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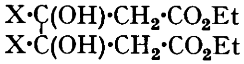
203. *The Reformatsky Reaction with Anisil.*

By J. W. Cook and W. Lawson.

The experiments here described were commenced with the object of synthesising compounds related to œstrin, by a modification and amplification of the chrysene synthesis of v. Braun and Irmisch (*Ber.*, 1931, **64**, 2461). In consequence of the statements of Ramage and Robinson (*Nature*, 1933, **131**, 205) and of Vogel (*ibid.*, p. 402) that they are themselves utilising the same method we have discontinued our experiments, but wish to place on record the results which we have obtained.

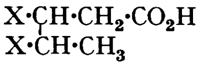
Reduction of methyl *p*-methoxycinnamate (compare Oommen and Vogel, J., 1930, 2150) gave unpromising results on account of the large proportion of material converted into methyl β-anisylpropionate, although we obtained a small yield of a *methyl* ββ′-*dianisyladipate*, m. p. 152°.

An alternative route to ββ′-dianisyladipic acid seemed to be provided by the Reformatsky reaction with anisil. This led to an *ethyl* ββ′-*dihydroxy*-ββ′-*dianisyladipate* (I), which, on reduction by the Clemmensen method, was converted into two acidic products. The major product gave analytical figures which showed that one carboxyl group had been lost (formula II), whereas the other product gave figures in agreement with a ββ'-*dianisyladipic acid* (III) :—



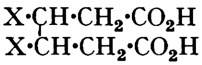
$$\begin{array}{l} X{\cdot}C(OH){\cdot}CH_2{\cdot}CO_2Et \\ \vert \\ X{\cdot}C(OH){\cdot}CH_2{\cdot}CO_2Et \end{array}$$

(I.)



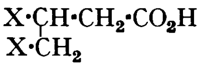
$$\begin{array}{l} X{\cdot}CH{\cdot}CH_2{\cdot}CO_2H \\ \vert \\ X{\cdot}CH{\cdot}CH_3 \end{array}$$

(II.)



$$\begin{array}{l} X{\cdot}CH{\cdot}CH_2{\cdot}CO_2H \\ \vert \\ X{\cdot}CH{\cdot}CH_2{\cdot}CO_2H \end{array}$$

(III.)



$$\begin{array}{l} X{\cdot}CH{\cdot}CH_2{\cdot}CO_2H \\ \vert \\ X{\cdot}CH_2 \end{array}$$

(IV.)

$(X = MeO{\cdot}C_6H_4)$

These structures are not established, as the Clemmensen reductions may have been accompanied by pinacolin rearrangements.

In addition to the crystalline product mentioned above, the Reformatsky reaction gave a considerable amount of a viscous resin which was converted by Clemmensen reduction into a crystalline *acid*, and the analytical figures showed that only one carbonyl group of the anisil had condensed with ethyl bromoacetate, the crystalline acid being probably represented, therefore, by formula (IV).

EXPERIMENTAL.

A mixture of anisil (35·5 g.), ethyl bromoacetate (61 g.), dry benzene (110 g.), and zinc filings (25·5 g.) was heated on the water-bath for 2 hours, iodine being used for activation. The product was poured on ice, the benzene layer thrice washed with dilute sulphuric acid and dried (sodium sulphate) and the benzene removed in a vacuum. Addition of alcohol to the residual syrup caused crystallisation of *ethyl* ββ'-*dihydroxy*-ββ'-*dianisyladipate* (I) (8·5 g.); colourless needles, m. p. 153—154°, from benzene–alcohol (Found: C, 64·6; H, 6·9. $C_{24}H_{30}O_8$ requires C, 64·55; H, 6·8%).

The alcoholic mother-liquor was evaporated, the residual syrup reduced by amalgamated zinc and concentrated hydrochloric acid, the resinous product extracted with dilute sodium carbonate solution, the extract acidified, and the precipitate recrystallised from alcohol. The resulting *acid* (probably IV) (11 g.), recrystallised from benzene and then from alcohol, formed a colourless crystalline powder, m. p. 167—168° (Found: C, 72·3; H, 6·7. $C_{18}H_{20}O_4$ requires C, 72·0; H, 6·7%). The *methyl* ester (methyl alcohol–hydrogen chloride method) crystallised from *cyclo*hexane in colourless needles, m. p. 63—64° (Found: C, 72·7; H, 7·1; OMe, 30·0; *M*, Rast method, 300, 309. $C_{19}H_{22}O_4$ requires C, 72·6; H, 7·1; OMe, 29·6%; *M*, 314).

Clemmensen Reduction of Ethyl ββ'-*Dihydroxy*-ββ'-*dianisyladipate.*—A suspension of the ester (I) (5 g.) in concentrated hydrochloric acid (50 c.c.) was boiled with amalgamated zinc (15 g.) for 24 hours. The acidic product extracted by aqueous sodium carbonate and reprecipitated by hydrochloric acid (2·9 g.) was separated into two components by crystallisation from benzene. The fraction which first crystallised (0·6 g.) was recrystallised from xylene and formed colourless needles, m. p. 248—249° (Found: C, 67·4; H, 5·7. $C_{20}H_{22}O_6$ requires C, 67·0; H, 6·2%). The *methyl* ester of this *acid* (III or isomeride) separated from methyl alcohol as a colourless crystalline powder, m. p. 108—109° (Found: C, 68·7; H, 6·4; OMe, 32·0; *M*, 326, 346. $C_{22}H_{26}O_6$ requires C, 68·4; H, 6·8; OMe, 32·1%; *M*, 386).

The benzene liquor from the above acid was concentrated to small bulk, and the product (1·6 g.; m. p. 135—142°) recrystallised from benzene and then esterified with methyl alcohol and hydrogen chloride. The *methyl* ester crystallised from methyl alcohol in colourless needles, m. p. 99—100° (Found: C, 73·4; H, 7·55; OMe, 28·1; *M*, 287, 304. $C_{20}H_{24}O_4$ requires C, 73·1; H, 7·4; OMe, 28·3%; *M*, 328). The *acid* (II or isomeride) formed by hydrolysis of the pure ester separated from benzene–*cyclo*hexane in small colourless prisms, m. p. 160·5—161·5° (Found: C, 72·2; H, 7·3. $C_{19}H_{22}O_4$ requires C, 72·6; H, 7·1%).

All the analyses were made by Dr. A. Schoeller.

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