

A SIMPLER AND HIGH-YIELD SYNTHESIS OF 6-NITROVANILLIN

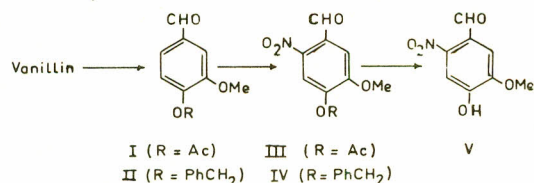
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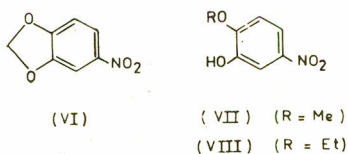
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Abstract. 6-Nitropiperonal with sodium methoxide in dry methanol gives 6-nitrovanillin in 75% yield.

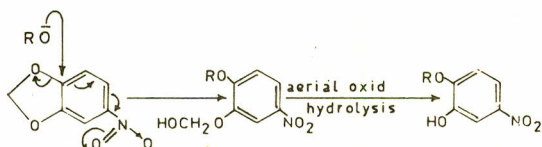
Multistep syntheses of 6-nitrovanillin have been reported in literature by the nitration of either acetylvannillin (I) [1] or *o*-benzylvanillin (II) [2] to give 4-acetoxy-3-methoxy-6-nitrovanillin (III) and 4-benzyloxy-3-methoxy-6-nitrovanillin (IV) respectively. The hydrolysis of III or IV then gives 6-nitrovanillin (V). However, the overall yield in both cases is below 25% when calculated on the basis of vanillin used.



In 1917 Robinson and Robinson [3] had made an observation that 4-nitromethylenedioxybenzene (VI) when heated with sodium methoxide or sodium ethoxide resulted in the formation of 2-methoxy-5-nitrophenol (VII) and 2-ethoxy-5-nitrophenol (VIII) respectively in good yield.

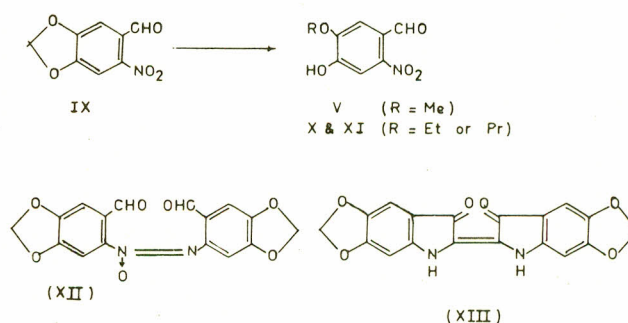


The opening of the methylenedioxy ring, and formation of 2-alkoxy-5-nitrophenol can now be explained as follows:



We considered applying the same procedure to 6-nitropiperonal (IX) to obtain 6-nitrovanillin, and indeed

the latter was obtained in 75% yield when IX was reacted for a short period with sodium methoxide in absolute methanol. However, when methanol was even slightly wet, no 6-nitrovanillin was formed, and instead an infusible dark brown product was formed. Earlier G.M. Robinson [4] had failed to obtain V when she reacted IX with sodium methoxide, and instead reported formation of the azoxy compound (XII).



Our attempts to extend this reaction to obtain 3-ethoxy (X) and 3-propoxy-4-hydroxy-6-nitrobenzaldehyde (IX) failed, when IX was reacted similarly with sodium ethoxide or propoxide in the corresponding dry alcohols. In each case an infusible dark-brown product was obtained. This product was not piperonal indigo (XIII, which too does not melt at high temperatures), and had been obtained earlier [5] by the interaction of nitropiperonal with alkali in acetone.

EXPERIMENTAL

6-Nitropiperonal was prepared in 81% yield by the nitration of piperonal as described in literature [6].

6-Nitrovanillin. 6-Nitropiperonal (4.0 g) was added to a solution of sodium (1.0 g) in dry methanol (100ml). The mixture was refluxed on water bath for 5 min under moisture-proof conditions. After removal of methanol under reduced pressure, the residue was dissolved in cold

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water, and acidified with hydrochloric acid with cooling to obtain reddish brown precipitate (3.0 g) of 6-nitrovanillin. Crystallization from acetic acid gave light-brown crystals mp 208-210°. This was identical (same IR spectra, and undepressed mixed mp) with an authentic sample prepared by the reported methods [1,2].

The acetyl derivative prepared by the conventional method, had the same mp (121.5°), as reported in [7].

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