**1-Amino-3-(*p*-tolylazo)cyclohepta[*b*]pyrrol-2(1*H*)-one (XXIX)**——A solution of XXII (160 mg.) in 8 ml. of 7% hydrochloride was added dropwise to a solution of *p*-tolyldiazonium chloride obtained from 107 mg. of *p*-toluidine and 69 mg. of sodium nitrite by the usual method. The mixture was stirred at 0° to 4° for 1 hr., allowed to stand overnight at room temperature, neutralized with sodium carbonate and extracted with benzene. After concentrating the benzene solution, the resulting residue was purified by chromatography on alumina. The crude crystals, obtained from the elution were recrystallized from MeOH to give 40 mg. of yellow crystals, m.p. 220°. *Anal.* Calcd. for $C_{16}H_{14}ON_4$: C, 69.05; H, 5.07; N, 20.13. Found: C, 69.00; H, 5.11; N, 19.61.

The authors are grateful to Prof. S. Uyeo of Kyoto University, Prof. Y. Kitahara of Tohoku University and Mr. M. Matui, Director of this Laboratory, for guidance and encouragements through the course of this work. The authors are also indebted to Mr. T. Tanaka for his technical assistance. The measurements of infrared and ultraviolet spectra were carried out by Mr. H. Higuchi, Misses N. Sawamoto and T. Lee, and microanalyses were performed by Messrs. K. Ono, H. Nagashima, Misses. Y. Saito and N. Gonda, to whom the authors are also grateful.

## Summary

Reactions of 2-methoxytropone and 2-halotropone with hydrazides were carried out. Hydrazide reacted with 2-methoxytropone to yield 2-(2-acylhydrazino)tropones. With hydrazides having an active methylene group, 2-halotropones gave 1-aminocyclohepta[*b*]pyrrol-2(1*H*)-one derivatives and with other hydrazides, 2-(2-acylhydrazino)tropones were obtained.

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UDC 547.517.07

# 60. Nobuo Soma, Jun-ichi Nakazawa, Taiichiro Watanabe, Yoshio Sato, and Genshun Sunagawa: Studies on Seven-membered Ring Compounds. XV.[*1] Preparations of Troponeimine Derivatives.[*2]

(*Research Laboratories, Sankyo Co., Ltd.*[*3])

Some years ago, N,N-dimethylcolchiceinamide was prepared by methylation of colciceinamide in this laboratory as part of the total synthesis of colchiceine.1) To explore this preparative route, we examined the methylation of 2-aminotropone (I) as a model compound for colchiceinamide. The results obtained in those experiments are now reported in this paper.

It has been reported that 2-aminotropone exists in an amino-type structure (I) forming a hydrogen bonding between amino hydrogen and carbonyl group, despite the possibility of another, tautomeric imino-type structure.2) Acylation of I afforded an N-acyl but not an O-acyl derivative.3) Recently, however, Ikegami suggested the

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[*1] Part XIV. G. Sunagawa, H. Nakao: This Bulletin, **13**, 450 (1965).

[*2] This work was presented at the 84th Annual Meeting of the Pharmaceutical Society of Japan, Tokyo, April 4, 1964.

[*3] Nishi-shinagawa, Shinagawa-ku, Tokyo (相馬信夫，中沢準一，渡辺泰一郎，佐藤良雄，砂川玄俊).

1) G. Sunagawa, T. Nakamura, J. Nakazawa: This Bulletin, **10**, 291 (1962); T. Nakamura: *Ibid.*, **10**, 299 (1962).

2) T. Nozoe, *et al.*: Proc. Japan Acad., **27**, 558 (1951).

3) T. Nozoe, *et al.*: Sci. Repts. Tohoku Univ., **I**, **36**, 126 (1952).

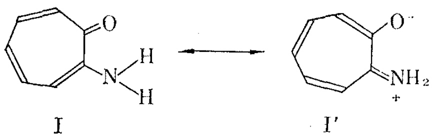

Chart 1.

contribution of the resonance structure (I′) on 2-aminotropone on the basis of the remarkably low-frequency shift of carbonyl absorption in infrared spectrum.[4] This paper deals with the methylation of I with dialkyl sulfates.

The sodium salt of 2-aminotropone obtained by refluxing I with sodium amide in toluene was readily methylated with dimethyl sulfate at room temperature affording 2-methylaminotropone (III). This was identified with the product obtained by the reaction of 2-methoxytropone (IV) with methyl amine.

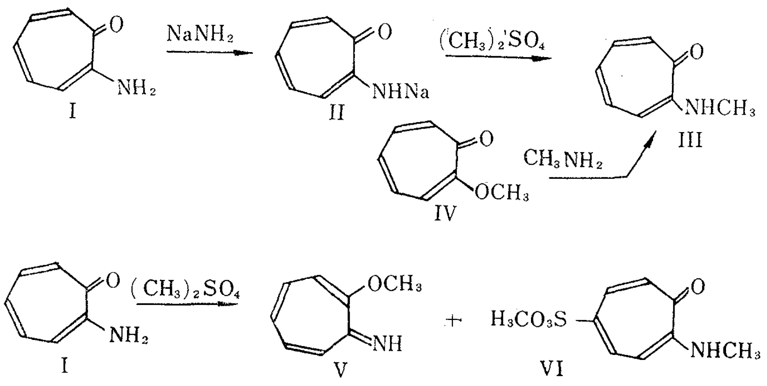

Chart 2.

On the other hand, direct methylation of 2-aminotropone (I) with dimethyl sulfate resulted in O-methylation affording 2-methoxytroponeimine (V) as the monomethylsulfate. The free base (V) was an unstable, yellow oil, and was characterized as picrate, m.p. 213°. The analytical data of this picrate agreed with a composition $C_{14}H_{12}O_8N_4$ corresponding to the picrate of monomethylated 2-aminotropone, and the methoxyl determination by Zeisel's method indicated the presence of one O-methyl group.

This interesting behaviour of 2-aminotropone (I) towards dimethyl sulfate can probably be attributed to contribution of resonance structure (I′). That is, this contribution facilitate the loss of an amino proton by the action of $NH_2^-$ from sodium amide consequently N-methylation takes places. Whereas in the case of direct methylation the most nucleophilic site is the negatively charged oxygen, thus O-methylation takes place.

The free base (V) is soluble in water and most organic solvents and shows an ultraviolet spectrum ($\lambda_{max}$: 240, 334 mμ) similar to that of 2-methoxytropone (IV). Although

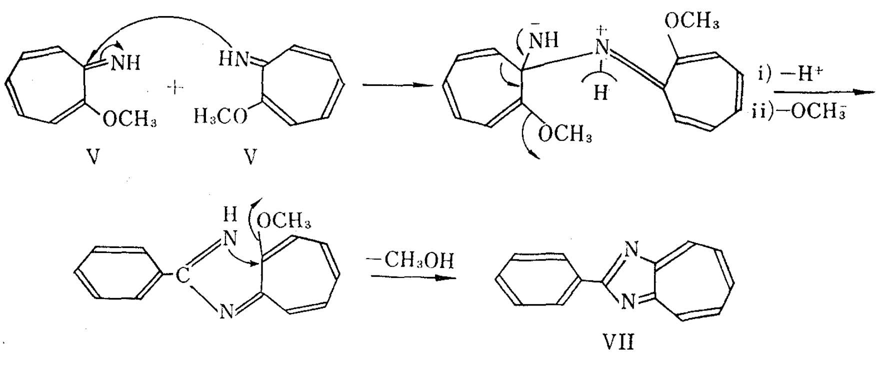

Chart 3.

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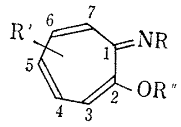
[4] Y. Ikegami: "Kagaku no Ryoiki, Extra No. 38." p. 66 (1959). Nankodo, Tokyo.

Table I. Troponeimines



| Compd. No. | R | R′ | R″ | Salt[a] | m.p. (b.p.) (°C) | Formula | Analysis (%) Calcd. C | Calcd. H | Calcd. N | Calcd. $OCH_3$ | Found C | Found H | Found N | Found $OCH_3$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| V | H | H | $CH_3$ | P | 213 | $C_{14}H_{12}O_8N_4$ | 46.16 | 3.32 | 15.38 | 8.52 | 45.93 | 3.43 | 15.23 | 8.44 |
| VIII | 〃 | 〃 | $C_2H_5$ | 〃 | 202 | $C_{15}H_{14}O_8N_4$ | 47.62 | 3.73 | 14.81 | | 47.79 | 3.78 | 14.87 | |
| IX | $C_2H_5$ | 5-Cl | $CH_3$ | 〃 | 169 | $C_{16}H_{15}O_8N_4Cl$ | 45.00 | 3.54 | 13.13 | 7.27 | 44.86 | 3.63 | 13.27 | 7.43 |
| X | H | 7-Br | 〃 | 〃 | 151 | $C_{14}H_{11}O_8N_4Br$ | 37.92 | 2.48 | 12.64 | 7.00 | 38.02 | 2.54 | 12.81 | 7.05 |
| XI | 〃 | 6-iso-$C_3H_7$ | 〃 | 〃 | 210 | $C_{17}H_{18}O_8N_4$ | 50.24 | 4.47 | 13.79 | 7.64 | 50.06 | 4.40 | 13.79 | 7.99 |
| XII | 〃 | 3-$CH_3$ | 〃 | 〃 | 165 | $C_{15}H_{14}O_8N_4$ | 47.62 | 3.73 | 14.81 | 8.20 | 47.82 | 3.85 | 14.77 | 8.54 |
| XIII | 〃 | 3-Br | 〃 | 〃 | 164 | $C_{14}H_{11}O_8N_4Br$ | 37.92 | 2.48 | 12.64 | 7.00 | 38.14 | 2.69 | 12.77 | 6.97 |
| XIV | 〃 | 3-$C_6H_5$ | 〃 | 〃 | 169 | $C_{26}H_{16}O_8N_4$ | 54.55 | 3.66 | 12.72 | 7.68 | 54.46 | 3.69 | 12.75 | 7.29 |
| XV | 〃 | 5-$NO_2$ | 〃 | 〃 | 195 (decomp.) | $C_{14}H_{11}O_{10}N_5$ | 41.08 | 2.71 | 17.11 | 7.57 | 40.79 | 3.03 | 16.98 | 7.69 |
| XVI | 〃 | 3-$OCH_3$ | 〃 | 〃 | 160 | $C_{15}H_{14}O_9N_4$ | 45.69 | 3.58 | 14.21 | 15.74 | 45.60 | 3.48 | 14.21 | 15.67 |
| XVII | 〃 | (3-Br<br>6-iso-$C_3H_7$ | 〃 | 〃 | 143 | $C_{17}H_{17}O_8N_4Br$ | 42.26 | 3.43 | 11.55 | 6.40 | 43.53 | 3.90 | 11.46 | 6.39 |
| XVIII | $CH_3$ | H | 〃 | — | (65/0.03) | $C_9H_{11}ON$ | 72.45 | 7.43 | 9.39 | | 71.79 | 7.39 | 9.26 | |
| | | | | M | 111 | $C_{10}H_{15}O_5NS$ | 45.97 | 5.79 | 5.36 | 23.76 | 45.72 | 5.86 | 5.54 | 24.36 |
| | | | | P | 163 | $C_{15}H_{14}O_8N_4$ | 47.62 | 3.73 | 14.81 | 8.20 | 47.46 | 3.67 | 14.63 | 8.33 |
| XIX | $-CH_2C_6H_5$ | 〃 | 〃 | 〃 | 115 | $C_{21}H_{18}O_8N_4$ | 55.51 | 3.99 | 12.33 | 6.83 | 55.56 | 4.02 | 12.29 | 6.88 |
| XX | $-CH_2CH_2N(CH_3)_2$ | 〃 | 〃 | 2P | 186 | $C_{24}H_{24}O_{15}N_8$ | 43.37 | 3.64 | 16.86 | 4.67 | 43.18 | 3.83 | 16.93 | 4.99 |
| XXI | $p$-$C_6H_4$-$CH_3$ | 〃 | 〃 | P | 133 | $C_{21}H_{19}O_8N_4$ | 55.38 | 4.17 | 12.30 | 6.81 | 55.18 | 3.99 | 12.13 | 7.19 |
| XXII | $-NHC_6H_5$ | 〃 | 〃 | — | 127 | $C_{14}H_{14}ON_2$ | 74.31 | 6.24 | 12.38 | 13.72 | 74.29 | 6.03 | 12.61 | 14.01 |
| XXIII | $-N(CH_3)_2$ | 〃 | 〃 | — | 60 | $C_{10}H_{14}ON_2$ | 67.38 | 7.92 | 15.72 | 17.41 | 67.15 | 7.81 | 15.71 | 17.12 |
| | | | | P | 131 | $C_{16}H_{17}O_8N_5$ | 47.17 | 4.21 | 17.19 | 7.62 | 47.17 | 4.35 | 17.38 | 7.80 |

a) P: picrate 2P: dipicrate M: monomethylsulfate

V was stable to aqueous acid, it was converted into tropolone by alkaline hydrolysis. Simply heating V afforded a small amount of 2-phenyl-1,3-diazaazulene (Ⅶ), although polymerisation was the predominant reaction. A possible mechanism for the formation of Ⅶ is shown in Chart 3 in which the successive dimerization, ring contraction and cyclization are involved.

In the previously-mentioned direct methylation of I with dimethyl sulfate, a small amount of methyl 7-methylamino-4-troponesulfonate (Ⅵ) was also obtained as by-product, which will be discussed latter.

Direct methylation of substituted 2-aminotropones with dimethyl sulfate afforded substituted 2-methoxytroponeimines. Similarly the reaction of I with diethyl sulfate afforded 2-ethoxytroponeimine (Ⅷ). The troponeimine derivatives obtained are listed in Table I. Some new 2-aminotropone derivatives which were used as starting materials in the preparation of these troponeimines were prepared as described below. The derivatives, 2-benzylaminotropone (XXIV), 2-(2-dimethylaminoethylamino)tropone (XXV), 2-(2-phenylhydrazino)tropone (XXVI) and 2-(2,2-dimethylhydrazino)tropone (XXVⅡ) were prepared by the reaction of 2-methoxytropone (Ⅳ) with benzylamine, N,N-dimethylethylenediamine, phenylhydrazine and 1,1-dimethylhydrazine, respectively. Subsequently, 2-amino-7-methoxytropone (XXIX) which was used as the starting material of 2,3-dimethoxytroponeimine (XVI) was obtained by the methylation of 3-aminotropolone (XXVⅢ) with diazomethane. In this reaction, another isomeric product, 2-methoxy-3-aminotropone (XXX) was obtained in addition to XXIX. Confirmation of the structure of XXIX was obtained by the similarity of its ultraviolet spectrum to that of 2-aminotropone (I).

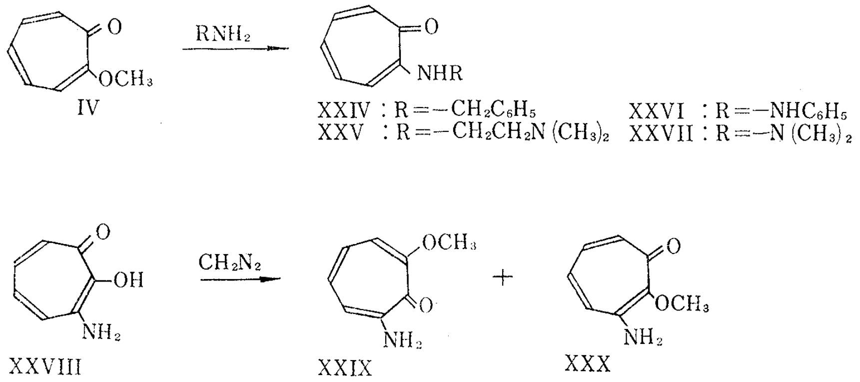


Chart 4.

The sulfonate formation was observed in several of the troponeimine preparations. The structure of Ⅵ, mentioned above, was proved by alkaline hydrolysis to the known 5-tropolonesulfonic acid (XXXVⅡ) and the fact that 2-methylaminotropone (Ⅲ) also afforded Ⅵ. The formation of Ⅵ from I indicates that N-methylation occurs in addition to O-methylation in the reaction of I with dimethyl sulfate, although it is not predominant. 2-Amino-7-methyltropone (XXXI), 2-amino-7-phenyltropone (XXXⅡ) and 2-amino-7-bromotropone (XXXⅢ) yielded methyl 2-methyl-7-methylamino-4-troponesulfonate (XXXIV), methyl 2-phenyl-7-methylamino-4-troponesulfonate (XXXV) and methyl-2-bromo-7-methylamino-4-troponesulfonate (XXXVI), respectively, in addition to the corresponding troponeimine derivatives. It is interesting to note that all sulfonates obtained above involved nitrogen methylation. Furthermore, 2-methylaminotropone (Ⅲ) afforded more sulfonate derivative (Ⅵ) than 2-aminotropone (I) afforded. These facts suggest sulfonation is facilitated by the substitution of a methyl group on the nitrogen of 2-aminotropone. The presence of a bulky group at C-7 in I resulted in decreasing

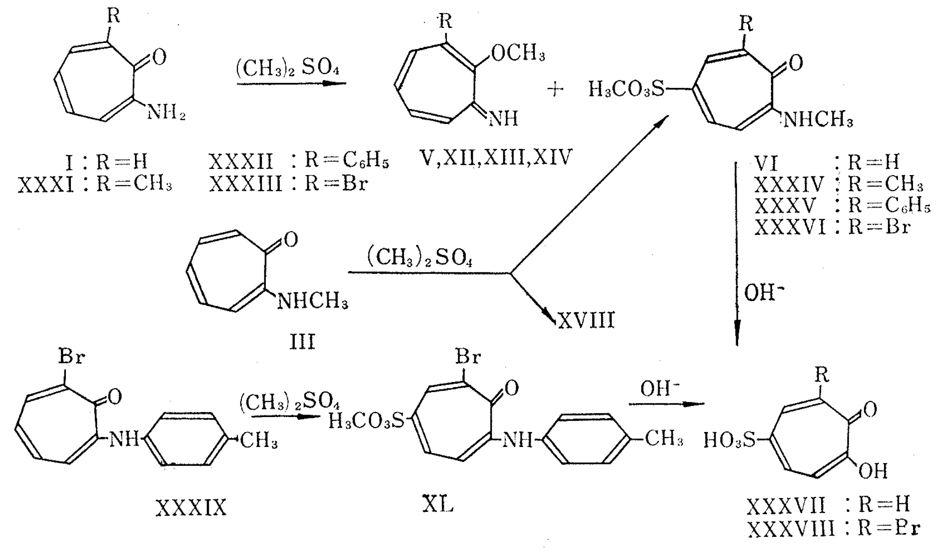
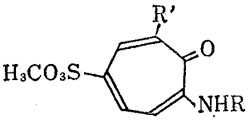


Chart 5.

yields of troponeimine derivatives and increasing sulfonate yields. Such behaviour was observed for 2-amino-7-phenyltropone (XXXII) and 2-amino-7-bromotropone (XXXIII). The reaction of 2-bromo-7-toluidinotropone (XXXIX) with dimethyl sulfate afforded methyl 2-bromo-7-toluidino-4-troponesulfonate (XL) in good yield. To prove the location of sulfonate group, methyl 2-bromo-7-methylamino-4-troponesulfonate (XXXVI) and methyl 2-bromo-7-toluidino-4-troponesulfonate (XL) were converted to the known 3-bromo-5-tropolonesulfonic acid (XXXVIII) by alkaline hydrolysis. Sulfonates obtained are shown in Table II.

Table II.



| Compd. No. | R | R′ | m.p. (°C) | Material | Tropone-imine deriv. obtained together | Formula | Analysis (%) Calcd. C | Calcd. H | Calcd. N | Found C | Found H | Found N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VI | $CH_3$ | H | 131 | (I)<br>(III) | (V)<br>(XVIII) | $C_9H_{11}O_4NS$ | 47.15 | 4.84 | 6.11 | 47.04 | 4.95 | 6.17 |
| XXXIV | 〃 | $CH_3$ | 148 | (XXXI) | (XII) | $C_{10}H_{13}O_4NS$ | 49.38 | 5.39 | 5.76 | 49.16 | 5.33 | 5.70 |
| XXXV | 〃 | $C_6H_5$ | 187 | (XXXII) | (XIV) | $C_{15}H_{15}O_4NS$ | 59.00 | 4.95 | 4.59 | 58.76 | 4.87 | 4.98 |
| XXXVI | 〃 | Br | 184 | (XXXIII) | (XIII) | $C_9H_{10}O_4NBrS$ | 35.06 | 3.25 | 4.55 | 35.04 | 3.24 | 4.77 |
| XL | *p*-$C_6H_4CH_3$ | 〃 | 171 | (XXXIX) | — | $C_{15}H_{14}O_4NBrS$ | 46.87 | 3.64 | 3.64 | 46.94 | 3.71 | 3.69 |
| XLI | -$CH_2C_6H_5$ | H | 140 | (XXIV) | (XIX) | $C_{15}H_{15}O_4NS$ | 59.00 | 4.95 | 4.59 | 59.10 | 4.79 | 4.44 |

In sulfonations of tropolone derivatives, it has been reported that sulfonation did not occur with even concentrated sulfuric acid or fuming sulfuric acid, owing to the formation of a conjugated acid in acidic solutions, and sulfonations are only accomplished by fusion with sulfamic acid.[5] In comparison with this, it is of interest that some 2-aminotropone derivatives, as described above, are sulfonated easily with dimethyl sulfate. The reason for this facility of sulfonation of 2-aminotropone derivatives is probably explainable by resonance. A contribution of the resonance structure (XLII″),

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5) T. Nozoe, *et al.* : Proc. Japan Acad., **27**, 24 (1951).

in addition to that of structure (XLII′) which has been discussed previously, is significant to 2-aminotropone derivative (XLII), consequently the sulfonation by dimethyl sulfate takes place. An N-methyl group would be expected to favours contributions of this

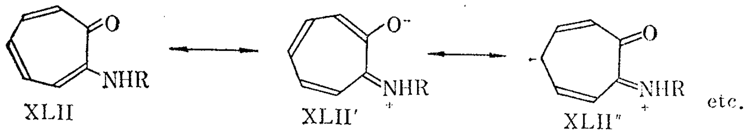


Chart 6.

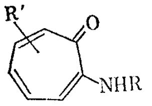
structure (XLII″) by its electron-releasing character, and consequently increase the yield of sulfonate. The activity of dialkyl sulfate towards sulfonation had been reported already by Belov.[6]

Troponeimine derivatives obtained above have high reactivities and further investigations are now in progress.

## Experimental

**2-Methylaminotropone (III)**——i) A mixture of 2.8 g. of 2-aminotropone (I) and 1.2 g. of sodium amide in 60 ml. of toluene was refluxed with stirring for 4 hr. After cooling, 3.3 g. of $(CH_3)_2SO_4$ was added, and the mixture was stirred at room temperatures for 5 hr. and allowed to stand overnight. The reaction mixture was filtered and the filtrate was extracted with 5% HCl. The HCl solution was made basic with $Na_2CO_3$ and extracted with benzene. The benzene solution, dried over $Na_2SO_4$, was evaporated to dryness and the residue was crystallized from benzene-cyclohexane affording yellow leaflets melting at 83°. The yield was 1.4 g. *Anal.* Calcd. for $C_8H_9ON$ : C, 71.09; H, 6.71; N, 10.36. Found : C, 70.76; H, 6.62; N, 10.36.

ii)*4 A mixture of 48 g. of 2-methoxytropone (IV) and 100 ml. of ethanol saturated with monomethylamine was allowed to stand at room temperatures for two days, and then refluxed for 1 hr. After removal of ethanol and excess monomethylamine, the residue was crystallized from benzene-cyclohezane as yellow leaflets melting at 83°, which was identified with the product obtained in i) by mixed melting point and IR spectra. The yield was 45.0 g.



XLIII

**Troponeimines (V, VIII～XXIII)**——2-Aminotropone derivatives (XLIII) in which R and R′ are shown Table I were allowed to react with dimethyl sulfate or diethyl sulfate. Examples are cited for V, XVIII and XXIII. Similar procedures were used in preparing other troponeimine derivatives.

**2-Methoxytroponeimine (V)**——i) A mixture of 3.0 g. of I and 6.0 g. of $(CH_3)_2SO_4$ in 30 ml. of toluene was refluxed with stirring for 4 hr. Water was added and the aqueous layer, after stirring, was separated from organic layer (containing VI). To the aqueous solution there was added an aqueous solution of picric acid and separated crystals were recrystallized from ethanol giving 8.0 g. of yellow leaflets melting at 213°. This is picrate of V and the analytical data are shown in Table I. In another experiment, the aqueous solution obtained above was made strongly alkaline with conc. NaOH and extracted with benzene. Benzene solution was drived over $K_2CO_3$ and most of benzene was evaporated under reduced pressure below 50°. (Exhaustive removal of the solvent resulted in the polymerisation of the product.) To this was added an ethanol solution of picric acid, and the precipitate was recrystallized from ethanol as yellow leafiets melting at 213°, which were identified with the product obtained above by mixed melting poing and comparison of IR spectra.

ii) A mixture of 18.0 g. of I and 27 ml. of $(CH_3)_2SO_4$ was gently heated in an oil bath. When the temperature of the mixture reached ca. 100°, an exothermic reaction occured and the oil bath was removed. After the reaction subsided, the mixture was heated at 110° for 10 min. Water and benzene were added and the aqueous layer was treated as described in i) giving the picrate of V, m.p. 213°.

**N-Methyl-2-methoxytroponeimine (XVIII)**——i) A mixture of 4.0 g. of 2-methylaminotropone (III) and 8.0 g. of $(CH_3)_2SO_4$ in 40 ml. of toluene was refluxed with stirring for 4.5 hr. Water was added to the reaction mixture and the aqueous layer, after stirring, was separated from the organic layer. The aqueous

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*4 Nozoe, *et al.* obtained 2-methylaminotropone (III) together with dimethylaminotropone by the reaction of 2-methoxytropone with commercial dimethylamine. T. Nozoe, *et al.* : Proc. Japan Acad., 28, 192 (1952); Sci. Repts. Tohoku Univ., **I**, **36**, 126 (1952).

6) N. V. Belov, M. Z. Finkel'stein : J. Gen. Chem. (U. S. S. R.), **16**, 1248 (C. A., **41**, 30651 (1947)).

solution was made alkaline with aqueous NaOH and extracted with benzene. After drying over $Na_2SO_4$, the benzene extract was distilled under reduced pressure giving 2.2 g. of a yellow oil, b.p. 65° at 0.03 mm. Analytical data are shown in Table I, UV $\lambda_{max}^{EtOH}$ mμ (log ε) : 246 (4.46), 335 (3.92). This oil darkens on exposure to air. The picrate prepared by the usual method melted at 163°. Its analytical data are shown in Table I.

ii) A mixture of 3.0 g. of 2-methylaminotropone (III) and 6.0 g. of $(CH_3)_2SO_4$ was heated at 110° for 10 min. The resulting solid product washed with benzene and recrystallized from iso-PrOH as light yellow prisms melting at 110°. This is monomethylsulfate of XVIII and its analytical data are shown in Table I; UV $\lambda_{max}^{EtOH}$ mμ (log ε) : 247 (4.46), 345 (4.08). To the aqueous solution of this monomethylsulfate was added aqueous solution of picric acid and then yellow crystals, m.p. 163°, were separated and identified with the picrate obtained in i) by mixed melting point.

**N-(Dimethylamino)-2-methoxytroponeimine (XXIII)**——A mixture of 5.0 g. of 2-(2,2-dimethylhydrazino)-tropone (XXVII) and 10.0 g. of $(CH_3)_2SO_4$ in 75 ml. of toluene was refluxed with stirring for 3 hr. The reaction mixture was extracted with water. The aqueous solution was made alkaline with aqueous NaOH and extracted with chloroform. Chloroform was removed under reduced pressure and the aesidue, after washing with ether, was recrystallized from cyclohexane to give 3.5 g. of red plates, m.p. 60°, UV $\lambda_{max}^{EtOH}$ mμ (log ε) : 230 (4.24), 335 (3.89). The analytical data are shown in Table I. The picrate prepared by the usual method was obtained as yellow prisms melting at 131° : analytical data are shown in Table I.

**2-Phenyl-1,3-diazaazulene (VII)**——2-Methoxytroponimine (V) prepared from 5.0 g. of 2-aminotropone (I) was heated at 50° for 1 hr. The reaction product was extracted with benzene. Benzene extract was filtered, concentrated and chromatographed with benzene as solvent. The benzene eluate was evaporated to dryness, and the residue was crystallized from cyclohexane as yellow needles; m.p. 160°. Yield was 0.5 g. *Anal.* Calcd. for $C_{14}H_{10}N_2$ : C, 81.53; H, 4.89; N, 13.58. Found : C, 81.44; H, 4.85; N, 13.39. This product was identified with the authentic sample of 2-hyenyl-1,3-diazaazulene (VII) by mixed melting point and IR spectra.

**Methyl Sulfonates (VI, XXXIV～XXXVI, XLI)**——The toluene solution described in the preparation of troponeimines was chromatographed on alumina with benzene or chloroform as solvent. After removal of the initial eluate containing $(CH_3)_2SO_4$, the eluent was evaporated to dryness and the residue was crystallized from EtOH or benzene. Methyl sulfonates obtained are listed in Table II.

**Methyl 2-Bromo-7-toluidino-4-troponesulfonate (XL)**——A mixture of 9.0 g. of 2-bromo-7-toluidinotropone (XXXIX) and 30 ml. of $(CH_3)_2SO_4$ was heated at 110° for 5 hr. Crystals separated on cooling were filtered and recrystallized from EtOH as yellow needles; m.p. 171°; yield, 7.9 g. Analytical data are shown in Table II. UV $\lambda_{max}^{EtOH}$ mμ (log ε) : 258 (4.34), 370 (4.19), 418 (4.33).

**5-Tropolonesulfonic Acid (XXXVII)**——A mixture of 90 mg. of VI and 60 mg. of KOH in 10 ml. of 75% EtOH was refluxed for 8 hr. To this was added 120 mg. of *p*-toluidine hydrochloride and the pH of the mixture was adjusted to 3.0 by addition of dil. HCl. After concentration of the mixture, crystals separated and were filtered, washed with water and recrystallized from EtOH to give white needles melting at 240°. *Anal.* Calcd. for $C_{14}H_{15}O_5NS$ (*p*-toluidine salt of XXXVII) : C, 54.35; H, 4.89; N, 4.53. Found : C, 54.25; H, 4.91; N, 4.00. This product was shown to be identical with the authentic sample of the *p*-toluidine salt of XXXVII by mixed melting point and IR spectra.

**3-Bromo-5-tropolonesulfonic Acid (XXXVIII)**——i) A mixture of 300 mg. of XXXVI and 130 mg. of KOH in 20 ml. of 50% EtOH was refluxed for 8 hr. After concentration under reduced pressure, 150 mg. of *p*-toluidine hydrochloride was added and the pH of the mixture was adjusted to 2.5 by addition of dil. HCl. Crystals separated and were filtered and recrystallized from EtOH to give pale yellow needles, m.p. 228°. *Anal.* Calcd. for $C_{14}H_{14}O_5NBrS$ (*p*-toluidine salt of XXXVIII) : C, 43.31; H, 3.36; N, 3.61. Found : C, 43.19; H, 3.57; N, 4.01. This product was shown to be identical with the authentic sample of *p*-toluidine salt of XXXVIII by mixed melting point and IR spectra.

ii) A mixture of 1.0 g. of XL and 0.5 g. of KOH in 10 ml. of EtOH was refluxed for 5 hr. Crystals (0.7 g.) separated from the cooled reaction mixture were filtered, and after addition of 0.7 g. of *p*-toluidine hydrochloride, dissolved in warm water. By addition of dil HCl, pH of the solution was adjusted to 2.5. Crystals separated and were filtered and recrystallized from EtOH to give pale yellow needles, m.p. 228°, undepressed on admixture with the product obtained above.

**2-Benzylaminotropone (XXIV)**——A mixture of 3.7 g. of 2-methoxytropone (IV) and 10 ml. of benzylamine was allowed to stand at room temperature for two days and the reaction mixture was poured into water. Crystals separated and were filtered, washed with water and recrystallized from benzene-cyclohexane in pale yellow needles melting at 128°. The yield was 4.2 g. *Anal.* Calcd. for $C_{14}H_{13}ON$ : C, 79.59; H, 6.20; N, 7.57. Found : C, 79.42; H, 6.14, N, 7.90. UV $\lambda_{max}^{EtOH}$ mμ (log ε) : 243 (4.64), 336 (4.24), 403 (4.25).

**2-(2-Dimethylaminoethylamino)tropone (XXV)**——A mixture of 5.0 g. of IV and 2.9 g. of N,N-dimethylethylenediamine in 80 ml. of EtOH was stirred at room temperatures for 5 hr. and allowed to stand overnight. After removal of EtOH, the residue was chromatographed on alumina with ether as solvent and recrystallized from cyclohexane to give yellow prisms, m.p. 57～58°; yield, 1.9 g. *Anal.* Calcd. for

$C_{11}H_{16}ON_2$ : C, 68.72; H, 8.39; N, 14.57. Found : C, 68.51; H, 8.52; N, 14.30. UV $\lambda_{\max}^{\mathrm{EtOH}}$ mμ (log ε) : 246 (4.99), 338 (4.60), 407 (4.57).

**2-(2-Phenylhydrazino)tropone (XXVI)**——A mixture of 3.0 g. of Ⅳ and 2.4 g. of phenylhydrazine in 20 ml. of EtOH was refluxed for 7.5 hr. Crystals separated from the cooled reaction mixture and were filtered. Recrystallization from AcOEt yielded 1.3 g. of pale yellow prisms, m.p. 175°. *Anal.* Calcd. for $C_{13}H_{12}ON_2$ : C, 73.56; H, 5.70; N, 13.20. Found : C, 73.27; H, 5.79; N, 13.02. UV $\lambda_{\max}^{\mathrm{EtOH}}$ mμ (log ε) : 244 (4.48), 334 (4.07), 395 (4.08).

**2-(2,2-Dimethylhydrazino)tropone (XXVII)**——A mixture of 2.0 g. of Ⅳ and 0.9 g. of 1,1-dimethylhydrazine in 10 ml. of EtOH was refluxed for 13 hr. After removal of EtOH, the residue was chromatographed on alumina with benzene as solvent and recrystallized from cyclohexane to give 0.8 g. of orange-yellow prisms, m.p. 96°. *Anal.* Calcd. for $C_9H_{12}ON_2$ : C, 65.83; H, 7.37; N, 17.06. Found : C, 65.85; H, 7.52 ; N, 17.08. UV $\lambda_{\max}^{\mathrm{EtOH}}$ mμ (log ε) : 240 (4.43), 336 (4.13), 400 (4.09).

**Reaction of 3-Aminotropolone (XXVIII) with Diazomethane : Preparation of 2-Amino-7-methoxytropone (XXIX) and 2-Methoxy-3-aminotropone (XXX)**——To a solution of 2.9 g. of XXVⅢ in ether was added excess etheral solution of diazomethane and the mixture was allowed to stand overnight. After removal of ether, the residue was dissolved in chloroform and the solution was chromatographed on alumina. The initial chloroform eluates, after removal of solvent, gave 1.8 g. of yellow prisms, m.p. 128°, which were recrystallized from AcOEt and PrOH. *Anal.* Calcd. for $C_8H_9O_2N$ (2-amino-7-methoxytropone (XXIX)) : C, 63.56; H, 6.00; N, 9.27. Found : C, 63.54; H, 6.08; N, 9.13. UV $\lambda_{\max}^{\mathrm{EtOH}}$ mμ (log ε) : 250 (4.44), 262 (4.24), 272 (4.12), 338 (4.15), 398 (3.99). Later eluates, after removal of chloroform, gave 0.3 g. of yellow leaflets, m.p. 156°, recrystallized from AcOEt. *Anal.* Calcd. for $C_8H_9O_2N$ (2-methoxy-3-aminotropone (XXX)) : C, 63.56; H, 6.00; N, 9.27. Found : C, 63.32; H, 5.92; N, 9.07. UV $\lambda_{\max}^{\mathrm{EtOH}}$ mμ (log ε) : 264 (4.44), 274 (4.39), 315 (3.88), 370 (3.32).

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## Summary

Reactions between 2-aminotropone derivatives and dialkyl sulfates were examined. Methylation of sodium salt of 2-aminotropone with dimethyl sulfate resulted in N-methylation yielding 2-methylaminotropone (Ⅲ). On the other hand, the direct methylation of 2-aminotropone (I) with dimethyl sulfate resulted in O-methylation yielding 2-methoxytroponeimine (Ⅴ). Troponeimines listed in Table I were prepared by the direct alkylation of 2-aminotropone derivatives with dialkyl sulfates. In these preparations, sulfonates listed in Table Ⅱ were also obtained.

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