398. *The Nitration of Some Derivatives of Eugenol.*

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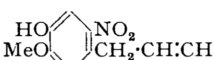
6-*Nitroeugenol* has been prepared and orientated by degradation to the known 6-nitrohomovanillic and 6-nitrohomoveratric acids.

5-Nitroeugenol is known (Weselsky and Benedict, *Monatsh.*, 1883, **3**, 386; Klemenc, *ibid.*, 1912, **33**, 378; Levin and Lowy, *J. Amer. Chem. Soc.*, 1933, **55**, 1995), but the isomeric 6-nitro-compound has not hitherto been described. 6-*Nitroeugenol* (2-*nitro*-4-*hydroxy*-5-*methoxyallylbenzene*) (I) is an intermediate in the preparation of the interesting 6-nitrohomovanillin, and is now easily accessible from eugenol. Nitration of eugenyl acetate, followed by hydrolysis, gave a poor yield of (I); it is more conveniently obtained by the nitration of *O*-benzyleugenol, to give 6-*nitro*-O-*benzyleugenol*, from which the benzyl group is then removed.



(I.)

Nitration of methyleugenol yields 6-*nitro*-O-*methyleugenol*, which is also prepared by the methylation of (I).

The position of the nitro-group in the nitro-compounds has been established by oxidation. 6-*Nitroeugenyl acetate* is oxidised by weakly acid permanganate solution to 6-nitrohomovanillic (2-nitro-4-hydroxy-5-methoxyphenylacetic) acid, whereas 6-*nitro*-O-*methyleugenol* yields 6-nitrohomoveratric (2-nitro-4 : 5-dimethoxyphenylacetic) acid and 6-nitroveratraldehyde on oxidation under similar conditions.

Experimental.

6-*Nitroeugenol.*—To eugenyl acetate (3·2 g.) in acetic anhydride (6 c.c.) a cold mixture of acetic anhydride (7 c.c.) and nitric acid (2·01 g.; sp. gr. 1·49) was added during 30 minutes with stirring. After 4 hours the product was poured into water and extracted with ether, the extracts were washed with water and sodium hydrogen carbonate solution and dried (Na_2SO_4), and the ether removed. The residue was dissolved in methanol (10 c.c.), a cool solution of potassium hydroxide (1·3 g.) in methanol (30 c.c.) added, and the mixture shaken for 5 hours, poured into water, and saturated with carbon dioxide. The product was extracted with ether, the extracts were washed (water) and dried, the ether was removed, and the 6-*nitroeugenol* distilled in a vacuum, giving a yellow oil, b. p. 150—160°/2 mm., which solidified to a waxy solid and crystallised from light petroleum (b. p. 40—60°) as white needles (0·3 g.), m. p. 69—71° (Found: C, 57·5; H, 5·6. $C_{10}H_{11}O_4N$ requires C, 57·4; H, 5·4%). It gave an intense red solution in concentrated sulphuric acid.

6-*Nitroeugenyl Acetate.*—6-Nitroeugenol (0·6 g.) was dissolved in pyridine (1 c.c.) and acetic anhydride (0·5 g.), and acetyl chloride (0·5 g.) was added dropwise at 0°. The mixture was kept for 10 minutes at room temperature and then diluted with water. The *acetate* separated and slowly solidified; it crystallised from methanol in large colourless plates (0·5 g.), m. p. 92—94° (Found: C, 57·6; H, 5·1. $C_{12}H_{13}O_5N$ requires C, 57·4; H, 5·2%).

6-*Nitro*-O-*benzyleugenol.*—Benzyleugenol (3·5 g.) (*Chem. Zentr.*, 1937, II, 3452) was dissolved in glacial acetic acid (21 c.c.), and a mixture of nitric acid (1·9 g.; sp. gr. 1·42) and acetic acid (5·2 c.c.) was added dropwise during 20 minutes at 9—11°. After a further 1·5 hours at 9—11° the product was poured into water and extracted with ether, the extracts were washed repeatedly with water and sodium hydroxide solution (5%) and dried (Na_2SO_4), and the ether removed. The *nitro*-compound slowly crystallised (3·0 g.) (m. p. 49—53°) and recrystallised from light petroleum (b. p. 40—60°) in long pale-yellow needles (1·9 g.), m. p. 58—59° (Found: C, 67·9; H, 5·7. $C_{17}H_{17}O_4N$ requires C, 68·2; H, 5·7%). The substance was insoluble in sodium hydroxide and gave an intense red solution in concentrated sulphuric acid.

6-*Nitroeugenol.*—6-Nitro-*O*-benzyleugenol (0·8 g.) was dissolved in warm glacial acetic acid (8 c.c.), concentrated hydrochloric acid (6 c.c.) added, and the mixture boiled gently under reflux for 10 minutes. The solution was diluted with water, benzyl chloride removed in a current of steam, and the residual solution cooled, whereupon an oil separated; this solidified (0·45 g.; m. p. 58—63°) and was distilled at 2 mm. (bath-temperature, 190°). The distillate solidified and was recrystallised from light petroleum (b. p. 40—60°), to give white needles (0·27 g.), m. p. 69—71°, not depressed by admixture with authentic 6-nitroeugenol.

6-*Nitro*-O-*methyleugenol.*—(*a*) Methyleugenol (3 g.) was mixed with glacial acetic acid (12 c.c.), and nitric acid (2·4 g.; sp. gr. 1·42) was added dropwise at 5—8° during 20 minutes. After 3 hours the product was poured into water and worked up as in the experiment with benzyleugenol, to give 6-*nitro*-O-*methyleugenol* as a yellow solid (1·9 g.), m. p. 38—40°, which crystallised from light petroleum (b. p. 40—60°) in pale yellow prisms, m. p. 41—43°, soluble in concentrated sulphuric acid to give an intense-red solution (Found: C, 59·8; H, 5·7. $C_{11}H_{13}O_4N$ requires C, 59·2; H, 5·8%).

(*b*) 6-Nitroeugenol (100 mg.) was dissolved in N-sodium hydroxide solution (3 c.c.), methyl sulphate (80 mg.) added, and the mixture shaken for 30 minutes. An oil separated and slowly crystallised (55 mg.; m. p. 39—41°). Recrystallisation from light petroleum gave pale yellow prisms, m. p. 41—43°, identical with 6-nitromethyleugenol (above). Unmethylated 6-nitroeugenol (20 mg.) was recovered.

Oxidation of 6-*Nitroeugenyl Acetate.*—6-Nitroeugenyl acetate (0·6 g.) was suspended in a hot mixture of water (240 c.c.) and glacial acetic acid (0·6 c.c.), and a solution of potassium permanganate (1·4 g.) in hot water (120 c.c.) was gradually added at 70—80° during 2 hours with frequent shaking. The permanganate was rapidly decolorised. The solution was filtered, basified (sodium hydroxide) evaporated to small bulk, and acidified (hydrochloric acid); 6-nitrohomovanillic acid then separated and crystallised from water (charcoal) in pale yellow needles (0·2 g.), m. p. 165—167° after sintering at 110°; it melted at 180° after drying for 4 hours at 100° (Found: C, 47·6; H, 3·9. Calc. for $C_9H_9O_6N$: C, 47·6; H, 4·0%). Gulland (*J.*, 1931, 2897) records m. p. 170°, sinters at 110°, and m. p. 184° after drying at 100°.

Oxidation of 6-*Nitromethyleugenol.*—6-Nitro-*O*-methyleugenol (1 g.) was suspended in hot water (500 c.c.) containing acetic acid (1·1 g.), and a hot solution of potassium permanganate (2·7 g.) in water (225 c.c.) added gradually at 70—80° during 2 hours with occasional shaking. The solution was filtered, basified (sodium hydroxide), and evaporated to small bulk, whereupon a solid (*A*) separated. When the filtrates were acidified, 6-nitrohomoveratric acid separated; this crystallised from water (charcoal) in long glistening pale yellow needles (0·3 g.), m. p. 201—203° (Found: C, 50·0; H, 4·5. Calc. for $C_{10}H_{11}O_6N$: C, 49·8; H, 4·6%). Gulland (*loc. cit.*) records m. p. 206°.

The solid (*A*) was crystallised from alcohol, to give pale yellow needles which became bright yellow in sunlight and had m. p. 131—132°, not depressed by admixture with authentic 6-nitroveratraldehyde (Pschorr, *Ber.*, 1899, **32**, 3412).

6-*Nitrohomoveratric Acid.*—6-Nitrohomovanillic acid, prepared as above, was methylated according to the method of Gulland (*loc. cit.*) and yielded 6-nitrohomoveratric acid, m. p. 200—202°, identical with the specimen prepared by the oxidation of 6-nitromethyleugenol.

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