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Studies on 1-Alkyl-2(1*H*)-pyridone Derivatives. XXIII.[1] The Friedel-Crafts Reaction of 1-Methyl-2(1*H*)-pyridone with Aliphatic Acid Derivatives

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The Friedel–Crafts reaction of 1-methyl-2(1*H*)-pyridone (I) was examined with three different reagents; (a) with acid anhydride and sulfuric acid, (b) with acid anhydride and aluminum chloride, and (c) with acid chloride and aluminum chloride. The method (a) afforded the acyl products in a high yield. Products identified as 5-acylated and 3,5-diacylated compounds were obtained by the methods (a) and (b), and 3- and 5-acylated compounds by the method (c).

In previous works of this series, the Friedel-Crafts reactions of 1-methyl-2(1*H*)-quinolone[3] and 2-methyl-1(2*H*)-isoquinolone[4] with aliphatic acid chloride were carried out, but, as reported by Adams, *et al.*,[5] this reaction of 1-methyl-2(1*H*)-pyridone (I) was unsuccessful. It was found only recently that the Friedel-Crafts reaction of I with benzoyl chloride was successfully carried out.[1] Therefore, the Friedel-Crafts reaction of I with aliphatic acid derivatives was attempted and the objective compounds were obtained in a high yield, which is reported herein.

When the reaction of I with acyl chlorides in the presence of aluminum chloride was carried out at the boiling point of the acyl chloride used, only cyclohexanecarbonyl chloride, whose boiling point is at 180—181°,[6] gave acyl compounds in about 46% yield, and other acyl chlorides, whose boiling points are far lower than that of cyclohexanecarbonyl chloride, did not give any acyl product. Therefore, the reaction temperature was raised to 180°, using a sealed tube. Even in this condition, the reaction of I with acetyl chloride did not proceed, but other acyl chlorides gave the corresponding acyl compounds in a poor yield. The reaction of I with propionyl chloride and aluminum chloride at 180° for 1 week gave propionyl-pyridone (II) in 4.4% yield. Mass spectrum of II (165 M^+) showed that its molecular weight corresponded to I with the introduction of one propionyl group. The nuclear magnetic resonance (NMR) spectrum of II (in $CDCl_3$) (Fig. 1) showed signals for three protons on the pyridone ring. The signal at the highest magnetic field, assigned at 3- or 5-position, showed the presence of only one *ortho* coupling constant. Other signals would be assigned to the protons at 4- and 6-positions from their chemical shifts. These data reveal that the location of the substituent would be at 5-position and the structure of II would be 1-methyl-5-propionyl-2(1*H*)-pyridone.

The reaction of I with butyryl chloride and aluminum chloride at 180° for 1 week gave two products (III and IV) and their mass spectra (179 M^+) showed that their molecular weight corresponded to I with the introduction of one butyryl group. III was obtained as pale yellow needles, mp 106—108°, in 3.6% yield. The structure of III was determined from the similarity

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[1] Part XXII: H. Tomisawa, R. Fujita, H. Hongo, and H. Kato, *Chem. Pharm. Bull.* (Tokyo), **22**, 2091 (1974).

[2] Location: *Komatsushima, Sendai.*

[3] H. Tomisawa, M. Watanabe, R. Fujita, and H. Hongo, *Chem. Pharm. Bull.* (Tokyo), **18**, 919 (1970).

[4] H. Tomisawa and R. Fujita, *Chem. Pharm. Bull.* (Tokyo), **21**, 2585 (1973).

[5] R. Adams, J. Hine, and J. Campbell, *J. Am. Chem. Soc.*, **71**, 387 (1949).

[6] M.S. Kharasch and H.C. Brown, *J. Am. Chem. Soc.*, **64**, 329 (1942).

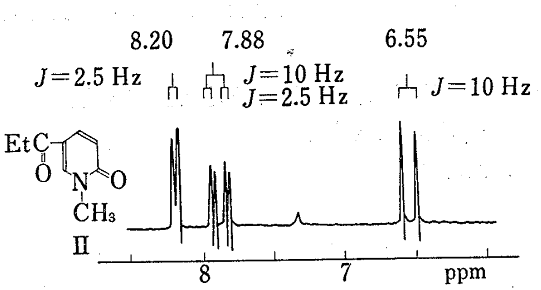

Fig. 1. NMR Spectrum of II (in $CDCl_3$) (100 MHz)

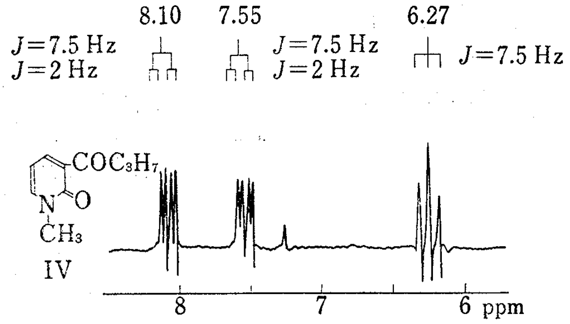

Fig. 2. NMR Spectrum of IV (in $CDCl_3$) (100 MHz)

of its NMR and ultraviolet (UV) spectra with those of II, and is 5-butyryl-1-methyl-2(1*H*)-pyridone. The product IV was obtained as yellow needles, mp 40—41°, in 6.0% yield. The NMR spectrum of IV (in $CDCl_3$) (Fig. 2) showed signals for three protons on the pyridone ring. The signal (triplet) at the highest magnetic field, assigned to 3- or 5-position, showed the presence of two *ortho* coupling constants. These data reveal that the location of the substituent would be at 3-position and the structure of IV would be 3-butyryl-1-methyl-2(1*H*)-pyridone.

The fact that only cyclohexanecarbonyl chloride gave the acyl product in a good yield and the results of the benzoylation of I,[1] seems to suggest that the yield of the Friedel-Crafts reaction of I would depend on the boiling point of acyl chloride. The carbonyl of acid anhydride is less reactive than that of acid chloride, but the boiling point of acid anhydride is higher than that of the corresponding acid chloride. Therefore, the Friedel-Crafts reaction of I with acid anhydride was carried out. When aluminum chloride was used as a catalyst, the reaction of I with acetic anhydride proceeded to yield acetylpyridone, though in a trace amount (1.9%), and the use of other anhydrides improved the yield slightly, but not good enough to be used as a synthetic method. Muchowski, *et al.*[7] reported that the Friedel-Crafts reaction of isoquinolone with acetic anhydride and conc. sulfuric acid gave the acetyl product in a high yield, and similar reaction conditions were used for the reaction of I. A mixture of I, acetic anhydride, and several drops of conc. sulfuric acid was heated at 140° for 4 days to yield 5-acetyl-1-methyl-2(1*H*)-pyridone (V) in 34.3% yield, mp 145—146°, which is in good

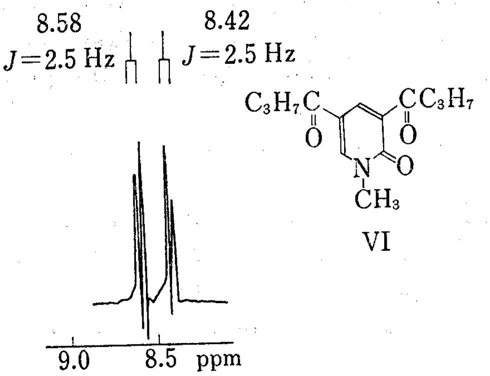

Fig. 3. NMR Spectrum of VI (in $CDCl_3$) (100 MHz)

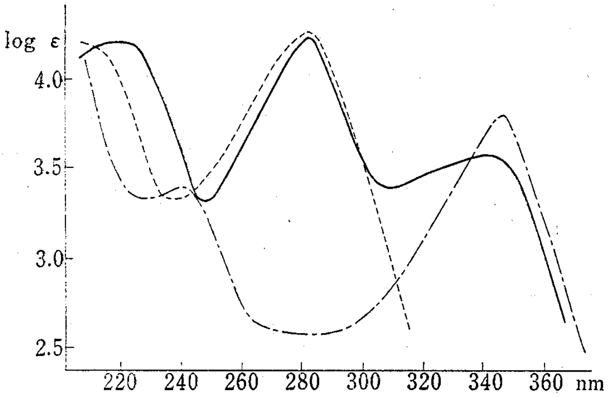

Fig. 4. UV Spectra of 3-, 5-Acylated, and 3,5-Diacylated Compounds (in EtOH)

------III: II, V, VII, VIII are similar curves.
-·-·- IV: IX is a similar curve.
—— VI: X, XI are similar curves.

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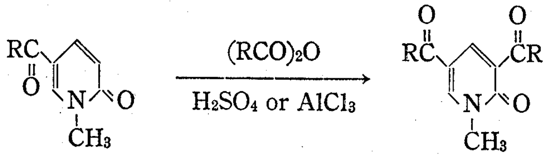
7) D.E. Horning, G. Lacasse, and J.M. Muchowski, *Can. J. Chem.*, **49**, 2785 (1971).

agreement with the reported value.[8] NMR spectrum of V is compatible with the structure for a 5-substituted compound.

This reaction condition gave the acyl products in better yield and would be useful as a synthetic route. However, in these reaction conditions, small amounts of diacyl compounds

TABLE I. Yields of 3,5-Diacylated Compounds obtained from 5-Acylated Compounds



Compound		Yield (%)	
Substituent (RCO)	No.	H_2SO_4 $(RCO)_2O$	$AlCl_3$ $(RCO)_2O$
C_2H_5CO	X	6.0	1.2
C_3H_7CO	VI	11.1	1.4
C_4H_9CO	XI	4.3	1.4

TABLE II. Yields of 3-and 5-Acylated, and 3,5-Diacylated Compounds

Compound			Yield (%)		
Substituent (RCO)	No.	Position	$AlCl_3$ RCOCl	$AlCl_3$ $(RCO)_2O$	H_2SO_4 $(RCO)_2O$
CH_3CO	V	5	—	1.9	34.3
C_2H_5CO	II	5	4.4	2.8	66.4
	X	3,5	—	—	2.5
C_3H_7CO	IV	3	6.0	—	—
	III	5	3.6	10.3	75.9
	VI	3,5	—	2.0	7.4
C_4H_9CO	VII	5	14.7	17.1	70.4
	XI	3,5	—	2.3	3.0
$C_6H_{11}CO$	IX	3	13.1		
	VIII	5	32.8		

TABLE III. NMR Signals of 3- and 5-Acylated, and 3,5-Diacylated Compounds (ppm, in $CDCl_3$)

Compound						
Substituent	No.	C3-H	C5-H	C4-H	C6-H	$N-CH_3$
5-CH_3CO	V	6.55 (d)	—	7.86 (q)	8.19 (d)	3.63 (s)
5-C_2H_5CO	II	6.55 (d)	—	7.88 (q)	8.20 (d)	3.62 (s)
5-C_3H_7CO	III	6.50 (d)	—	7.83 (q)	8.12 (d)	3.60 (s)
5-C_4H_9CO	VII	6.50 (d)	—	7.85 (q)	8.13 (d)	3.59 (s)
5-$C_6H_{11}CO$	VIII	6.56 (d)	—	7.87 (q)	8.16 (d)	3.65 (s)
3-C_3H_7CO	IV	—	6.27 (t)	8.10 (q)	7.55 (q)	3.60 (s)
3-$C_6H_{11}CO$	IX	—	6.25 (t)	8.00 (q)	7.53 (q)	3.60 (s)
3,5-diC_2H_5CO	X	—	—	8.42 (d) or	8.59 (d)	3.70 (s)
3,5-diC_3H_7CO	VI	—	—	8.42 (d) or	8.58 (d)	3.70 (s)
3,5-diC_4H_9CO	XI	—	—	8.42 (d) or	8.59 (d)	3.72 (s)

Tetramethylsilane was used as an internal standard.

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8) S. Sugasawa and M. Kirisawa, *Pharm. Bull.* (Japan), 3, 190 (1955).

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were formed in addition to the main product. The reaction of I with butyric anhydride in the presence of conc. H_2SO_4 gave 5-butyryl compound (III) in 75.9% yield, with VI in a poor yield (7.4%). The mass spectrum of VI (249 M^+) showed that its molecular weight corresponded to I with the introduction of two butyryl groups. Location of the two butyryl groups in VI was estimated from three reasonings; the first, that the NMR spectrum of VI (Fig. 3) showed signals, assigned to the protons on the pyridone ring, appeared as two doublets having a *meta* coupling constant and located at too low a magnetic field to be assigned to the protons at 3- and 5-positions (Fig. 1, 2, and 3), and the second is the fact that VI was produced by the reaction of 5-butyryl compound (III) and butyric anhydride, as shown in Table I. The third, the UV spectra (Fig. 4) of 3-, 5-butyryl compounds and VI suggested that location of two acyl groups in VI are 3- and 5-positions. Therefore, the structure of VI would be 1-methyl-3,5-dibutyryl-2(1*H*)-pyridone.

The results of the Friedel-Crafts reaction of I are shown in Table II, and NMR spectra of the compounds obtained in Table III.

Experimental[9]

Reaction of 1-Methyl-2(1*H*)-pyridone (I) and Acetic Acid Derivatives——a) A mixture of 3 g of I, 8.4 g of Ac_2O, and 14 drops of conc. H_2SO_4 was heated in an oil bath at 140° for 4 days. The cooled mixture was poured into ice water, basified with NaOH soln., and the mixture was extracted with $CHCl_3$. The $CHCl_3$ extract was dried over $MgSO_4$, evaporated, and its residue was passed through a column of silica gel. The column was eluted with benzene–acetone (5: 1) and gave 1.42 g (34.3%) of 5-acetyl-1-methyl-2(1*H*)-pyridone (V) as colorless needles (from benzene) mp 145—146° and 0.23 g (7.6%) of I. Admixture of V with 5-acetyl-1-methyl-2(1*H*)-pyridone, prepared by a different route,[8] did not depress the melting point. Mass Spectrum *m*/*e*: 151 (M^+). *Anal.* Calcd. for $C_8H_9O_2N$: C, 63.56; H, 6.00; N, 9.27. Found: C, 63.94; H, 6.23; N, 9.54. UV λ_{max}^{EtOH} nm (log ε): 211 (4.14), 280 (4.16). NMR (in $CDCl_3$) ppm: 2.45 (3H, s, $COCH_3$), 3.63 (3H, s, NCH_3), 6.55 (1H, d, J=10 Hz, 3-H), 7.86 (1H, q, J=10, J=2.5 Hz, 4-H), 8.19 (1H, d, J=2.5 Hz, 6-H).

b) A mixture of 3 g of I, 5.4 g of $AlCl_3$, and 8.4 g of acetic anhydride was heated in an oil bath at 140° for 5 days. The reaction mixture was treated as in the foregoing case to yield 0.08 g (1.9%) of V and 1 g (33.3%) of I.

Reaction of 1-Methyl-2(1*H*)-pyridone (I) and Propionic Acid Derivatives——a) A mixture of 3 g of I, 10.7 g of propionic anhydride, and 14 drops of conc. H_2SO_4 was heated in an oil bath of 180° for 2 days. The reaction mixture was treated as in the foregoing cases. The column of silica gel eluted with benzene–acetone (15: 1) afforded two fractions. The first fraction was recrystallized from benzene to 0.155 g (2.5%) of 1-methyl-3,5-dipropionyl-2(1*H*)-pyridone (X) as pale yellow needles, mp 127—129°. Mass Spectrum *m*/*e*: 221 (M^+). *Anal.* Calcd. for $C_{12}H_{15}O_3N$: C, 65.14; H, 6.83; N, 6.33. Found: C, 65.43; H, 6.92; N, 6.44. IR $\nu_{max}^{CCl_4}$ cm^{-1}: 1700, 1680 (C=O), 1670 (amide C=O). UV λ_{max}^{EtOH} nm (log ε): 220 (4.14), 280 (4.14), 340 (3.54). NMR (in $CDCl_3$) ppm: 1.17 (6H, sextet, J=7.5 Hz, $C\text{–}CH_3 \times 2$), 2.87 (2H, q, J=7.5 Hz, $COCH_2$), 3.15 (2H, q, J=7.5 Hz, $COCH_2$), 3.70 (3H, s, NCH_3), 8.42 (1H, d, J=2.5 Hz, 4- or 6-H), 8.59 (1H, d, J=2.5 Hz, 4- or 6-H).

The second was recrystallized from benzene to 3.015 g (66.4%) of 1-methyl-5-propionyl-2(1*H*)-pyridone (II) as colorless needles, mp 101—103°. Mass Spectrum *m*/*e*: 165 (M^+). *Anal.* Calcd. for $C_9H_{11}O_2N$: C, 65.44; H, 6.71; N, 8.48. Found: C, 65.49; H, 7.01; N, 8.59. IR ν_{max}^{Nujol} cm^{-1}: 1680 (C=O), 1650 (amide C=O), 840, 800(δ-CH). UV λ_{max}^{EtOH} nm (log ε): 211 (4.14), 280 (4.16). NMR (in $CDCl_3$) ppm: 1.19 (3H, t, J=7.5 Hz, $C\text{-}CH_3$), 2.31 (2H, q, J=7.5 Hz, $COCH_2$), 3.62 (3H, s, NCH_3), 6.55 (1H, d, J=10 Hz, 3-H), 7.88 (1H, q, J=10, J=2.5 Hz, 4-H), 8.20 (1H, d, J=2.5 Hz, 6-H).

b) A mixture of 5.4 g of $AlCl_3$ and 15.7 g of propionic anhydride was cooled in ice water and 3 g of I was added to the mixture. This mixture was heated in an oil bath at 180° for 3 days and treated as in the foregoing (a) to yield 0.127 g (2.8%) of II and 1.9 g (63%) of I.

c) A mixture of 5.4 g of $AlCl_3$ and 7.6 g of propionyl chloride, cooled in ice water, added dropwise with 3 g of I, was reacted in a sealed tube in an oil bath at 180° for 1 week. The reaction mixture was treated as in the foregoing (a) to yield 0.198 g (4.4%) of II.

Reaction of 1-Methyl-2(1*H*)-pyridone (I) and Butyric Acid Derivatives——a) A mixture of 3 g of I, 13.4 g of butyric anhydride, and 14 drops of conc. H_2SO_4 was heated in an oil bath at 180° for 2 days. The

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9) All melting points are uncorrected. Abbreviation used s=singlet, d=doublet, t=triplet, q=quartet, m=multiplet. Mass spectra were measured on a Hitachi RMU-6M spectrometer at an ionizing voltage of 80 eV.

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reaction mixture was treated as in the foregoing cases. Elution of the column of silica gel with benzene–acetone (20: 1) afforded two fractions. The first fraction was recrystallized from isopropyl ether to 0.510 g (7.4%) of 3,5-dibutyryl-1-methyl-2(1*H*)-pyridone (VI) as yellow needles, mp 70—72°. Mass Spectrum *m/e*: 249 (M$^+$). *Anal.* Calcd. for $C_{14}H_{19}O_3N$: C, 67.44; H, 7.68; N, 5.62. Found: C, 67.51; H, 7.82; N, 5.81. IR ν_{max}^{Nujol} cm^{-1}: 1685 (C=O), 1660 (amide C=O), 780 (δ-CH). UV λ_{max}^{EtOH} nm (log ε): 220 (4.14), 280 (4.14), 340 (3.49). NMR (in $CDCl_3$) ppm: 1.00 (6H, t, *J*=6 Hz, C–$CH_3\times 2$), 1.6—1.9 (4H, m, $\underline{CH_2}$–$CH_3\times 2$), 2.84 (2H, t, *J*=7 Hz, $COCH_2$), 3.12 (2H, t, *J*=7 Hz, $COCH_2$), 3.70 (3H, s, NCH_3), 8.42 (1H, d, *J*=3 Hz, 4- or 6-H), 8.58 (1H, d, *J*=3 Hz, 4- or 6-H).

The second was recrystallized from benzene to 3.732 g (75.9%) of 5-butyryl-1-methyl-2(1*H*)-pyridone (III) as pale yellow needles, mp 106—108°. Mass Spectrum *m/e*: 179 (M$^+$). *Anal.* Calcd. for $C_{10}H_{13}O_2N$: C, 67.02; H, 7.31; N, 7.82. Found: C, 67.31; H, 7.49; N, 7.81. IR ν_{max}^{Nujol} cm^{-1}: 1680 (C=O), 1650 (amide C=O), 840 (δ-CH). UV λ_{max}^{EtOH} nm (log ε): 211 (4.13), 280 (4.15). NMR (in $CDCl_3$) ppm: 0.98 (3H, t, *J*=6 Hz, C-CH_3), 1.70 (2H, m, $\underline{CH_2}$-CH_3), 2.72 (2H, t, *J*=7.5 Hz, $COCH_2$), 3.60 (3H, s, NCH_3), 6.50 (1H, d, *J*=10 Hz, 3-H), 7.83 (1H, q, *J*=10, *J*=3 Hz, 4-H), 8.12 (1H, d, *J*=3 Hz, 6-H).

b) A mixture of 5.4 g of $AlCl_3$ and 13.4 g of butyric anhydride was cooled in ice water and 3 g of I was added dropwise, and the mixture was heated in an oil bath at 180° for 3 days. The reaction mixture was treated as in the foregoing (a) to yield 0.14 g (2.0%) of VI and 0.506 g (10.3%) of III.

c) A mixture of 5.4 g of $AlCl_3$ and 8.3 g of butyryl chloride was cooled in ice water, 3 g of I was added dropwise, and the mixture was reacted in a sealed tube in an oil bath at 180° for 1 week and treated as in the foregoing (a). Elution of the chromatographic column afforded two fractions. The first fraction was recrystallized from hexane–isopropyl ether to 0.294 g (6.0%) of 3-butyryl-1-methyl-2 (1*H*)-pyridone (IV) as yellow needles, mp 40—41°. Mass Spectrum *m/e*: 179 (M$^+$). *Anal.* Calcd. for $C_{10}H_{13}O_2N$; C, 67.02; H, 7.31; N, 7.82. Found: C, 66.81; H, 7.48; N, 7.99. IR ν_{max}^{Nujol} cm^{-1}: 1680 (C=O), 1665 (amide C=O), 770 (δ-CH). UV λ_{max}^{EtOH} nm (log ε): 243 (3.35), 340 (3.66). NMR (in $CDCl_3$) ppm: 0.97 (3H, t, *J*=7.5 Hz, C–CH_3), 1.70 (2H,m, $\underline{CH_2}$–CH_3), 3.13 (2H, t, *J*=7.5 Hz, $COCH_2$), 3.60 (3H, s, NCH_3), 6.27 (1H, t, *J*=7.5 Hz, 5-H), 7.55 (1H, q, *J*=7.5, *J*=2 Hz, 6-H), 8.10 (1H, q, *J*=7.5, *J*=2 Hz, 4-H).

The second was recrystallized from benzene to 0.181 g (3.7%) of III.

Reaction of 1-Methyl-2(1*H*)-pyridone (I) and Valeric Acid Derivatives——a) A mixture of 3 g of I, 10 g of valeric anhydride, and 10 drops of conc. H_2SO_4 was heated in an oil bath at 180° for 2 days. The reaction mixture was treated as in the foregoing cases. The column of silica gel eluted with benzene–acetone (20: 1) afforded two fractions. The first fraction was recrystallized from hexane–isopropyl ether to 0.23 g (3.0%) of 1-methyl-3,5-divaleryl-2(1*H*)-pyridone (XI) as pale yellow fine crystalline powder, mp 55°. Mass Spectrum *m/e*: 277 (M$^+$). *Anal.* Calcd. for $C_{16}H_{23}O_3N$: C, 69.28; H, 8.36; N, 5.05. Found: C, 69.58; H, 8.61; N, 5.82. IR ν_{max}^{Nujol} cm^{-1}: 1700, 1690 (C=O), 1650 (amide C=O). UV λ_{max}^{EtOH} nm (log ε): 220 (4.14), 280 (4.14), 340 (3.52). NMR (in $CDCl_3$) ppm: 1.10 (6H, t, *J*=7 Hz, C–$CH_3\times 2$), 1.4—1.9 (8H, m, $\underline{CH_2CH_2}$–$CH_3\times 2$), 2.87 (2H, t, *J*=7 Hz, $COCH_2$), 3.17 (2H, t, *J*=7 Hz, $COCH_2$), 3.72 (3H, s, NCH_3), 8.42 (1H, d, *J*=2.5 Hz, 4- or 6-H), 8.59 (1H, d, *J*=2.5 Hz, 4- or 6-H).

The second was recrystallized from benzene to 3.74 g (70.4%) of 1-methyl-5-valeryl-2(1*H*)-pyridone (VII) as colorless needles, mp 64—65°. Mass Spectrum *m/e*: 193 (M$^+$). *Anal.* Calcd. for $C_{11}H_{15}O_2N$: C, 68.37; H, 7.82; N, 7.25. Found: C, 68.61; H, 7.91; N, 7.36. IR ν_{max}^{Nujol} cm^{-1}: 1680 (C=O), 1640 (amide C=O), 825 (δ-CH). UV λ_{max}^{EtOH} nm (log ε): 211 (4.13), 280 (4.15). NMR (in $CDCl_3$) ppm: 0.8—1.05 (3H, broad t, C-CH_3), 1.1—1.8 (4H, broad m, $\underline{CH_2CH_2}$–CH_3), 2.75 (2H, t, *J*=7 Hz, $COCH_2$), 3.58 (3H, s, NCH_3), 6.50 (1H, d, *J*=9 Hz, 3-H), 7.85 (1H, q, *J*=9, *J*=3 Hz, 4-H), 8.12 (1H, d, *J*=3 Hz, 6-H).

b) A mixture of 5.4 g of $AlCl_3$ and 10 g of valeric anhydride was cooled in ice water, added dropwise with 3 g of I, and heated in an oil bath at 180° for 3 days. The reaction mixture was treated as in the foregoing (a) to yield 0.180 g (2.3%) of XI and 0.910 g (17.1%) of VII.

c) A mixture of 5.4 g of $AlCl_3$ and 9.9 g of valeryl chloride, cooled in ice water, added dropwise with 3 g of I, was heated in a sealed tube in an oil bath at 180° for 1 week. The reaction mixture was treated as in the foregoing (a) to yield 0.783 g (14.7%) of VII.

Reaction of 1-Methyl-2(1*H*)-pyridone (I) and Cyclohexanecarbonyl Chloride——A mixture of 3.63 g of $AlCl_3$ and 12.1 g of cyclohexanecarbonyl chloride cooled in ice water, added dropwise with 3 g of I, was heated in an oil bath at 180° for 6 days. The reaction mixture was treated as in the foregoing cases and the column of silica gel eluted with benzene–acetone (30: 1) afforded two fractions. The first fraction was recrystallized from hexane–isopropyl ether to 0.792 g (13.1%) of 3-cyclohexanecarbonyl-1-methyl-2(1*H*)-pyridone (IX) as pale yellow fine crystalline powder, mp 81—82°. Mass Spectrum *m/e*: 219 (M$^+$). *Anal.* Calcd. for $C_{13}H_{17}O_2N$: C, 71.20; H, 7.82; N, 6.39. Found: C, 71.51; H, 8.21; N, 6.48. IR ν_{max}^{Nujol} cm^{-1}: 1665, 1645 (C=O). UV λ_{max}^{EtOH} nm (log ε): 243 (3.34), 346 (3.64). NMR (in $CDCl_3$) ppm: 1.1—2.1 (11H, broad m, cyclohexane ring-H), 3.6 (3H, s, NCH_3), 6.25 (1H, t, *J*=7 Hz, 5-H), 7.53 (1H, q, *J*=7, *J*=2 Hz, 6-H), 8.0 (1H, q, *J*=7, *J*=2 Hz, 4-H).

The second was recrystallized from hexane–isopropyl ether to 1.975 g (32.8%) of 5-cyclohexanecarbonyl-1-methyl-2(1*H*)-pyridone (VIII) as colorless fine crystalline powder, mp 126—128°. Mass Spectrum *m/e*: 219 (M$^+$). *Anal.* Calcd. for $C_{13}H_{17}O_2N$: C, 71.20; H, 7.82; N, 6.39. Found: C, 71.51; H, 8.11; N, 5.46. IR ν_{max}^{Nujol} cm^{-1}: 1665, 1660 (C=O), 815, 775 (δ-CH). UV λ_{max}^{EtOH} nm (log ε): 211 (4.13), 280 (4.15). NMR (in

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$CDCl_3$) ppm: 1.2—1.95 (11H, broad m, cyclohexane ring-H), 3.65 (3H, s, NCH_3), 6.56 (1H, d, $J=9$ Hz, 3-H), 7.87 (1H, q, $J=9$, $J=2.5$ Hz, 4-H), 8.16 (1H, d, $J=2.5$ Hz, 6-H).

Syntheses of 1-Methyl-3,5-dipropionyl-2(1*H*)-pyridone (X)——a) Under the same conditions as for I by method (a), a mixture of 0.5 g of II, 2.3 g of propionic anhydride, and 2 drops of conc. H_2SO_4 was reacted and treated to yield 0.04 g (6.0%) of X and the recovery of 0.378 g (75.6%) of II. of III.

b) To a mixture of 1.2 g of propionic anhydride and 0.9 g of $AlCl_3$, 0.5 g of II was added and this mixture was treated under the same conditions as for I by method (b) to yield 8 mg (1.2%) of X and the recovery of 0.155 g (31%) of II.

Syntheses of 3,5-Dibutyryl-1-methyl-2(1*H*)-pyridone (VII)——a) A mixture of 1 g of III, 2.5 g of butyric anhydride, and 1 drop of conc. H_2SO_4 was reacted under the same conditions as for I by method (a). The reaction mixture was treated similarly to yield 0.154 g (11.1%) of VI and the recovery of 0.647 g (64.7%) of III.

b) To a mixture of 1.2 g of butyric anhydride and 0.9 g of $AlCl_3$, 0.5 g of III was added and this mixture was treated under the same conditions as for I by method (b) to yield 10 mg (1.4%) of VI and the recovery of 0.220 g (44%) of III.

Syntheses of 1-Methyl-3,5-divaleryl-2(1*H*)-pyridone (XI)——a) A mixture of 1 g of VII, 2.3 g of valeric anhydride, and two drops of conc. H_2SO_4 was reacted under the same conditions as for I by method (a). The reaction mixture was treated similarly to yield 0.05 g (3.5%) of XI and the recovery of 0.715 g (71.5%) of VII.

b) To a mixture of 1.4 g of valeric anhydride and 0.9 g of $AlCl_3$, 0.5 g of VII was added and this mixture was treated under the same conditions as for I by method (b) to yield 10 mg (1.4%) of XI and 0.260 g (52%) of the recovered VII.

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