Method *b*. To a stirred solution of 18.5 g. of hydrated ferrous sulfate in 300 ml. of water at 75° was added 27 g. of hydrated barium hydroxide. After 15 min., 2 g. of powdered 2-amino-4-benzyloxyamino-5-nitro-6-methylpyrimidine was added, the mixture stirred, and the temperature raised to 100° for 20 min. The hot solution was filtered and the filter cake was extracted with boiling water. The combined filtrates were evaporated to dryness under reduced pressure and the residue recrystallized from ethanol to give 0.81 g. (79.5%) of pale brown prisms, m.p. 241–243°, identical with the product obtained by method (*a*) above.

*2,4-Diamino-5-nitro-6-methylpyrimidine* (IV). Method *a*. A suspension of 2 g. of 2-amino-4-benzyloxyamino-5-nitro-6-methylpyrimidine in 20 ml. of ethanol and 20 ml. of concentrated ammonium hydroxide was saturated with hydrogen sulfide and then heated under reflux for 30 min. Addition of 60 ml. of water followed by cooling caused the separation of a yellow solid which was collected by filtration and dissolved in dilute hydrochloric acid. Extraction of this acidic solution with methylene chloride removed a small amount of oily material. Neutralization of the aqueous layer with dilute ammonium hydroxide precipitated a yellow solid which was recrystallized from ethanol to give 0.9 g. (73%) of yellow needles, m.p. 235–236°. A mixture melting point determination with a sample of authentic 2,4-diamino-5-nitro-6-methylpyrimidine prepared as described below showed no depression. The reported melting point for a crude sample of this material is 235° dec.[7]

Method *b*. A solution of 2 g. of 2-amino-4-chloro-5-nitro-6-methylpyrimidine in 125 ml. of ethanol was saturated with dry ammonia and then heated under reflux for 2 hr. while ammonia was passed continually through the refluxing solution. The reaction mixture was cooled overnight and filtered to give 1.4 g. of crude product, m.p. 237–240°. A further quantity (0.2 g.) was obtained by concentration of the filtrate. Recrystallization of the combined crude products from ethanol yielded 1.45 g. (80.5%) of yellow needles, m.p. 235–236°.

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## Effect of Molecular Size and Structure on the Pyrolysis of Esters. II[1]

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It has been demonstrated that a change in the size of the acyl portion of esters causes a change in the ease of their pyrolysis.[1] For example, esters of stearic acid pyrolyze at a lower temperature than esters of acetic or formic acid. The decrease, however, in the temperature of pyrolysis as the acyl portion increases in size by one methylene group is not a regular decrease; rather it decreases in a zigzag fashion with esters from acids of an even number of carbon atoms being slightly more stable than their neighboring homologues.

The question as to whether this effect is due to a change in the size of the acyl portion or a change in the molecular weight of the ester was not answered.

Nine isomeric normal aliphatic primary esters of molecular weight 200 and formula $C_nH_{2n+1}CO_2C_mH_{2m+1}$ (n + m = 12) have been pyrolyzed under conditions identical to those reported in the earlier study. The results from this study clearly demonstrate that the ease of pyrolysis of esters is a function of molecular weight (or size) of the ester and not of the acyl portion alone.

In comparing the ease of pyrolysis of the nine esters their "characteristic temperatures"[2] were determined by passing a constant amount at a definite rate through a flow system and measuring the extent of pyrolysis at seven different temperatures over a range of 81°. The extent of pyrolysis in this temperature range was from 6.9 to 96.3 per cent. All esters studied showed a characteristic

TABLE I

PYROLYSIS OF ALKANOATES OF THE FORMULA $C_nH_{2n+1}CO_2C_mH_{2m+1}$

| Name | Yield, % | B.p. °C. | B.p. Mm. | $n_D$ | $d_{20}^{20}$ | Analysis: Carbon, % Calcd. | Carbon, % Found | Hydrogen, % Calcd. | Hydrogen, % Found | Characteristic Temp., °C. | Yield, % at C.T. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ethyl decanoate | 83 | 114–116[a] | 20 | 1.4257[b,c] | 0.8708[b,d] | | | | | 561 | |
| Propyl nonoate | 82 | 127–129[e] | 21 | 1.4236[f,g] | 0.8637[h] | | | | | 562 | 94.7 |
| Butyl octanoate | 93 | 122–125[i] | 20 | 1.4229[f,j] | 0.8646 | | | | | 558 | 95.5 |
| Pentyl heptanoate | 87 | 120–126[k] | 20 | 1.4233[f,l] | 0.8632 | | | | | 562 | 92.0 |
| Hexyl hexanoate | 93 | 125–126 | 20 | 1.4249[b] | 0.8630[m] | 71.95 | 71.79 | 12.08 | 11.79 | 561 | 93.0 |
| Heptyl pentanoate | 91 | 124–126 | 20 | 1.4248[b] | 0.8610[n] | 71.95 | 72.08 | 12.08 | 11.87 | 560 | 92.4 |
| Octyl butanoate | 75 | 120–123 | 19 | 1.4250[b] | 0.8621[o] | 71.95 | 72.00 | 12.08 | 11.96 | 560 | 91.3 |
| Nonyl propanoate | 85 | 126–128 | 20 | 1.4259[b] | 0.8637 | 71.95 | 72.02 | 12.08 | 11.91 | 559 | 94.8 |
| Decyl acetate | 88 | 126–127[p] | 20 | 1.4272[b,q] | 0.8654[r] | | | | | 561 | 96.3 |

[a] Reported[3] b.p. 122–124°/13 mm. [b] 20°. [c] Reported[4] $n_D^{45}$ 1.4154. [d] Reported[5] $d_4^{20}$ 0.862. The low yield (14.4%) in the pyrolysis of this ester was demonstrated to be caused by contamination of the ethyl decanoate with methyl decanoate by conversion to the 3,5-dinitrobenzoate, m.p. 107–108°. The methyl ester is stable to pyrolysis at this temperature. [e] Reported[6] b.p. 120–122°/20 mm. [f] 25°. [g] Reported[6] $n_D^{25}$ 1.4236. [h] Reported[6] $d_4^{25}$ 0.8540. [i] Reported[6] b.p. 121–122°/20 mm. [j] Reported[6] $n_D^{25}$ 1.4232. [k] Reported[6] b.p. 118–119°/20 mm. [l] Reported[6] $n_D^{25}$ 1.4231. [m] Reported[7] $d^{30}$ 0.85414. [n] Reported[7] $d_4^{15}$ 0.86625. [o] Reported[7] $d_4^{15}$ 0.86686. [p] Reported[8] b.p. 125–126°/15 mm. [q] Reported[9] $n_D^{20}$ 1.4272. [r] Reported[10] $d_4^{20}$ 0.8671.

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(2) The "characteristic temperature" has been defined[1] as the temperature at which a maximum is obtained from a plot of percentage yield divided by pyrolysis temperature *vs.* the pyrolysis temperature. In effect the characteristic temperature is that temperature at which the most efficient pyrolysis takes place when the rate of flow is constant.

temperature between 558–562 ± 1°. A titration of the acid and a measure of the carbon dioxide formed (which at no time was greater than 2.8%) served to determine the extent of pyrolysis. The esters were prepared according to the method of Brändström,[3] and the data on their preparation, identification, and pyrolysis are given in Table I.

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## Methadon Analogs[1]

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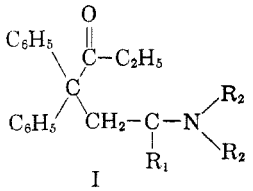
Variations in the structure of methadon [I, $R_1$ = $CH_3$, $NR_2$ = $N(CH_3)_2$] have been made[2,3] without



I

substantial increase in activity, and often with loss of activity. Thus substitution in I ($R_1$ = $C_2H_5$) resulted in disappearance of activity,[4] while substitution of $-NR_2$ as morpholine or piperidine afforded retention of analgesic acitvity.[3] Recent studies have critically examined the structural features of methadon analogs which influence activity.[5]

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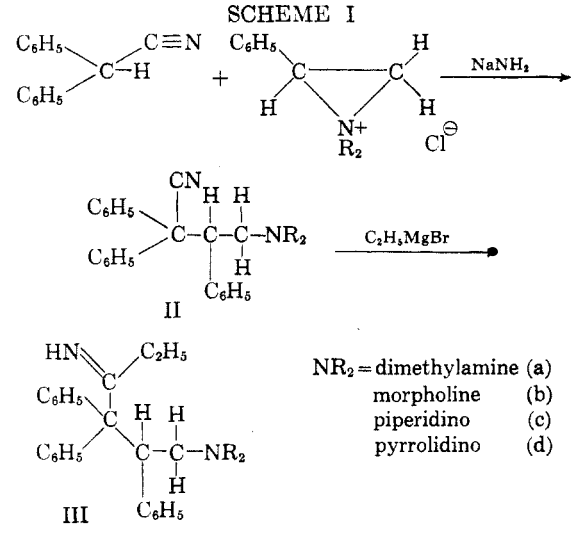
This paper reports the isolation of 1-substituted amino-2,3,3-triphenylhexanimines in the attempted synthesis of I ($R_1$ = $C_6H_5$) from the previously described 2-dialkylamino-1-phenethyl chlorides.[6]

The sequence of reactions used is reported as shown in Scheme I.

In earlier work with methadon analogs, the condensation of dialkylaminoisoalkyl chlorides with diphenylacetonitrile has been shown to proceed *via* an ethyleneimonium ion[7] with subsequent reaction at the imonium ion being governed[8] by steric factors, as well as polar factors, both

SCHEME I




within the cyclic ion and in the diphenylacetonitrile anion with which it reacts.

The imonium ion obtained from the 2-dialkylamino-1-phenethyl chlorides would in all probability be more vulnerable to nucleophilic attack[6] by the diphenylacetonitrile anion at the phenyl-bearing carbon to yield the 2,2,3-triphenyl-4-substituted aminobutyronitrile (II). Only one compound was isolable in these condensations. The likelihood of reaction being effected at this more hindered carbon of the imonium ion, is also consistent[9] with the isolation of the ketimines (III).

Considerable difficulty was initially experienced in the isolation of the butyronitriles (II) in view of their unanticipated failure to be extracted into aqueous solvents as their hydrochlorides. The steric influence of the 3-phenyl group in such nitriles is apparent when one considers the ease of hydrochloride formation in analogous compounds wherein

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