc.*, **75**, 1068 (1953); Z. Horii, H. Kugita, T. Takeuchi, *J. Pharmac. Soc. Japan*, **73**, 895 (1953); *Ref. Zh. Khim.*, No. 22, 51835 (1955).
2. M. S. Newman, A. S. Smith, *J. Org. Chem.*, **13**, 592 (1948).
3. R. E. Miller, F. F. Nord, *J. Org. Chem.*, **15**, 728 (1951).
4. A. Siegel, H. Keckeis, *Monatsh.*, **84**, 910 (1953).
5. A. Einhorn, *Ber.*, **16**, 2645 (1883).
6. A. Einhorn, G. Prausnitz, *Ber.*, **17**, 1660 (1884).

Note: Figure translations are in progress. See original paper for figures.