3) 4-Methoxychinolin-*N*-oxyd wird durch die Druckhydrierung mit Raney-Nickel in methanolischer Lösung in das 4-Methoxychinolin (bei 40~50°) und das 4-Methoxy-Bz-tetrahydrochinolin (140~260°) als Hauptprodukt mit guter Ausbeute übergeführt, und daneben auch in das *cis-N*-Methyldekahydrochinolin und das *N*-Methyl-Py-tetrahydrochinolin, je nach der Reaktionstemp., erfasst.

4) 4-Methoxychinolin wird bei der Druckhydrierung mit Raney-Nickel unter Zusatz von Nickelchlorid in methanolischer Lösung nur zum Teil von einer Umlagerung begleitet, wobei das *N*-Methyl-4-chinolon gebildet wird.

(Eingegangen am 14. Juli, 1952)

374. Tyunosin Ukita and Toru Tsumita : Studies on the Resin Acid in the Fruits of *Juniperus japonica*.

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In the previous paper¹⁾, Ukita and Matsuda reported that a pale yellow, acidic resinous oil, $C_{20}H_{30}O_2$, b.p._{0.1} 183~185°, $[\alpha]_D^{25} = +11^\circ$, obtainable from ethereal extract of *Juniperus rigida* Sieb. et Zucc., and *Juniperus conferta* Parl, was found to have an antibacterial activity against *Staph. aureus* both in broth and in Knight's synthetic medium, in a dilution of 1:12,800 and 1:51,200, respectively, and this was assumed to be a kind of diterpenic acid.

This paper deals with the further purification and separation of two crystalline isomeric acids from the acidic oil.

Starting from the fruits on a larger scale, the acidic fraction, b.p._{0.1} 183~185°, was collected by fractional distillation, which, upon treating with alcohol or acetic acid, solidified into a crystalline mass, melting at 150~152°. This was recrystallized from acetic acid to furnish colorless needles (A) with constant melting point of 162.5~165°, and specific rotation, $[\alpha]_D^{24} = -8.9^\circ$ ²⁾, but the yield of the crystals was about 30% calculated from the starting compound of m.p. 150~152°.

The mother solution was treated according to the method developed by Harris and Sanderson, which was based on the recrystallization of amino salts to separate pure resin acids from their mixtures³⁾.

On treating the mother liquor of the recrystallization of (A) with butanolamine (2-amino-2-methylpropanol), fine needles having a constant rotation of $[\alpha]_D^{25.5} = \pm 0^\circ$, m.p. 200° (decomp.) precipitated. The salt was decomposed with diluted sulfuric acid, and the resin acid was recovered, which was recrystallized from alcohol to colorless needles, m.p. 160~161°, $[\alpha]_D^{25.5} = \pm 0^\circ$ (B).

Because of the less solubility of the butanolamine salt of (B) in ethyl acetate than that of (A), (B) was also obtained in pure state by the amine salt method directly applied to the compound of m.p. 150~152°.

Although (A) and (B) were analytically proved to have the same molecular formula, $C_{20}H_{30}O_2$, they showed a remarkable depression on mixed fusion, and the different patterns in X-ray diffraction schema. They were, therefore, assumed to be isomeric resin acids (Tables I and III).

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1) T. Ukita, R. Matsuda : This Journal, **71**, 1050 (1951).

2) All rotations were measured in acetone-chloroform (1:1) mixture.

3) G. C. Harris, T. F. Sanderson : J. Am. Chem. Soc., **70**, 334 (1948).

Table I

	m.p.	$[\alpha]_D$	Mixed Fusion with	
			(A)	(B)
(A)	162.5~165°	-8.9°		
(B)	160~161°	$\pm 0^\circ$	148~152°	
7-Isodextropimaric acid	162~164°	$\pm 0^\circ$	151~155°	160~163°

(A) and (B) were easily methylated by diazomethane to furnish the methyl esters, m.p. 61.5~62.5°, and m.p. 63~64°, respectively. The mixed melting point of both esters also depressed remarkably as listed in Table II.

On hydrogenation in acetic acid with 10% palladium-charcoal, both (A) and (B) easily absorbed one mole each of hydrogen yielding their dihydro compounds: $C_{20}H_{32}O_2$, m. p. 152~155°, $[\alpha]_D^{25.5} = +15.2^\circ$, from (A), and m. p. 172.5~175°, $[\alpha]_D^{20.5} = -15.8^\circ$, from (B).

Table II

	Methyl ester			Dihydro acid		
	m.p.	$[\alpha]_D$	Mixed Fusion	m.p.	$[\alpha]_D$	Mixed Fusion
(A)	61.5~62.5°	-6.6°	45~48°	152~155°	+15.2°	148°
(B)	63~64°	-7.2°		172.5~175°	-15.8°	
7-Isodextropimaric acid	61~62°	—		173~175°	0° (-16.0°)	

Recently, Harris and Sanderson⁴⁾ isolated a new pimaric type acid, named 7-isodextropimaric acid (I), $C_{20}H_{30}O_2$, m.p. 162~164°, $[\alpha]_D^{24} = \pm 0^\circ$, which was an isomeric compound of dextropimaric acid (II) at C-7 position⁵⁾.

As listed in Tables I and II, the melting points and optical rotations of (I) and its derivatives resemble those of (B), except the optical rotatory powers of both dihydro compounds. (A) and (B) were compared with the authentic 7-isodextropimaric acid, which was supplied through the courtesy of Dr. G. C. Harris, by mixed fusion and the result was that the mixture of the authentic specimen with (A) showed a remarkable depression, but that with (B) melted without depression. The identity of (B) with 7-isodextropimaric acid was further supported by their X-ray diffraction patterns as shown in Table III.

In order to clarify the discrepancy between the rotatory power of dihydro-(B)-acid and that of dihydro-7-isodextropimaric acid appearing in the previous papers, the latter was prepared from the authentic 7-isodextropimaric acid by catalytic hydrogenation and it was found that both showed the same specific rotation, $[\alpha]_D^{21} = -16.0^\circ$ in 1.87% solution of chloroform-acetone (1:1) mixture.

4) G. C. Harris, T. F. Sanderson: J. Am. Chem. Soc., **70**, 2079 (1948).

5) Ibid., **70**, 2081 (1948).

Table III

A		B		7-isodextropimaric acid	
d(Å)	intensity	d(Å)	intensity	d(Å)	intensity
7.17	mw	12.27	s	12.27	s
6.13	s	10.65	vw	10.65	vw
5.63	s	8.53	ms	8.53	ms
5.05	mw	6.88	mw	6.88	mw
4.60	vw	5.76	vs	5.76	vs
4.23	vs	5.20	s	5.20	s
3.84	ms	4.85	w	4.85	w
3.59	vw	4.27	w	4.27	w
3.32	vw	4.09	vw	4.09	vw
		3.72	vw	3.72	vw
		3.32	vw	3.32	vw

mw—moderately weak, w—weak, vw—very weak, ms—moderately strong,
s—strong, vs—very strong.

The authors wish to thank Dr. A. Watanabe of the Takeda Pharmaceutical Industries, Ltd., for his help in the measurements of X-ray diffraction patterns, and to Miss. R. Ohta, Miss. E. Kondo, and Mr. B. Kurihara for carrying out the microanalyses. The authors are also indebted to Chiba Forestry Experimental Station, Agricultural Faculty, University of Tokyo, for collecting the fruits of the Junipers used.

Experimental

Preparation of resin acids—The powdered fruits of *Juniperus rigida* and *J. conferta* were thoroughly extracted with ether at room temperature and from the ethereal extract, the acid fraction was separated with 5% sodium hydroxide solution. On acidifying the alkaline solution with diluted hydrochloric acid, the resin acids precipitated, which were extracted again with ether. The residue, obtained on removal of ether, was refluxed with benzene on a water bath for one hour and after standing overnight at a room temperature, the supernatant was taken and benzene was evaporated. After two distillations, the residue furnished a pale yellow resinous oil, b.p. 0.1 183–185°, which was dissolved in a small amount of acetic acid and kept overnight at a room temperature. The colorless needles, precipitated from the acetic acid solution, melted at 150–152° and the yield was 0.2–0.1%, calculated from the original fruits.

Isolation of resin acid (A)—3.0 g. of the crystals, m. p. 150–152°, were repeatedly recrystallized from acetic acid and the melting point was raised to 162.5–165°. The final crystals (0.9 g.) showed the constant melting point of 162.5–165°, and specific rotation of $[\alpha]_D^{24} = -8.9^\circ$ in 2.5% solution. *Anal.* Calcd. for $C_{20}H_{30}O_2$: C, 79.47; H, 9.93; COOH, 14.90. Found: C, 79.09; H, 10.03; COOH, 15.06.

Isolation of resin acid (B)—The mother liquor left from the recrystallization of (A) was diluted with water to precipitate colorless crystals, which were filtered and dried. To the solution of these crystals in a small amount of acetone, 10% butanolamine solution in acetone was added, until no more crystals precipitated. After standing it in a refrigerator, the precipitate was filtered and recrystallized four times from a large amount of ethyl acetate to furnish fine needles, m.p. 200°, and $[\alpha]_D^{26.5} = \pm 0^\circ$ (in 1% solution). *Anal.* Calcd. for $C_{24}H_{36}O_2N$: N, 3.75. Found: N, 3.90.

The salts were suspended in ether and decomposed by shaking twice with diluted sulfuric acid. The ethereal layer was washed with water, dried and the solvent was evaporated to dryness. The residual colorless oil solidified and was crystallized from a small amount of ethanol to fine prisms, with the constant melting point of 160–161° and $[\alpha]_D^{25.5} = \pm 0^\circ$ (in 2.5% solution). *Anal.* Calcd. for $C_{20}H_{30}O_2$: C, 79.47; H, 9.93; COOH, 14.90. Found: C, 79.44; H, 10.02; COOH, 15.01.

Methyl ester of (A)—0.2 g. of (A) was methylated with diazomethane by the ordinary procedure. A thin platelets (0.12 g.) were obtained by recrystallization from ethanol, m.p. 61.5–62.5°, and $[\alpha]_D^{24} = -6.6^\circ$ (in 2.4% solution). *Anal.* Calcd. for $C_{21}H_{32}O_2$: C, 79.75; H, 10.13. Found: C, 79.77; H, 10.22.

Methyl ester of (B)—(B) was similarly methylated as in the case of (A) to yield a methyl ester with m.p. 63–64° and $[\alpha]_D^{25.5} = -7.2^\circ$ (in 4.3% solution). *Anal.* Calcd. for $C_{21}H_{32}O_2$: C, 79.75; H, 10.13. Found: C, 79.76; H, 10.19.

Hydrogenation of (A)—0.31 g. of (A), m.p. 162.5–165°, was dissolved in acetic acid and the

solution was hydrogenated at a room temperature with 0.1 g. of 10% palladium-charcoal as a catalyst until 16.2 cc. of hydrogen was absorbed (one molar equivalent, 16.2 cc.). The catalyst was removed from the reaction mixture and the dihydro compound was precipitated from the filtrate with water and recrystallized from ethanol. m.p. 152~155°, $[\alpha]_D^{25.5} = +15.2^\circ$ (in 1.25% solution). Yield, 0.22 g. *Anal.* Calcd. for $C_{20}H_{32}O_2$: C, 78.94; H, 10.53. Found: C, 79.01; H, 10.48.

Hydrogenation of (B)—0.20 g. of (B), m.p. 160~161°, was hydrogenated similarly as in the case of (A) and 0.13 g. of dihydro compound of m.p. 172.5~175° was obtained, which showed a specific rotation of $[\alpha]_D^{20.5} = -15.8^\circ$ (in 1.8% solution). *Anal.* Calcd. for $C_{20}H_{32}O_2$: C, 78.94; H, 10.53. Found: C, 78.71; H, 10.39.

Dihydro-7-isodextropimaric acid—0.1 g. of 7-isodextropimaric acid was hydrogenated as above, and dihydro-7-isodextropimaric acid with m.p. 172~175° was obtained. 37.41 mg. was dissolved in chloroform-acetone (1:1) mixture to 2.0 cc. and the solution showed the specific rotation $[\alpha]_D^{21} = -16.0^\circ$.

Summary

The fraction of diterpenic acid, which had previously been isolated from the fruits of *Juniperus japonica*, was reinvestigated and two isomers were obtained in a pure state. The one was a new diterpenic acid, $C_{20}H_{30}O_2$, and the other was found to be identical with 7-isodextropimaric acid.

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375. Tyunosin Ukita, Shoshichi Nojima, and Kinzo Nagasawa :

On the Santonin Analogs. II.* Reimer-Tiemann Reaction of 1-Methyl-2-hydroxy-5,6,7,8-tetrahydronaphthalene.

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Von Auwers and his collaborators¹⁾ discovered the fact that on Reimer-Tiemann reaction, both para- and ortho-substituted phenols, besides the expected phenolic aldehydes, gave a kind of ketone compounds containing chlorine, and proposed quinonoid structures (I) and (II) for the respective ketone compounds.

Woodward²⁾, and Arnold, et al.³⁾ developed this reaction to obtain 2-keto-10-dichloromethyl- $\Delta^{1,9:3,4}$ -hexahydronaphthalene (IV) from 2-hydroxy-5,6,7,8-tetrahydronaphthalene (III), together with 1-aldehyde-2-hydroxy-5,6,7,8-tetrahydronaphthalene (V) and 2-hydroxy-3-aldehyde-5,6,7,8-tetrahydronaphthalene (VI), which were expected as the ordinary products of this reaction. Further, (IV) was converted into 2-keto-10-methyl-decalin, which was confirmed to be the same compound with the authentic sample prepared by the ring closure method of Robinson⁴⁾. Woodward's work served as an indirect evidence for the paraquinonoid structure of (I) assumed by von Auwers.

* Part I: This Journal, **72**, 796(1952).

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1) K. von Auwers, et al.: Ber., **35**, 465, 4207 (1902); Ann., **401**, 303 (1913).

2) R. B. Woodward: J. Am. Chem. Soc., **62**, 1208 (1940).

3) R. T. Arnold, et al.: Ibid., **63**, 1314 (1941).

4) R. Robinson, et al.: J. Chem. Soc., **1937**, 53.