

REDUCTION OF 8-NITROQUINOLINES

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Many reducing agents are known for unsubstituted and substituted 8-nitroquinolines. However, many of these reagents quite often give unreliable yields or the methods of extraction are tedious. We now report the successful reduction of four different 8-nitroquinolines in good yields.

Results and Discussion

Methods available for the reduction of 8-nitroquinoline include that of Winterbottom¹ who reduced this compound in a low pressure Parr hydrogenator using acetone as solvent and Raney nickel as a catalyst; yield obtained was 69%. Dikshoorn² used iron powder and 50% acetic acid and obtained a yield of 75%. In reducing 2-methyl-8-nitroquinoline with stannous chloride Gerdeisen³ obtained a 90% yield, while Madeja⁴ obtained 89% yield using iron powder and acetic acid at 60–70°. 8-Nitro-2-phenylquinoline was reduced by Elderfield⁵ *et al.* using stannous chloride in hydrochloric acid at 10°, a strict control of temperature being required. A yield of 80–90% was obtained. 8-Nitro-4-phenylquinoline was reduced by Case⁶ with stannous chloride to obtain a 68% yield.

When these methods were employed it was found that yields were not always reproducible and working up of the mixtures may be tedious and time-consuming, this being due to prolonged stirring at a fixed temperature; also, the presence of large quantities of Fe(OH)₃ or SnO₂ may make the product difficult to extract. In addition, the possible formation of chelates in not too acidic mixtures and the reluctance of the quinolines to be removed from the metal sites has to be considered.

These factors influenced us to use a reducing agent that did not involve metal ions in solution, and where a temperature control was not so important or alternatively

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¹ Winterbottom, R., *J. Am. chem. Soc.*, 1940, **62**, 160.

² Dikshoorn, R. P., *Recl Trav. chim. Pays-Bas*, 1929, **48**, 147.

³ Gerdeisen, F., *Ber. dt. chem. Ges.*, 1889, **22**, 245.

⁴ Madeja, K., *J. prakt. Chem.*, 1962, **17**, 97.

⁵ Elderfield, R. C., Gensler, W. J., Williamson, T. A., Griffing, J. M., Kupchan, S. M., Maynard, J. T., Kreysa, F. J., and Wright, J. B., *J. Am. chem. Soc.*, 1946, **68**, 1584; Elderfield, R. C., Gensler, W. J., Bembry, T. H., Williamson, T. A., and Weisl, H., *J. Am. chem. Soc.*, 1946, **68**, 1590.

⁶ Case, F. H., *J. org. Chem.*, 1951, **16**, 1541.

easily maintained. Dewar and Mole⁷ successfully reduced 8-nitroquinoline in 65% yield using palladized charcoal and hydrazine hydrate. Another reducing agent was that of Raney nickel W-7 and hydrazine hydrate suggested by Balcom and Furst⁸ for reduction of any aromatic nitro compound. A review on the use of this reducing agent has been published.⁹

It was found that Raney nickel W-7 and hydrazine hydrate successfully reduced the four 8-nitroquinolines (see Table 1). Best results were obtained when the solvent was hot, and vigorous frothing and bubbling occurred upon addition of Raney nickel W-7 to the mixture (see Experimental). In all cases the products were pure enough after the first precipitation to be used further in the synthesis of substituted phenanthrolines. This method was advantageous in that the reaction was swift, the temperature was easily controlled, and the final product was readily isolated in good yields.

Experimental

The procedure for the reduction can be considered quite general, the quantities of reactants are given in Table 1. Yields were approximately 80% in all cases. The reduction of 8-nitroquinoline only is given.

TABLE 1
REDUCTION OF NITROQUINOLINES TO AMINOQUINOLINES

Starting Material	Wt. (g)	EtOH (ml)	N ₂ H ₄ ·H ₂ O (ml)	M.P. of Amine
8-Nitroquinoline	10	100	12.5	61° (lit. 62–64°)
2-Methyl-8-nitroquinoline	11	120	14	53 (lit. 56)
8-Nitro-2-phenylquinoline	6.7	100	9	109 (lit. 111)
8-Nitro-4-phenylquinoline	6.7	100	9	89 (lit. 90)

Reduction of 8-Nitroquinoline

Raney nickel W-7 was prepared as was done by Billica and Adkins.¹⁰

In a 2-l. three-neck flask was placed 10 g of 8-nitroquinoline and 95 ml of ethanol. The flask was warmed and the nitro compound dissolved. While still hot the flask was placed in a heating mantle at low heat and 12.5 ml of hydrazine hydrate (100%) were added. Two Quickfit condensers were joined and placed in one of the necks of the flask. An efficient mechanical stirrer was placed in the second neck of the flask, a filter funnel was placed in the third neck and enough Raney nickel W-7 to cover the end of a spatula (c. 1 g) was placed in the funnel and washed through with a little alcohol. A stopper was quickly inserted into the third neck after removal of the funnel.

The reaction that occurred was instantaneous. There was much heat evolved accompanied by frothing and bubbling. Once the reaction started to subside more Raney nickel W-7 was added (1 g) when once again bubbling and frothing appeared. After the third gram of Raney nickel W-7 was added the reaction became less violent as the hydrazine supply was exhausted. After the fourth or fifth addition the reaction was complete. The frothing progressed through a brownish yellow stage and then to a dirty cream stage. Time for reaction was 10–15 min.

⁷ Dewar, M. J. S., and Mole, T., *J. chem. Soc.*, 1956, 2556.

⁸ Balcom, D., and Furst, A., *J. Am. chem. Soc.*, 1953, **75**, 4334.

⁹ Furst, A., Berlo, R. C., and Hooton, S., *Chem. Rev.*, 1965, **65**, 51.

¹⁰ Billica, R. H., and Adkins, H., *Org. Synth.*, 1955, Coll. Vol. III, 176, 179.

The resulting greenish solution was filtered to remove Raney nickel W-7 which was maintained in a moist condition. The ethanol was treated with charcoal and filtered; and a light yellow solution resulted. The ethanol was removed under vacuum, and a yellow product remained mixed with some impurity. When dry light petroleum or hexane (80–100 ml) was added to the yellow product and heated, the amine dissolved leaving behind a small tarry matter, which was extracted several times with hexane. On removal of the solvent 8-aminoquinoline was obtained in 80% yield.