Fragmentation Reactions Catalysed by Fétizon's Reagent (Silver Carbonate on Celite)

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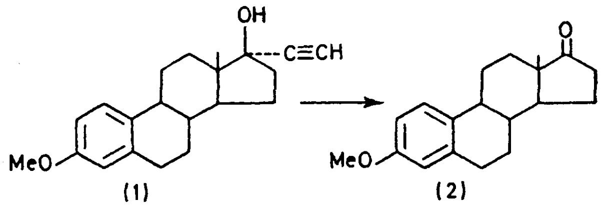
Summary Fétizon's reagent (silver carbonate on Celite) quantitatively fragments steroidal 17-ethynyl alcohols and 17- and 20-cyanohydrins to the corresponding ketones at approximately the same rate as that at which it oxidizes the allylic 3β-hydroxy-4-ene to the enone.



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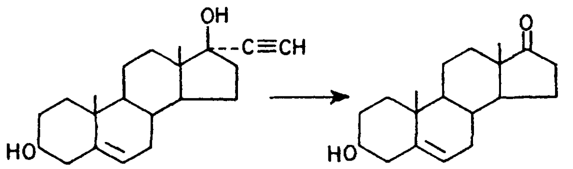

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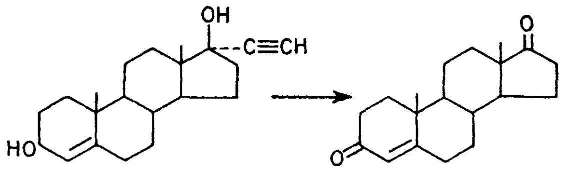

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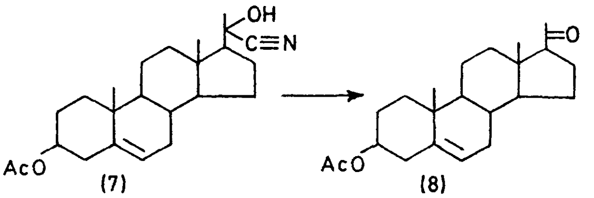

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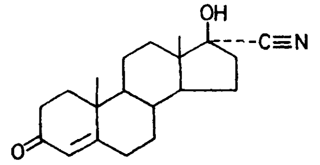

(9)

Silver carbonate on Celite (Fétizon's reagent) has recently been introduced as an oxidizing agent.[1] It is particularly useful in that oxidations occur in neutral solution, at convenient temperatures and the product is easily isolated, usually in high yield. We report additional uses of this reagent in the fragmentation of propargylic alcohols and cyanohydrins.

Treatment of 17-α-ethynyloestradiol methyl ether (**1**) (1·0 g) with silver carbonate on Celite (5 g) in toluene under reflux gave a quantitative yield of a product (**2**) which lacked the ethynyl proton resonance in the n.m.r. The i.r. spectrum showed the disappearance of the ethynyl absorptions and the appearance of a cyclopentanone carbonyl absorption at 1745 cm^{-1}. These observations indicated that (**1**) had fragmented to oestrone methyl ether, and comparison with an authentic sample confirmed the identity of (**2**) as the 17-ketone.†

When the homo-allylic 17-α-ethynylandrost-5-ene-3β,17β-diol (**3**) (1·0 g) was refluxed in toluene with Ag_2CO_3–Celite (15 g), a quantitative yield of dehydroepiandrosterone (**4**) was formed after 3 h. Similarly, when (**5**) was treated under the same conditions as (**3**), a quantitative yield of the dione (**6**) was formed and identified by spectral, t.l.c., and mixed m.p. comparison with an authentic sample. Thus the rate of expulsion of acetylene is approximately equivalent to the rate of oxidation of the allylic alcohol.

The fragmentation of steroidal cyanohydrins has also been investigated. Pregnenolone acetate cyanohydrin (**7**) when treated with Ag_2CO_3–Celite in refluxing toluene is rapidly and quantitatively cleaved to pregnenolone acetate (**8**) and hydrogen cyanide. Similarly, the 17-cyanohydrin (**9**) was also converted into androst-4-ene-3,17-dione (**6**).

The reversal of the ethynylation reaction by strong base and high temperatures is well known and generally leads to an equilibrium mixture of ethynyl alcohol and ketone.[2] Therefore, the catalysis of the quantitative reversal by Ag_2CO_3 in neutral solution and at moderate temperature indicates the possible use of the ethynyl group as a ketone protecting group, and the general undesirability of conducting these oxidations in the presence of ethynyl alcohols. Additionally the use of Ag_2CO_3–Celite offers an additional possibility for the rapid quantitative cleavage of cyanohydrins in neutral solution and with easy isolation of product.

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† All steroids were identified by comparison with authentic samples from the Searle steroid collection.

[1] M. Fétizon and M. Golfier, *Compt. rend.*, 1968, **267**, 900; V. Balogh, M. Fétizon, and M. Golfier, *Angew. Chem.*, 1969, **81**, 423; M. Fétizon, M. Golfier, and J.-M. Louis, *Chem. Comm.*, 1969, 1102, 1118; V. Balogh, M. Fétizon, and M. Golfier, *J. Org. Chem.*, 1971, **36**, 1339.

[2] H. Langecker, *Naturwiss.*, 1959, **21**, 601; W. Chodkiewicz, *Ann. Chim. (France)*, 1957, **2**, 819; T. C. Miller and R. G. Christiansen, *J. Org. Chem.*, 1967, **32**, 2781.