Sauerstoffstrom, dessen hohes Reaktionsvermögen die Oxydation des in geschlossenen Gefässen befindlichen, getrockneten organischen Materials ohne nennenswerte Verkohlung bereits bei 100–150 °C ermöglicht. Hierdurch werden Substanzverluste durch Verflüchtigung oder Reaktion mit dem Gefässmaterial weitgehend vermieden[5].

Die Asche wurde gewogen, ein- bis zweimal mit gereinigter, verdünnter HCl abgeraucht, schliesslich mit 1 *n* HCl aufgenommen und mit H_2O bidestilliert auf 10 ml aufgefüllt. Aus diesen Lösungen, die jeweils die Asche der gesamten Probe enthielten, wurden aliquote Teile entnommen und mit den oben beschriebenen Methoden, unter Anwendung eines «Zugabeverfahrens mit rechnerischer Auswertung» (zur Ausschaltung von eventuellen Störeinflüssen durch andere Elemente[4]) auf ihren Mangan- und Kupfergehalt untersucht. Pro Probe und Element wurden jeweils 3 Parallelbestimmungen durchgeführt. Die Analysenergebnisse sind in der Tabelle zusammengefasst.

Setzt man die Summe der in der Trockensubstanz der 4 Fraktionen gefundenen ppm-Gehalte gleich 100, ergibt sich für die Verteilung der beiden Elemente auf die 4 Fraktionen folgendes Bild (vgl. Tabelle): Kupfer ist zu 93,5% in den Fraktionen III und I angereichert und zu etwa gleichen Anteilen auf diese beiden Fraktionen verteilt. Mangan verteilt sich überwiegend auf die Fraktion III und auf den «Abfall», während auf Fraktion I nur ein Anteil von 15% entfällt. Die «Cytoplasten» enthalten einen vernachlässigbaren Anteil an den beiden Elementen.

Aus den Analysenergebnissen lässt sich lediglich der Schluss ziehen, dass Kupfer vornehmlich in den an Chloroplasten reicheren Fraktionen auftritt, während Mangan hauptsächlich in den an Chloroplasten ärmeren Fraktionen zu finden ist.

Um sichere Aussagen über die Verteilung der beiden Elemente auf die einzelnen Zellfraktionen von *V. olitoria* machen zu können, dürfte eine grössere Anzahl weiterer Untersuchungen in noch schärfer getrennten Fraktionen erforderlich sein[6].

Summary. Employing catalytic methods, the Mn- and Cu-content was determined in different cell fractions (chloroplasts, cytoplasts) of freeze-dried leaves of *Valerianella olitoria* isolated with a new dry method by BEHRENS et al.[1]. Cu was found essentially in the fractions with high chloroplast content; Mn was found mainly in the fractions with low chloroplast content.

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[5] C. GLEIT und W. HOLLAND, Analyt. Chem. *34*, 1454 (1962).

[6] Den Herren Prof. Dr. M. BEHRENS und Prof. Dr. R. HERRMANN danken wir für die uns freundlicherweise zur Verfügung gestellten isolierten Zellfraktionen, Herrn Prof. Dr. H. D. CREMER für die Ermöglichung dieser Arbeit, Frau U. WRUCK für die Mithilfe bei der Durchführung der Analysen. Dem Forschungskreis der Ernährungsindustrie danken wir für die Unterstützung im Rahmen des Forschungsvorhabens J 205.

Chemical Examination of the Roots of *Cissampelos pareira* Linn. Part V. Structure and Stereochemistry of Hayatidin

The structures of hayatinin and hayatin, two of the *bis*-benzyltetrahydroisoquinoline alkaloids isolated from the roots of *Cissampelos pareira* Linn. (Menispermaceae), were discussed earlier[1,2]. In the present communication, the structure and stereochemistry of another alkaloid – hayatidin[3], isolated from the same plant – are described.

Hayatidin, m.p. 179–180°; $[\alpha]_D$ – 109° (pyridine); λ_{max} = 280 nm (log ε = 3.07) (EtOH-H_2O, 4:1); λ_{max} = 287 nm (log ε = 2.97) (EtOH-N·NaOH, 4:1); corresponded to the molecular formula $C_{37}H_{40}N_2O_6$ (mol. weight = 608 by mass spectrometry). Its proton magnetic resonance (p.m.r.) spectrum showed that it had 10 aromatic protons including one at τ 4.12 characteristic of a C-8 proton highly shielded by the aromatic ring of a benzyl group[4], 3 of OMe and 2 of NMe groups.

The mass spectrum of hayatidin showed abundant ions at *m/e* 312, 298, 296, 191, 190, 174, 162, 148 and 145. There were small peaks at *m/e* 608 (M^+), 593, 501, 487, and a characteristic though much smaller peak at *m/e* 258.5 $[((M-91)/2)^{++}]$[5].

Hayatidin was ethylated with triethylanilinium hydroxide. The ethyl ether which could not be crystallized gave only a single spot on thin layer chromatography (t.l.c.) (silica gel; system: benzene, ethyl acetate and diethylamine, 7:2:1), showed abundant ions at *m/e* 326, 312 and 296 in the mass spectrum and had an IR-spectrum identical with that of the *O*-ethyl derivative of (++)-4′′-*O*-methylcurine. It was therefore apparent that hayatidin was a stereoisomer of (++)-4′′-*O*-methylcurine isolated by HAYNES et al.[6] from *Cissampelos pareira* Linn. of Jamaican origin.

In order to study the stereochemistry at the 2 centres in this alkaloid, hayatidin ethyl ether was subjected to sodium and liquid ammonia reduction. The phenolic fragment, which was laevorotatory, could not be obtained in the crystalline form but had the same Rf on t.l.c. as *N*-methylcoclaurine. Further, the IR-spectrum of *O,O′*-dimethyl methiodide of this compound, m.p. 131°, was identical with that of an authentic sample of the methiodide of *l-O,O′,N*-trimethylcoclaurine. This confirms

[1] A. K. BHATNAGAR and S. P. POPLI, Indian J. appl. Chem., in press.

[2] A. K. BHATNAGAR, S. BHATTACHARJI, A. C. ROY, S. P. POPLI and M. L. DHAR, J. org. Chem., in press.

[3] S. BHATTACHARJI and M. L. DHAR, International Symposium on Medicinal Plants, held under the auspices of UNESCO and the Government of Ceylon (Kandy, Ceylon; 15–18th December, 1964).

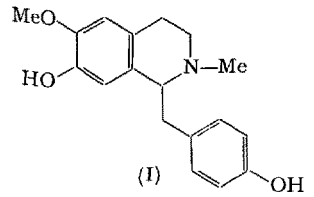
[4] D. R. DALTON, M. P. CAVA and K. T. BUCK, Tetrahedron Lett. *1965*, 2687.

[5] J. BALDAS, Q. N. PORTER, I. R. C. BICK and M. J. VERNANGO, Tetrahedron Lett. *1966*, 2059.

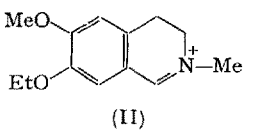
[6] L. J. HAYNES, E. J. HERBERT and J. R. PLIMMER, J. chem. Soc., *1966*, 615.

the structure of the phenolic fragment as *l*-*N*-methylcoclaurine (I).

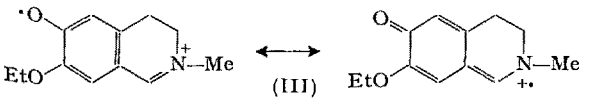
The non-phenolic fragment could also not be crystallized; it was purified by chromatography on alumina (neutral, activity I), gave a single spot on t.l.c. on silica gel and was dextrorotatory. Its p.m.r. spectrum was identical with that of the corresponding non-phenolic fragment obtained from hayatinin ethyl ether[1]. The absence of a signal at τ 6.40–6.50 indicated *O*-ethylation at the 7-position. This assignment was supported by (1) deuteration studies with hayatidin, which showed that there were no protons *ortho* or *para* to the phenolic group, as well as by (2) the mass spectrum, which showed intense peaks at *m/e* 220 and 206. The former corresponded to the ion (II) and the latter to (III) with a hydrogen transfer. The peaks for the other ions were at *m/e* 192, 190, 111, 97 and 91; the molecular ion peak was absent.



(I)



(II)

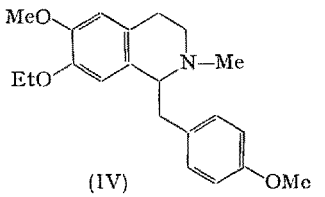


(III)

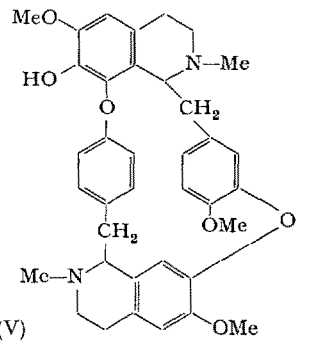
The methiodide of the non-phenolic fragment, m.p. 180°, was identical with that of the corresponding methiodide obtained from the non-phenolic fragment of hayatinin ethyl ether.

All this evidence led to the formulation of the non-phenolic fragment as *d*-1-*p*-methoxybenzyl-6-methoxy-7-ethoxy-2-methyl-tetrahydroisoquinoline (IV).

The assignment of the 2 fragments resulting from sodium and liquid ammonia reduction of hayatidin ethyl ether as (I) and (IV) respectively, clearly established the structure of hayatidin as (+ −)-4″-*O*-methylbebeerine (V). Using the serine convention and the sequence rule, (+) = L = S and (−) = D = R, hayatidin then corresponds to the (S, R) absolute configuration[7,8].



(IV)



(V)

Zusammenfassung. Das Alkaloid Hayatidin, aus Wurzeln von *Cissampelos pareiras* Linn. isoliert, konnte nach Reduktion seines Äthyläthers und Identifikation der Fragmente durch die Darstellung passender Derivate mit protonmagnetischer Resonanz und weiteren Methoden als (+ −)-4″-*O*-Methylbebeerine charakterisiert werden.

A. K. Bhatnagar and S. P. Popli

Central Drug Research Institute, Lucknow (India), 10th October 1966.

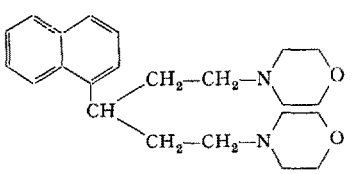
[7] M. Tomita and J. Kunitomo, J. pharm. Soc., Japan *82*, 741 (1962).

[8] The authors thank Prof. A. R. Battersby, Drs. M. L. Dhar and S. Bhattacharji for much useful advice, Dr. R. S. Kapil for mass spectral determinations and Dr. James Walker and Dr. E. J. Herbert for samples of the methiodide of *l*-*O*,*O*′,*N*-trimethylcoclaurine and *O*-ethyl derivative of (+ +)-4″-*O*-methylcurine respectively.

Anti-Arrhythmic Properties of 1,5-Dimorpholino-3-(1-Naphthyl)-Pentane: DA 1686

During investigations performed in the field of naphthalene derivatives, it has been observed that 1,5-dimorpholino-3-(1-naphthyl)-pentane possesses both in vitro and in vivo anti-arrhythmic properties.

The structural formula of DA 1686 is as follows:



molecular weight 368.50

DA 1686 is a brown viscous oil, insoluble in water; the dihydrochloride is a white crystalline compound, very soluble in water.

When tested on isolated guinea-pig auricles at a concentration of $4 \cdot 10^{-6}$, DA 1686 reduces the tachycardic effect of aconitine $1 \cdot 10^{-7}$ and reduces the effect of the increased frequency of electrical stimulation. In this latter test DA 1686 is 1.8 times more active than quinidine and 9 times more active than procainamide.

DA 1686 at 2% concentration has a local anaesthetic activity similar to that of quinidine but higher than that of procainamide when tested in vivo in mice (tail-pinch method adapted for testing local anaesthetics). The compound has a considerable effect at 2% concentration when tested on the cornea of guinea-pigs.

In dogs anaesthetized with morphine and pentobarbital, DA 1686 slowly infused at a dose of 20 mg/kg protects the animals from death induced by a rapid i.v. administration of adrenalin during inhalation of benzol.

DA 1686 protects rats from the arrhythmia induced by aconitine (34 µg/kg, i.v.) and in guinea-pigs delays the