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DIMERIZATION AND DENITRATION OF 1-METHYL-3,6,8-TRINITRO-2-QUINOLONE

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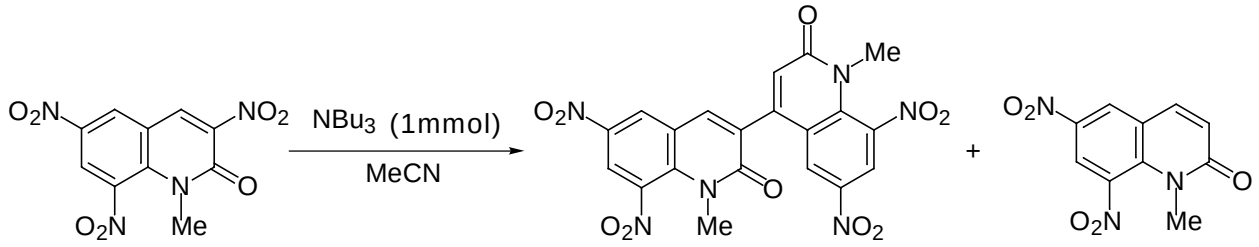
Abstract - The reaction of 1-methyl-3,6,8-trinitro-2-quinolone (**1**) with tertiary amine caused dimerization and denitration. Dimerization predominantly proceeded at room temperature, and denitration mainly occurred under heated conditions.

A great number of quinoline alkaloids have been isolated, and determination of their structures and syntheses have been performed. Among them, alkaloids having the 1-methyl-2-quinolone (MeQone) skeleton form a large family.[1-3] From a viewpoint of biochemical interest, it is highly required to synthesize novel MeQone derivatives and to develop facile method for functionalizing MeQone.

1-Methyl-3,6,8-trinitro-2-quinolone (**1**) showed interesting chemical behaviors. *cine*-Substitution brought about the regioselective C-C bond formation at the 4-position.[4] It was also found that the nitro group at the 8-position sterically activated the quinolone ring.[5] In this communication, we would like to show a novel reactivity of **1**, dimerization and denitration, observed in the reaction with tertiary amines.

Trinitroquinolone (**1**) was stirred with NBu_3 at room temperature in MeCN for 7 days. Concentration of the



1 (1 mmol) **2** **3**

Temp. /°C	Solv./mL	Time/d	Ratio of **2**/**3**[a]	Isolated Yield/%	
				2[b]	**3**
25	10	7	88/12	81	6
60	10	1	63/37		
80	10	1	40/60[c]		
60	50	1	25/75	20	58

[a] Determined by ^{1}H NMR. [b] Based on **1**. [c] A small amount of by-products was formed.

reaction mixture followed by column chromatography gave 3,4'-bis(1-methyl-6,8-dinitro-2-quinolone) (**2**) in 81 %. In the ^{1}H NMR of **2**, two singlets were observed at 7.06 and 8.56 ppm in addition to two pairs of doublets (H5, H7, H5' and H7' hydrogens). This fact revealed that a couple of 6,8-dinitroquinolones was connected at the 3- and 4'-positions. Other spectral and analytical data supported this dimeric structure.[6]

Several other tertiary amines were employed instead of NBu_3. To a solution of quinolone (**1**) (0.1 mmol) in CD_3CN (0.3 mL), amine (0.1 mmol) was added, and the reaction mixture was monitored with ^{1}H NMR for 7 days. In each case, signals other than those of **1** and **2** were not observed in the aromatic region. Considerable differences of reactivity between amines appeared. No reaction proceeded in the reaction of **1** with NMe_3 and NBn_3. When NEt_3 and NPr_3 were used, dimer (**2**) was produced in 34 % and 76 % yields, but these reactions were much slower than the case of NBu_3 (93 %). Although the role of amines has not been clarified, the longer carbon chain caused more positive effect.

Dinitroquinolone (**3**) became the major product under heated conditions. Dilution of the reaction mixture to avoid the intermolecular coupling reaction increased the ratio of **3**. Since isolated **2** and **3** did not interconvert on treatment with NBu_3 in MeCN, one was not an intermediate of the other. It seems that dimer (**2**) is kinetically controlled product, and **3** is thermodynamically controlled product.

The present denitration newly established the preparative method for 6,8-dinitroquinolone (**3**) in cooperation with trinitration of MeQone.[4] This method is superior to the direct preparation from MeQone by the nitration with 15 M HNO_3 and 18 M H_2SO_4 (in 30 % yield), which suffers from troublesome isolation from the mixture with by-products.[5] As a result, the former procedure furnished dinitroquinolone (**3**) in a higher yield (53 % based on MeQone) with simple manipulations.

Two kinds of methods for modification of the MeQone skeleton were provided.

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4 N. Nishiwaki, A. Tanaka, M. Uchida, Y. Tohda, and M. Ariga, *Bull. Chem. Soc. Jpn.*, 1996, **69**, 1377. Nitration of MeQone with fuming HNO_3 (d = 1.52) afforded trinitroquinolone (**1**) in 90 % yield.

5 N. Nishiwaki, C. Tanaka, M. Asahara, N. Asaka, Y. Tohda, and M. Ariga, *Heterocycles*, 1999, **51**, 567. 3,6-Dinitroquinolone (41 %), 6-nitroquinolone (19 %) and **1** (9 %) were produced together with **3**.

6 **2**; Pale yellow powder (eluted with $CHCl_3$); mp 288-291 °C (decomp); IR (Nujol / cm^{-1}) 1662, 1554, 1346; ^{1}H NMR (400 MHz, DMSO-d_6, TMS) δ 3.41 (s, 3H), 3.43 (s, 3H), 7.06 (s, 1H), 8.56 (s, 1H), 8.57 (d, *J* = 2.5 Hz, 1H), 8.95 (d, *J* = 2.5 Hz, 1H), 9.02 (d, *J* = 2.6 Hz, 1H), 9.10 (d, *J* = 2.6 Hz, 1H); ^{13}C NMR (100 MHz, DMSO-d_6 / ppm) 34.7 (q), 34.7 (q), 122.0 (s), 122.6 (d), 122.7 (d), 122.7 (d), 124.6 (s), 126.1 (s), 128.4 (d), 129.4 (s), 137.3 (s), 137.5 (s), 137.7 (s), 138.2 (s), 140.1 (d), 140.2 (d), 140.3 (s), 145.0 (s), 160.8 (s), 161.1 (s); MS (FAB) 497 (M^++1). Anal. Calcd for $C_{20}H_{12}N_6O_{10}$; C: 48.40, H: 2.44, N: 16.93. Found; C: 48.50, H: 2.42, N: 17.22.