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Reactions of Lactonic Compounds with Nitrogen-containing Reagents. II.[1] Reaction of Meranzin with Dimethylamine or Piperidine

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Synthetic meranzin (IVa) was treated with dimethylamine or piperidine in methanol at 40—42° (condition A) and in benzene at 150° (condition B). *cis*-Amides (VII) and (IX) and *trans*-amides (VIII) and (X) were obtained under conditions A and B, respectively. Re-examination of the reaction of natural IVa with dimethylamine under condition B revealed that the product was not V proposed by Böhme, *et al.* but one of the optical isomers of VIII. Treatment of natural IVa with dimethylamine under condition A gave one of the optical isomers of racemic VII. VII—VIII or IX—X equilibrium in ethanol induced by diffused light was also described.

In the previous paper,[1] we have reported that the reaction of byakangelicol (I) with dimethylamine or piperidine gave the corresponding furo-[2,3]-benzodioxin derivatives, (II) and (III). These results suggested that the similar treatment of meranzin (IVa) with secondary amines would afford nitrogen-containing dihydrobenzofuran derivatives. In 1939, Böhme, *et al.*[3] reported that aminoalcohol (V) was obtained by the treatment of natural IVa with dimethylamine in benzene at 150°. On the other hand, Venturella, *et al.*[4] obtained *trans*-meranzinic acid (VI) by treating IVa with sodium methylate. The publication of this recent work prompted us to reexamine the work of Böhme, *et al.*[3] The starting material, IVa, was prepared by epoxidation of osthol (IVb) which was isolated from the roots of *Angelica ursina* Maxim. For the isolation of IVb, we have modified the method of Nikonov, *et al.*,[5] by using trichloroethylene as extraction solvent in place of ethanol.

We have treated synthetic IVa with dimethylamine or piperidine under two different conditions; namely, standing in methanol at 40—42° (condition A) and heating in benzene in a sealed tube at 150° (condition B). We have also investigated the reaction of isomeranzin[6] (IVc), obtainable by isomerization of IVa,[3] with dimethylamine.

As the results, the treatment of IVa with dimethylamine or piperidine under condition A gave neutral products. The same starting material (IVa) was worked up under condition B giving also neutral products, which showed evidently different behaviors on thin-layer chromatogram (TLC) from those obtained under condition A. These two pairs of products had the same analytical data, $C_{17}H_{23}O_4N$ (in case of dimethylamine) and $C_{26}H_{27}O_4N$ (in case of piperidine) and revealed rather similar infrared (IR) spectra. The ultraviolet (UV) spectra, however, were different in each case. The neutral products obtained under condition B showed marked absorption maxima at 302 mμ. Considering our previous data[1] together with the above results, we have assigned structures (VII), (VIII), (IX), and (X) to the products obtained from the reactions of IVa with dimethylamine or piperidine. In contrast with *cis*-amides II previously prepared, having no absorption maximum in the vicinity of 300 mμ,

1) M. Murayama, H. Murai, K. Sempuku, and T. Suminokura, *Chem. Pharm. Bull.* (Tokyo), **18**, 2453 (1970).
2) Location: *Nishioji-hachijo, Minami-ku, Kyoto.*
3) H. Böhme and G. Pietsch, *Ber.*, **72**, 773 (1939).
4) P. Venturella, A. Bellino, and M.L. Marino, *Annali Chim.*, **59**, 428 (1969).
5) G.K. Nikonov, N.I. Rodina, and M.G. Pimenoov, *Aptech. Delo*, **12**, 41 (1963).
6) The previous name was isoaurapten given by Böhme, *et al.*[3]

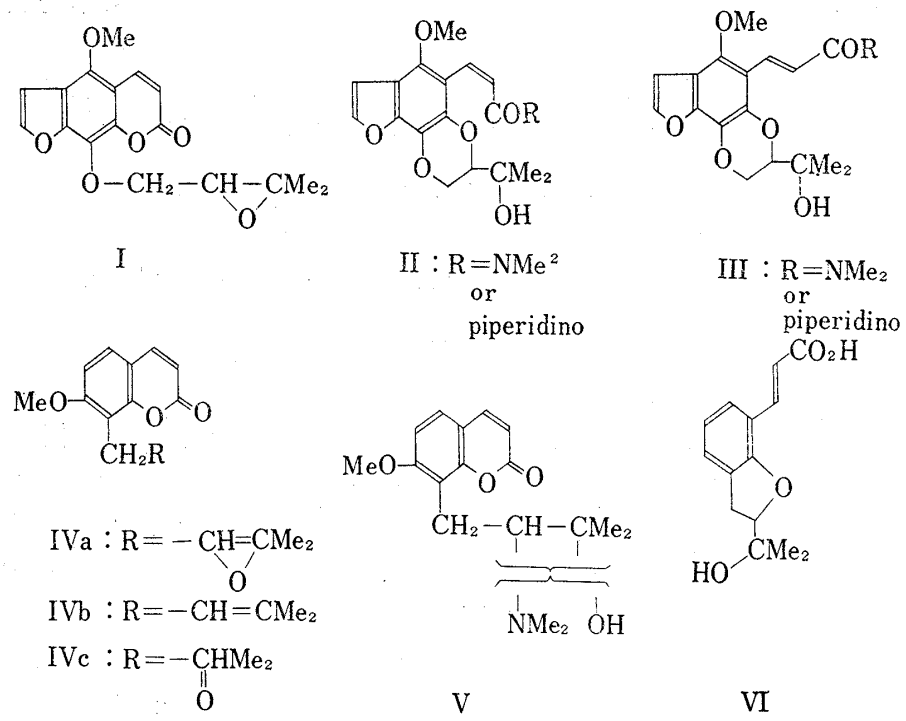


Chart 1

cis-amides VII and IX had each UV absorption maximum at 308 mμ. This difference was explainable by considering the less restircted coplanarity of the side chain with the benzene ring in VII and IX due to the absence of a methoxy group at the *ortho* position. The above structural assignment was verified by the nuclear magnetic resonance (NMR) spectra in which the vinyl protons of VII and IX showed a coupling constant of 13.0 cps while those of VIII and X gave a greater value of 15.6 cps. The geometrically isomeric relationship between VII—IX and VIII—X was finally established by converting them into XI and XII by hydrogenation on Pd-black.

The duality of products VII and VIII or IX and X caused by the difference in solvents employed was reasonably understood, as mentioned previously,[1] by taking into account

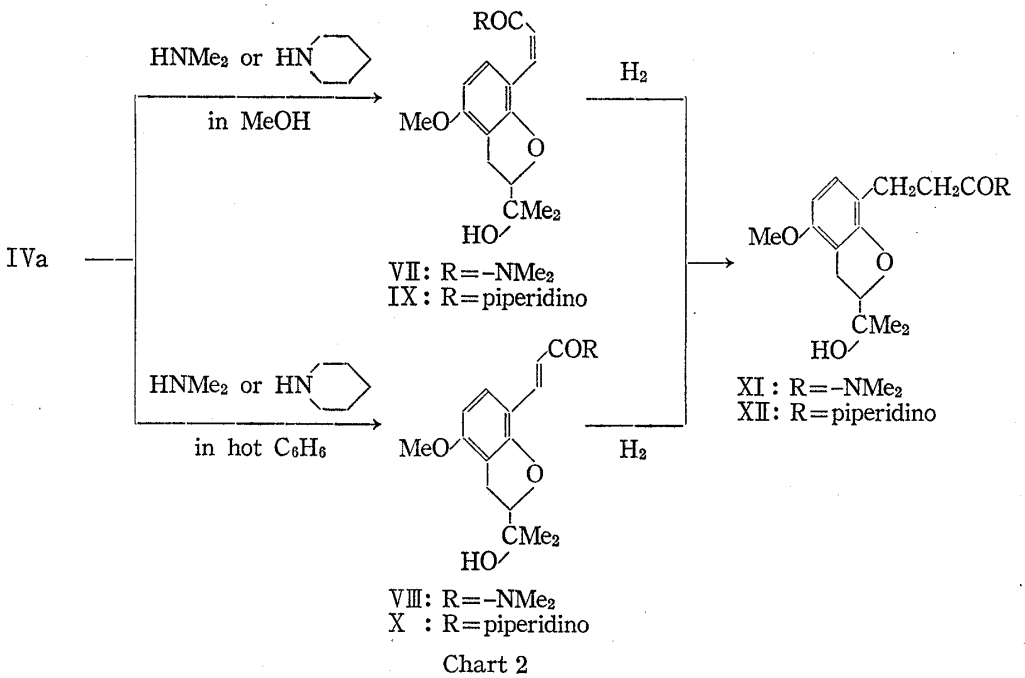
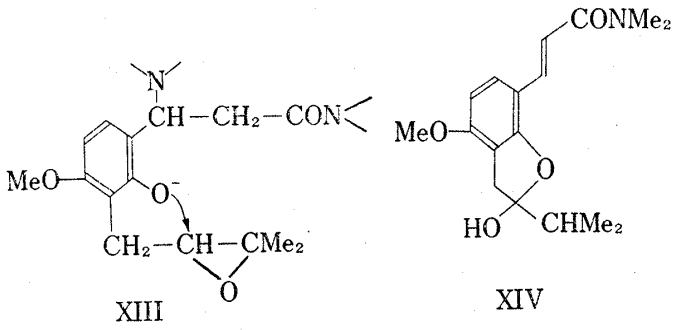


Chart 2

the different reaction mechanisms due to the difference in the polarity of the solvents. In brief, the reaction in hot benzene seemingly proceeded with the initial addition of an amine molecule to the double bond of the lactonic moiety, the attack of a second amine molecule on the carbonyl carbon, and the subsequent attack of resultant phenolate ion (XIII) on the epoxide ring with typical intramolecular S_N 2 mechanism followed by *trans*-elimination of the first amine molecule. On the other hand, the reaction in methanol would proceed with the direct attack of an amine molecule on the polarized carbonyl group with the retention of the *cis* double bond. Refluxing of methanolic solution of IVc with dimethylamine expectedly gave XIV, whose isopropyl group showed a typical NMR pattern in which the signal of the *gem*-dimethyl protons was split into a double doublet characteristic of $-CH(CH_3)_2$.



XIII XIV

Chart 3

In this case, however, from the NMR pattern in the range of τ 2—4, the geometrical configuration of the vinyl side chain was found to be *trans*. Formation of the *trans*-isomer in methanol was ascribed to the prolonged heating undertaken due to the low reactivity of IVc with dimethylamine.

In an attempt to reexamine the result obtained by Böhme, *et al.*,[3] we have tried the reaction of natural IVa, isolated from bitter orange oil,[7] with dimethylamine in benzene at 150°. Thereby, we have obtained an amide as the sole product and no basic product such as V has been found to occur. Although the amide had the same mp and $[\alpha]_D$ as those of the reaction product which was thought to be V by Böhme, *et al.*, the UV, IR, and NMR spectral data were in good agreement with those of VIII. We have, therefore, concluded that the above amide is one of the optical isomers of racemic VIII. For comparison, we have further treated natural IVa with dimethylamine in methanol at 40° and obtained an amide having the same UV, IR, and NMR spectral patterns as those of VII. It has, thus, been deduced from these spectral data that this amide is again one of the optical isomers of racemic VII.

Finally, it has been found from the UV measurement that the exposure of both *trans* amides VIII and X to diffused light resulted in the rapid and almost complete conversion to the corresponding *cis* amides VII and IX.

Experimental[8]

Isolation of Osthol (IVc) from *Angelica ursina* Maxim.——Dried and crushed roots (1 kg) of *Angelica ursina* were percolated with $CHCl=CCl_2$ (3×3 liters) for 24 hr. The combined extracts were concentrated *in vacuo* to 200 ml, 10% aqueous KOH (200 ml) was added, and the mixture was stirred at 25° for 24 hr. The organic layer was separated, washed with H_2O, dried over anhydrous Na_2SO_4, and evaporated *in vacuo*. The residue was dissolved in ether (50 ml) and the solution was kept at −20° for 48 hr to precipitate pale yellow crystals. The crystals were recrystallized from ether to give IVb (3.2 g), mp 80—81°. Treatment with active C and further recrystallization from MeOH gave pure IVb (2.8 g), mp 83—84° (*lit.*[5] mp 83—84°). The above precipitation filtrate and recrystallization mother liquors were combined and evaporated

7) H. Böhme and G. Pietsch, *Arch. Pharm.*, **276**, 482 (1938).

8) All the mps were uncorrected. Unless otherwise specified, column chromatography was carried out on Merck's silica gel (grain size 0.2—0.5 mm). For thin-layer chromatography, Silica gel GF_{254} was used with AcOEt–$CHCl_3$ as solvent system. The spots were detected under UV light of 2537 Å and 3650 Å or on exposure to iodine vapor. IR and UV measurements were taken on a Hitachi EPI-S_2 and a Model-124 equipped with an automatic recorder, respectively. NMR spectra were measured in $CDCl_3$ on a Varian A-60D with Me_4Si as the internal standard.

in vacuo to leave a residue. The viscous residue was blended with silicic acid (Mallinckrodt 100 mesh, 30 g) and loaded on a column of silicic acid (50 g) soaked with petroleum ether. The column was eluted successively with petroleum ether, petroleum ether–ether (9:1), and finally petroleum ether–ether (6:4) to give a red brown, a yellow, and a colorless materials, respectively. The fraction containing colorless material was concentrated to leave crystals. Recrystallization from MeOH gvae pure IVb (1.4 g), mp 83—84°. The total yield was 0.42% based on the dried plant. IR cm^{-1} (KBr): $\nu_{C=O}$ 1723. UV λ_{max}^{EtOH} mμ (log ε): 258 (3.62), 322 (4.16). NMR τ: 2.40, 3.79 (2H, AB q, J=9.7 cps, C4-H and C3-H); 2.71, 3.17 (2H, AB q, J=8.7 cps, C_5-H and C_6-H); 4.75 (1H, t, J=7.5 cps, –CH=); 6.08 (3H, s, O-CH_3); 6.47 (2H, d, J=7.5 cps, -CH_2-); 8.14, 8.32 (6H, s, 2C-CH_3). *Anal.* Calcd. for $C_{15}H_{16}O_3$: C, 73.75; H, 6.60. Found: C, 73.73; H, 6.78.

Decomposition Degree of IVb by 10% Aqueous KOH in Ether and CHCl=CCl_2[5]——To a solution (50 ml) of IVb dissolved in ether or CHCl=CCl_2 was added 10% aqueous KOH (50 ml). The mixture was stirred at 25° for 24 hr. UV measurement at 322 mμ determined the decomposition degree of IVb in ether and CHCl=CCl_2 to be 53.6% and 6%, respectively.

Preparation of Meranzin (IVa) from Osthol (IVb)[9]——A 9% solution of $C_6H_5CO_3H$ in $CHCl_3$ (115 ml) was added to IVb (5 g) dissolved in $CHCl_3$ (390 ml) and the mixture was kept in a refrigerator for 20 hr. The reaction mixture was washed with 1% aqueous Na_2CO_3 (3×300 ml) and then with H_2O (3×300 ml), the solvent was removed, and the residue was recrystallized from (iso-Pr)$_2$O to give colorless needles (4.45 g), mp 100—100.5° (*lit.*[3] mp 98° for natural IVa). IR cm^{-1} (KBr): $\nu_{C=O}$ 1715. UV λ_{max}^{MeOH} mμ (log ε): 320 (4.18). NMR τ: 2.37, 3.77 (2H, AB q, J=9.7 cps, C_4-H and C_3-H); 2.65, 3.15 (2H, AB q, J=8.9 cps, C_5-H and C_6-H); 6.09 (3H, s, O-CH_3); 6.6—7.2 (3H, m, -CH_2-CH〈); 8.53, 8.73 (6H, s, 2C-CH_3). *Anal.* Calcd. for $C_{15}H_{16}O_4$: C, 69.21; H, 6.20. Found: C, 69.34, H, 6.23.

***dl*-2,3-Dihydro-2-(α-hydroxy-α-methyl)ethyl-4-methoxy-7-(*cis*-β-dimethylcarbamoyl)vinylbenzofuran (VII)**——A 40% aqueous solution (1 ml) of $HNMe_2$ was added to meranzin (IVa) (150 mg) dissolved in MeOH (10 ml) and the mixture was allowed to stand at 40° for 6 hr. Removal of the solvent and recrystallization of the resulting residue from AcOEt gave colorless fine needles, mp 146—148°, yield 100 mg. IR cm^{-1} (KBr): $\nu_{C=O}$ 1635. UV λ_{max}^{EtOH} mμ (log ε): 273 (3.75), 308 (3.48). NMR τ: 2.85, 3.54 (2H, AB q, J=9.0 cps, C_6-H and C_5-H); 3.28, 4.05 (2H, AB q, J=13.0 cps, vinyl); 5.35 (1H, t, J=9.1 cps, -CH〈); 6.17 (3H, s, O-CH_3); 6.91 (2H, d, J=9.1 cps, -CH_2-); 7.01 (6H, s, 2N-CH_3); 7.42 (1H, s, O-H); 8.69, 8.82 (6H, s, 2C-CH_3). *Anal.* Calcd. for $C_{17}H_{23}O_4N$: C, 66.86; H, 7.59; N, 4.59. Found: C, 67.02; H, 7.56; N, 5.00.

***dl*-2,3-Dihydro-2-(α-hydroxy-α-methyl)ethyl-4-methoxy-7-(*trans*-β-dimethylcarbamoyl)vinylbenzofuran (VIII)**——A 40% C_6H_6 solution (1 ml) of $HNMe_2$ was added to IVa (200 mg) dissolved in C_6H_6 (10 ml), the mixture was put in a sealed glass tube, and heated at 150° for 7 hr. Removal of the solvent and recrystallization of the residue from MeOH gave colorless needles, mp 216—217°, yield 130 mg. IR cm^{-1} (KBr): $\nu_{C=O}$ 1640. UV λ_{max}^{MeOH} mμ (log ε): 302 (4.03). NMR τ: 2.38, 2.93 (2H, AB q, J=15.6 cps, vinyl); 2.81, 3.59 (2H, AB q, J=8.8 cps, C_6-H and C_5-H); 5.25 (1H, t, J=9.1 cps, -CH〈); 6.18 (3H, s, O-CH_3); 6.89 (2H, d, J=9.1 cps, -CH_2-); 6.93 (6H, s, 2N-CH_3); 8.12 (1H, s, O-H); 8.62, 8.75 (6H, s, 2C-CH_3). *Anal.* Calcd. for $C_{17}H_{23}O_4N$: C, 66.86; H, 7.59; N, 4.59. Found: C, 66.90; H, 7.68; N, 4.88.

***dl*-2,3-Dihydro-2-(α-hydroxy-α-methyl)ethyl-4-methoxy-7-(*cis*-β-piperidinocarbonyl)vinylbenzofuran (IX)**——A mixture of IVa (300 mg) and piperidine (2 g) in MeOH (15 ml) was kept at 42° for 40 hr. After removal of the solvent and excess piperidine, the oily residue was subjected to silica gel column chromatography (1 cm×25 cm) with C_6H_6–AcOEt (1:1) as eluent. The eluate was concentrated and the residue was crystallized by adding *n*-hexane. Recrystallization from (iso-Pr)$_2$O gave colorless fine needles, mp 89.5—91°, yield 200 mg. IR cm^{-1} (KBr): $\nu_{C=O}$ 1637. UV λ_{max}^{EtOH} mμ (log ε): 273 (3.69), 308 (3.60). NMR τ: 2.81, 3.64 (2H, AB q, J=9.0 cps, C_6-H and C_5-H); 3.21, 4.06 (2H, AB q, J=13.0 cps, vinyl); 5.35 (1H, t, J=9.1 cps, -CH〈); 6.18 (3H, s, O-CH_3); 6.52 (4H, broad s, 4 α-protons on the piperidine ring); 6.93 (2H, d, J=9.1 cps, -CH_2-); 7.46 (1H, s, O-H); 8.47 (6H, broad s, 6 β- and γ-protons on the piperidine ring); 8.70, 8.82 (6H, s, 2C-CH_3). *Anal.* Calcd. for $C_{20}H_{27}O_4N$: C, 69.54; H, 7.88; N, 4.06. Found: C, 69.53; H, 7.89; N, 4.27.

***dl*-2,3-Dihydro-2-(α-hydroxy-α-methyl)ethyl-4-methoxy-7-(*trans*-β-piperidinocarbonyl)vinylbenzofuran (X)**——A mixture of IVa (300 mg), piperidine (2 g), and C_6H_6 (15 ml) was put in a sealed glass tube and heated at 150° for 7 hr. After removal of the solvent and excess piperidine, the residue was recrystallized from iso-PrOH to give colorless needles, mp 164—165°, yield 250 mg. IR cm^{-1} (KBr): $\nu_{C=O}$ 1637. UV λ_{max}^{EtOH} mμ(log ε): 302 (3.99). NMR τ: 2.40, 2.92 (2H, AB q, J=15.6 cps, vinyl); 2.82, 3.60 (2H, AB q, J=8.9 cps, C_6-H and C_5-H); 5.27 (1H, t, J=9.1 cps, -CH〈); 6.17 (3H, s, O-CH_3); 6.42 (4H, broad s, 4 α-protons on the piperidine ring); 6.90 (2H, d, J=9.1 cps, -CH_2-); 7.86 (1H, s, O-H); 8.40 (6H, broad s, 6 β- and γ-protones on the piperidine ring); 8.64, 8.75 (6H, s, 2C-CH_3). *Anal.* Calcd. for $C_{20}H_{27}O_4N$: C, 69.54; H, 7.88; N, 4.06. Found: C, 69.75; H, 7.98; N, 4.32.

***dl*-2,3-Dihydro-2-(α-hydroxy-α-methyl)ethyl-4-methoxy-7-(β-dimethylcarbamoyl)ethylbenzofuran (XI)**——A solution of VII (350 mg) in 80% aqueous MeOH (100 ml) was vigorously stirred with Pd-black (150 mg) under H_2 atmosphere at room temperature for 1 hr to absorb the theoretical amount of H_2. Pd-black

9) P.W. Austin, T.R. Seshadri, M.S. Sood, and Vishwapaul, *Tetrahedron*, 24, 3247 (1968).

was filtered off, the solvent was removed, and the resulting residue was recrystallized from iso-PrOH to give colorless needles, mp 93—94°, yield 320 mg. IR (KBr): $\nu_{C=O}$ 1630. NMR τ: 3.10, 3.70 (2H, AB q, J=8.5 cps, C_6-H and C_5-H); 5.39 (1H, t, J=9.1 cps, -CH<); 6.22 (3H, s, O-CH_3); 6.93 (2H, d, J=9.1 cps, -CH_2-); 7.08 (6H, s, 2N-CH_3); 7.0—7.5 (4H, m, -CH_2-CH_2-); 7.66 (1H, s, O-H); 8.70, 8.82 (6H, s, 2C-CH_3). *Anal.* Calcd. for $C_{17}H_{25}O_4N$: C, 66.42; H, 8.19; N, 4.55. Found: C, 66.49; H, 8.20; N, 4.45. The same treatment of VIII gave a product identical with XI in TLC and IR and UV measurements.

***dl*-2,3-Dihydro-2-(α-hydroxy-α-methyl)ethyl-4-methoxy-7-(β-piperidinocarbonyl)ethylbenzofuran (XII)**——IX (170 mg) was worked up in the same way as in the case of VII giving colorless needles from iso-PrOH, mp 116.5—118°, yield 150 mg. IR cm^{-1} (KBr): $\nu_{C=O}$ 1630 (shoulder). NMR τ: 3.09, 3.69 (2H, AB q, J=8.5 cps, C_6-H and C_5-H); 5.36 (2H, t, J=9.1 cps, -CH<); 6.20 (3H, s, O-CH_3); 6.56 (4H, broad s, 4 α-protons on the piperidine ring); 6.91 (2H, d, J=9.1 cps, -CH_2-); 7.0—7.5 (4H, m, -CH_2-CH_2-); 7.81 (1H, s, O-H); 8.45 (6H, broad s, 6 β- and γ-protons on the piperidine ring); 8.68, 8.79 (6H, s, 2C-CH_3). *Anal.* Calcd. for $C_{20}H_{29}O_4N$: C, 69.13; H, 8.41; N, 4.03. Found: C, 69.59; H, 8.60; N, 4.05. The same treatment of X gave a product identical with XII in TLC and IR and UV measurements.

***dl*-2,3-Dihydro-2-hydroxy-2-isopropyl-4-methoxy-7-(*trans*-β-dimethylcarbamoyl) vinylbenzofuran (XIV)**——A mixture of IVc (mp 69°, *lit.*[3] mp 66°) (600 mg), MeOH (20 ml), and 40% aqueous $HNMe_2$ (3 ml) was refluxed for 10 hr, concentrated, dissolved in $(iso\text{-}Pr)_2O$, and cooled to precipitate a powder, which was collected by filtration (350 mg). The powder was chromatographed on silica gel (1.5 cm×30 cm) with C_6H_6–AcOEt (4:1) as eluent. The first eluate (75 ml) contained the starting material IVc (250 mg). The second fraction (200 ml) was concentrated to give crystals (80 mg), which was recrystallized from EtOH to give colorless needles (65 mg), mp 170—172°. IR cm^{-1} (KBr): $\nu_{C=O}$ 1640. UV λ_{max}^{EtOH} mμ(log ε): 300 (4.03). NMR τ: 2.52, 3.07 (2H, AB q, J=15.5 cps, vinyl); 2.84, 3.62 (2H, AB q, J=9.0 cps, C_6-H and C_5-H); *ca.* 5.0 (1H, broad s, O-H); 6.16 (3H, s, O-CH_3); 6.91, 7.09 (6H, s, 2N-CH_3); 6.8—7.7 (2H, s, -CH_2-); 7.90 (1H, q, J=6.8 cps, -CH<); 8.55, 8.97 (6H, overlapping dd, J=6.8 cps, 2C-CH_3). *Anal.* Calcd. for $C_{17}H_{23}O_4N$: C, 66.86; H, 7.59; N, 4.59. Found: C, 66.88; H, 7.89; N, 4.70.

Isolation of Natural Meranzin (IVa) from Bitter Orange Oil by Dry Column Chromatography——Bitter orange oil (5.25 g), purchased from Shiono Koryo Kaisha, Ltd., was subjected to dry column chromatography in two separate successive nylon columns. The first chromatography was carried out on silica gel (50 mm× 600 mm) using C_6H_6–acetone (9:1) as developing solvent. The section containing IVa was cut, eluted with $CHCl_3$–MeOH (3:1), and the eluate was concentrated. The residue was subjected to the second chromatography on silica gel (30 mm×600 mm) using C_6H_6–AcOEt (15:1) as developing solvent. The same treatment as above was given to afford an oil (30 mg) rich in natural IVa. The oil was recrystallized from $(iso\text{-}Pr)_2O$ to give colorless leaflets (15 mg), mp 93—96° (*lit.*[7] mp 98°). The mp was not depressed in admixture with synthetic IVa. $[\alpha]_D^{21}$: −41.5° (c=0.31, l=0.5, 96% EtOH) (*lit.*[7] $[\alpha]_D^{20}$: −33.4°, c=0.72, l=2, 96% EtOH). IR cm^{-1} (KBr): $\nu_{C=O}$ 1710. UV λ_{max}^{EtOH} mμ(log ε): 320 (3.85). The NMR data are exactly the same as those of synthetic IVa. *Anal.* Calcd. for $C_{15}H_{16}O_4$: C, 69.21; H, 6.20. Found: C, 69.11; H, 6.33.

***d*-2,3-Dihydro-2-(α-hydroxy-α-methyl) ethyl-4-methoxy-7-(*trans*-β-dimethylcarbamoyl) vinylbenzofuran (VIII)**——A 18% C_6H_6 solution (2 ml) of $HNMe_2$ was added to a solution of natural IVa (250 mg) in C_6H_6 (3 ml) and the mixture was put in a sealed glass tube and heated at 150° for 5 hr. Removal of the solvent, washing the residue (180 mg) with ether and recrystallization from C_6H_6 or MeOH gave colorless needles (164 mg), mp 167—168° (*lit.*[3] mp 170° for V). $[\alpha]_D^{21}$: +80.2° (c=1.65, l=0.5, 96% EtOH) (*lit.*[3] $[\alpha]_D^{15}$: +78.8° in EtOH for V). IR cm^{-1} (KBr): $\nu_{C=O}$ 1640. UV λ_{max}^{EtOH} mμ(log ε): 302 (4.03). The NMR data are identical with those of racemic VIII obtained from synthetic IVa. *Anal.* Calcd. for $C_{17}H_{23}O_4N$: C, 66.86; H, 7.56; N, 4.59. Found: C, 66.91; H, 7.39; N, 4.71. Extraction of the reaction mixture with 3% HCl afforded no basic products.

***l*-2,3-Dihydro-2-(α-hydroxy-α-methyl) ethyl-4-methoxy-7-(*cis*-β-dimethylcarbamoyl) vinylbenzofuran (VII)**——A 40% solution (1 ml) of $HNMe_2$ was added to a solution of natural IVa (150 mg) in MeOH (10 ml) and the mixture was kept at 40° for 5 hr. After removal of the solvent, the residue was dissolved in AcOEt and chromatographed on silica gel (1.5 cm×30 cm). At first, a fraction consisting of an oil (75 mg) was eluted and then another fraction gave a crystalline material (70 mg) on evaporation. Recrystallization of this substance from ether gave colorless needles (60 mg), mp 95—96°. $[\alpha]_{578}^{28}$: −6.93° (c=0.28, l=0.5, 96% EtOH). IR cm^{-1} (KBr): $\nu_{C=O}$ 1635. UV λ_{max}^{EtOH} mμ(log ε): 273 (3.74), 308 (3.61). The NMR data are the same as those of racemic VII obtained from synthetic IVa. *Anal.* Calcd. for $C_{17}H_{23}O_4N$: C, 66.86; H, 7.56; N, 4.59. Found: C, 66.74; H, 7.72; N, 4.58.

Equilibrium between VII and IX or IX and X in EtOH by Diffused Light——VIII or X (0.5 mg) in 50 ml of EtOH was kept standing in the dark at 37° for 24 hr to show no changes in the UV absorption spectra. Next, the solution was allowed to stand in difused light at room temperature. It was found, by the UV absorption measurement, that an equilibrium was complete for both VII—VIII and IX—X systems within 4 hr. The ratios of VII to VIII and IX to X were calculated to be 97: 3 and 95: 5, respectively, from the absorption coefficients at 302 mμ.

Acknowledgement Thanks are due to the members of Analytical Section of this Laboratory who undertook the elemental analysis and NMR measurement.