SYNTHESIS OF 6-FORMYLPTERIN

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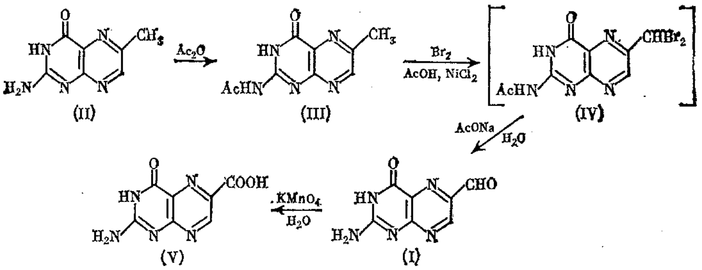
6-Formylpterin (I) is used as an intermediate in the synthesis of folic acid [1]. In the present study we developed a convenient method for obtaining (I) from 6-methylpterin (II) [2, 3]:



6-Methylpterin (II) was acetylated as described in [2] to 2-acetamido-4-hydroxy-6-methylpteridine (III), which then was brominated with Br_2 in AcOH at ~100°C in the presence of catalytic amounts of $NiCl_2$. Without isolation, the formed dibromide (IV) was hydrolyzed with AcONa in aqueous AcOH to give (I) in 75% yield, which was identified by comparing with an authentic specimen via the IR, UV, and PMR spectra, and also by conversion to the 2,4-dinitrophenylhydrazone and by oxidation with $KMnO_4$ to pterin-6-carboxylic acid (V). The smooth bromination of (III) is facilitated by the presence in its molecule of the electron-acceptor acetyl group at NH_2, which raises the lability of the hydrogen atoms of the CH_3 group. Attempts to brominate (II) in AcOH in the presence of $NiCl_2$ or without it gave unsatisfactory results. The bromination of (II) in 48% HBr solution gave (I) in low yield [4].

EXPERIMENTAL

The UV spectra were taken on a Specord UV-VIS instrument, the IR spectra were taken as KBr pellets on a UR-20 instrument, and the PMR spectra were taken on a DA-60IL instrument, using TMS as the external standard. The TLC was run in the system $i\text{-PrOH—H}_2\text{O—NH}_4\text{OH}$, 7 : 2 : 1 (detection of the fluorescent spots in UV light).

6-Formylpterin (I). A mixture of 1 g of 2-acetamido-4-hydroxy-6-methylpteridine (III) [2], 0.58 ml of Br_2, and 0.04 g of $NiCl_2 \cdot 6H_2O$ in 40 ml of AcOH was stirred for 10 h at 95-100° (bath temperature), and then it was evaporated in vacuo and the residue was treated with 40 ml of H_2O and 10 g of $AcONa \cdot 3H_2O$. The reaction mixture was refluxed for 1 h, cooled to ~20°, and the precipitate was filtered, washed with H_2O and, with stirring, dissolved at 50° in 100 ml of 5% HCl solution, after which activated carbon was added, the stirring was continued for another 10-15 min at 50°, and the filtrate was neutralized with $NaHCO_3$ to pH 6.5-7. The precipitate was filtered, washed with H_2O and alcohol, and dried in vacuo at 100°. We obtained 0.65 g (75%) of (I), decompn. point above 300°, R_f 0.35 (Al_2O_3, II activity). Ultraviolet spectrum (0.1 N KOH, λ_{max}, nm): 255, 275(sh), 367. PMR spectrum (CF_3COOH, δ, ppm): 8.99 s (H at C^7), 9.72 s (CHO). Infrared spectrum (ν, cm^{-1}): 860, 960, 1120, 1255, 1295, 1380, 1530, 1570, 1660, 1690, 2930, 3130–3140, 3270–3290.

The reaction of 2,4-dinitrophenylhydrazine with (I) as described in [8] gave the 2,4-dinitrophenylhydrazone, decompn. point above 350°. Ultraviolet spectrum (alcohol) (λ_{max}): 410 nm. Infrared spectrum (ν, cm^{-1}): 1105, 1145, 1200, 1290, 1320, 1340, 1435, 1480, 1500, 1520, 1585, 1620, 1650, 1695, 3110, 3280. The authentic 2,4-dinitrophenylhydrazone of (I) had the same characteristics [8].

Pterin-6-carboxylic Acid (V). To a solution of 0.15 g of (I) in 10 ml of 1 N KOH solution was added aqueous $KMnO_4$ solution in drops until a permanent violet color remained. The excess $KMnO_4$ was destroyed with Na_2SO_3, the MnO_2 precipitate was filtered, and the mother liquor was heated up to ~100° and acidified with AcOH to pH 5-6. The precipitate was filtered, washed in succession with water and alcohol, and dried in vacuo at 100°. We obtained 0.16 g (100%) of acid (V), decompn. point above 360°, R_f 0.37 (Silufol UV-254). Ultraviolet spectrum

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(0.1 N KOH, λ_{max}): 263, 364 nm. The authentic specimen of (V) had the same characteristics [2].

CONCLUSIONS

A method was developed for the synthesis of 6-formylpterin by the bromination of 2-acetamido-4-hydroxy-6-methylpteridine in AcOH in the presence of $NiCl_2$ and subsequent hydrolysis of the intermediate 2-acetamido-4-hydroxy-6-dibromomethylpteridine.

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1,3-MIGRATION OF HYDROGEN IN RADICAL TELOMERIZATION OF ALLYL ACETATE WITH METHYL PROPIONATE

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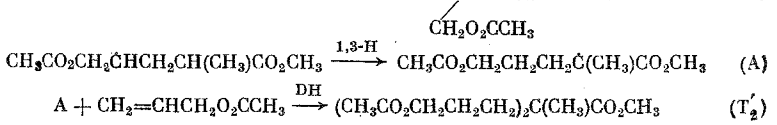
When unsaturated compounds are telomerized with comparatively inefficient telogens, only in the case of the reaction of propylene with carboxylic esters was rearrangement of the first growing radical with 1,3-migration of the hydrogen atom observed [1].

$$CH_3\dot{C}HCH_2CH(R)CO_2CH_3 \xrightarrow{1,3\text{-}H} CH_3CH_2CH_2\dot{C}(R)CO_2CH_3$$

It seemed of interest to expand the gamut of reactions of this type by using propylene analogs of type $CH_2{=}CH{-}CH_2R$ as the monomers. At the same time, this permits ascertaining the effect of the nature of the R substituent in the monomer on the course of the 1,3-H migration during telomerization.

The telomerization of allyl acetate with methyl propionate was studied in the present paper, with variation of the monomer:telogen ratios (M/S) and the reaction temperature. The experiments were run in sealed glass ampuls, using tert-butyl peroxide (TBP, 150 and 125°C), benzoyl peroxide (BP, 90°), and dicyclohexyl peroxydicarbonate (DPC, 60°) as the initiators. Employing fractional distillation and subsequent purification via preparative GLC, from the reaction mixture, obtained in a series of preparative experiments (TBP, 150°, M/S = 1:5), we isolated and characterized the individual T_1, T_2', and T_2 telomers (see scheme and Table 1), and also two substances (15% of the T_1-T_2 sum), one of which is the dimer $[CH(CH_3)CO_2CH_3]_2$, while the structure of the other was not established.

The formation of the main reaction products can be depicted by the following scheme:



$$CH_3CH_2CO_2CH_3 \xrightarrow{R\dot{O}} CH_3\dot{C}HCO_2CH_3$$

$$CH_3\dot{C}HCO_2CH_3 + CH_2{=}CHCH_2O_2CCH_3 \xrightarrow{DH} H(\underset{CH_2O_2CCH_3}{CH}CH_2)_nCH(CH_3)CO_2CH_3 \qquad (T_n)$$

$$CH_3CO_2CH_2\dot{C}HCH_2CH(CH_3)CO_2CH_3 \xrightarrow{1,3\text{-}H} CH_3CO_2CH_2CH_2CH_2\dot{C}(CH_3)CO_2CH_3 \qquad (A)$$

$$A + CH_2{=}CHCH_2O_2CCH_3 \xrightarrow{DH} (CH_3CO_2CH_2CH_2CH_2)_2C(CH_3)CO_2CH_3 \qquad (T_2')$$

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