Tetrahedron Letters No. 33, pp 3117 - 3118.
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0040-4039/79/0808-3117$02.00/0

A RAPID THERMAL CYCLISATION OF ETHANE-1,2-BIS-FATTY AMIDES AND ALCOHOL DERIVATIVES TO Δ^2-IMIDAZOLINES WITH PHENYLPHOSPHORODIAMIDATE.

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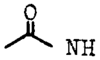
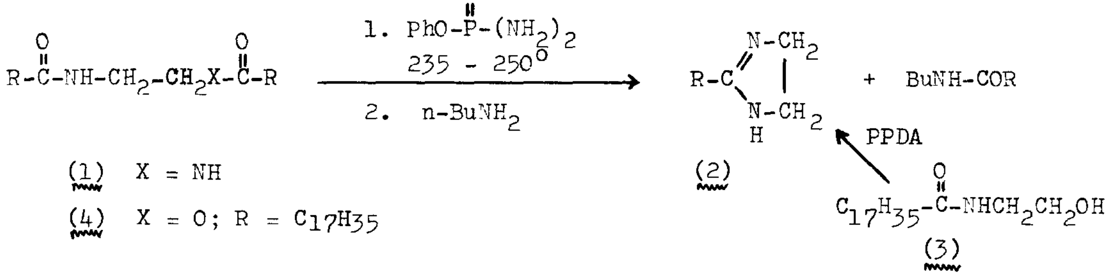
Summary: Brief heating of ethane-1,2-bis-fatty amides at 235 - 250° with phenylphosphorodiamidate gave high yields of 2-fattyalkyl-Δ^2-imidazolines.

Consideration of adenosine-5'-phosphoroamidate as a potential active aminating species in enzymatic transaminations has recently led to the development of phenylphosphorodiamidate as a useful direct aminating agent for converting six-membered amidoheterocycles () to the corresponding amino derivatives ().[1 - 4] However the reagent has been little explored and its reactions with acyclic amide systems have not been reported. Difficulties of obtaining fatty Δ^2-4,5-H-imidazolines from thermal reactions of ethane-1,2- diamides (1), formed in the thermal reactions of 1,2-diamines with carboxylic acids,[5] arise from low yields coupled with prolonged expensive high-temperature reactions.[6 - 8] For example, heating ethane-1,2-distearamide (1, R = n-$C_{17}H_{35}$) at 240 - 250° for 3 days gave only a 17 yield of 2-heptadecyl-Δ^2-imidazoline (2, R = n-$C_{17}H_{35}$).[5] Catalysts such as hydrochloric acid,[9] metal chlorides[10,11] and phosphorus pentaoxide,[12] have been employed to improve these cyclisations but reaction times were still lengthy. We wish to report a rapid thermal cyclisation involving phenylphosphorodiamidate, (PPDA), PhO-P=O$(NH_2)_2$, which gave high yield cyclisations in <u>less than ten minutes</u>.

Mixtures of the diamides (1)[13] and PPDA (2 mol.) were rapidly raised to the temperature range 235 - 250° by placing the flask in a preheated isomantle. Melting was complete at 220° and thereafter a vigorous reaction gave off phenol and ammonia vapours. After 5 - 8 min. the mixture was cooled to 85 - 100° and



leached for about 5 min. with boiling n-butylamine after which insoluble polyphosphates were removed. On cooling the butylamine solution high yields of the imidazolines (2)[14] separated: R (parent fatty acid), yield (%) of (2), m.p.: n-$C_{17}H_{35}$ (stearic acid) 90 %, 87 - 89°; n-$C_{15}H_{31}$ (palmitic acid), 92 %, 92 - 93°; n-$C_{13}H_{27}$ (myristic acid), 86 %, 92 - 93°; $C_{11}H_{23}$ (lauric acid), 80 %, 90 - 91°; n-C_9H_{19} (capric acid), 80 %, 91 - 92°. Fractional evaporation of the butylamine solutions gave the n-butylamides of the fatty acids (80 - 95 %).

The imidazolines were detected in the cooled reaction mixtures, prior to the butylamine extractions, by their characteristic i.r. >C=N band at 1600 - 1610cm.$^{-1}$ Heating of the amides (1) separately with butylamine or higher boiling amines had no effect and an aminolysis with PPDA is unlikely. The reaction probably involved an initial transamination which converted one of the amido carbonyl groups to an amidine, $-C(NH_2)=N-$, moiety. High yields (90 %) of compound (2, R = $C_{17}H_{35}$) were also obtained on similar PPDA treatment of both the 2-stearamidoethanol (3) and the ester (4). These results suggest that one of the nitrogens of the imidazoline moiety came from the phosphorodiamidate reagent and also that alkyl-oxygen and alkyl-nitrogen cleavages were occurring in these high temperature reactions. Mechanistic studies are in progress.

This work was supported by Chemoran Ltd. and the Irish Industrial Development Authority. We thank Chemoran Ltd. for permission to publish the results herein.

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14. Structures were confirmed by microanalyses, i.r., ^1H and ^{13}C n.m.r. spectra and by comparison with authentic samples.

(Received in UK 11 June 1979)