

CHEMICAL EVALUATION OF OIL FROM *MENTHA ARVENSIS* LINN

Part I. Extraction and Chemical assay of oil

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Summary

Yield, physico-Chemical constants and chemical composition of oil from the leaves of *Mentha arvensis*, were determined. The results obtained were compared with those of oil from *Mentha piperita* L; *Mentha piperita* var. *Vulgaris* and *Mentha arvensis*. It was observed that this oil was of fair standard and could be used for flavouring pharmaceuticals tooth pastes, dental cream, cough drops and alcoholic lequeurs like those of oils from other *Mentha* spp. Further work on the other aspects of this problem is in progress.

Introduction

Peppermint oil is usually, obtained from the leaves of *Mentha* spp. such as *Mentha piperita* L; *Mentha piperita* var. *Vulgaris* and *Mentha arvensis* L. belonging to the family Labiatae. The volatile or essential oil occurs in numerous minute glands on the upper and under surfaces of the leaves and is extracted from the cut plant leaves by steam distillation (5).

This plant which is indigenous to Mitcham (Surrey, England), has now spread throughout Europe, America, Japan, Russia, India and Pakistan (5,10,11). The so called American mint (*Mentha piperita* L) was introduced originally from Europe. It resembles the English or black mint, but has stem and leaves of lighter green colour. In the United States it grows wild in the damp places from Nova Scotia to Minnesota and South to Florida and Tennessee. It is extensively cultivated in Southern Michigan, Northern Indiana, Oregon, Washington and Ohio, in two commercially important forms, viz, the black or English mint (*Mentha piperita* var. *Vulgaris*) and the American mint (*Mentha piperita* L) (5).

The so called white mint (*Mentha piperita* *Officinalis* L.) is grown in regions around Mitcham (Surrey, England). The oil obtained from this variety enjoys a high reputation; in fact, it is considered the finest of all commercial peppermint oils.(5).

Mentha viridis, *M. Piperita*, *Mentha incana*, *Mentha sativa* and *Mentha aquatica* occur in Indian Gardens. *Mentha arvensis* is native of Western Himalaya. (10). In Pakistan *Mentha arvensis* is found in Azad Kashmir, N.W.F.P. Punjab and Baluchistan from 2000–3500 m. It is also now cultivated in the gardens of Pakistan (II).

The dried *Mentha* plant is antispasmodic, carminative, Stomachic, refrigerent, stimulant and diuretic. Mint herb is an aromatic and is used in chutneys (II). In colic, mint juice with a little black pepper and honey is given (10).

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Peppermint oil is one of the most popular and widely used essential oils. It is employed for flavouring of pharmaceuticals and oral preparations such as tooth pastes, dental creams, and mouth washes. It is also used as a flavouring agent in cough drops, chewing gums, confectionary and alcoholic lequeurs. It is used in medicines for internal use. Because of its more pleasant taste. It is an excellent gastric stimulant. To a stimulatory effect in the alimentary canal it adds an antiseptic and local anaesthetic influence. Greeks and Romans used *Mentha sativa* as an ingredient in sauces and for medicinal purposes (5,10,11).

In addition to menthol *mentha* oil contains, acetaldehyde, dimethyl sulphide, isovaleric aldehyde, free acetic acid, isoamyl alcohol, amyl alcohol, x-pinene, cineole, terpinene, d-menthone, L-menthone and methyl ester of an acid $\text{C}_8\text{H}_{12}\text{O}_2$ (5,11). Menthol is a natural laevo-organic compound obtained from the volatile oil of various *Mentha* spp. It is colourless prismatic crystals. It has a penetrating odour, resembling that of peppermint. It has a warm and aromatic taste followed by a sensation of cold (2).

Review of literature

Yield of oil from *Mentha arvensis* grown in Hokkaido averages 1.3%, and from plant grown in Hiroshima is 1.6% (5). Ellis and Morris reported an oil yield of 0.3 to 0.4% in case of meadow mint (4). According to Chauvet one hectare (2.47 acres) of Italian mint produces 15,000 to 25,000 kg. of herb, yielding 0.2 to 0.3% of oil (5). Kopp reported the yield of oil from fresh herb in Roumanian mint between 0.2 and 0.24%. The properties of Roumanian peppermint oil vary within the following limits; specific gravity at 18°C, 0.9042 to 0.9113; optical rotation, 21°10' to 27°09' refractive index at 20°C, 1.4602 to 1.4618; total menthol content 50.0 to 65.8%. Solubility in 2.7 to 3 vol. of 70% alcohol (5).

In China yield of oil derived from the summer crop varies from 1.3 to 2% whereas that of the fall crop averages 2%. The properties of Chinese mint oil vary between the following limits: specific gravity at 15°C, 0.8990 to 0.9091; optical rotation, -30° 2' to 37° 32'; total menthol content 70.5 to 87.4%. The physico-chemical properties as well as the odour of the Chinese oil closely resemble those of Japanese products (5). It has also been reported that two years old plant which had been exposed to normal light yielded oil containing 51 to 65% of total menthol and only 2.5–5.3% of menthone, whereas shaded plants yielded oils containing only 47 to 53% of total menthol and 11.8% of menthone. The mint harvested in July contained 2% of oil and that harvested in October had only 0.6% of oil (9). Natural peppermint oil with a pale yellow colour has the following properties: specific gravity at 15°C, 0.900 to 0.920; optical rotation -18° 0'; refractive index at 20°C, 1.460 to 1.4640; total menthol content, 48.0 to 65.8%, menthone content, 9.0 to 15.0% (5).

It has been reported that peppermint (*Mentha* spp.) grow on a wide range of soil, but thrive best in deep rich, well drained lands. Various types of loamy upland soils are best suited. An optimum of growth and oil yield is obtained on non-acid soil of pH value from 6.0 to 7.5 with pH 5.0 to 8.0 as the wider limit. Light, sandy or loamy soils produce oils of higher menthol and ester content than heavier soils (8).

The present preliminary study was undertaken to find the yield of oil and menthol content and to study the physico-chemical characteristics of oil in order to explore the possibility of its commercial utilization in the pharmaceutical industry. It has been planned for future study to determine the effect of period of collection, age of plant, soil conditions and fertilizers on the growth, oil and menthol content in *Mentha arvensis* as it has been reported that age of plant, soil conditions weather and fertilizers directly effect the plant growth and oil yield (5).

Materials and Methods

Mentha arvensis L., leaves collected from the B.S.M.P. Farm Pakistan Forest Institute, Peshawar in the month of March were cleaned and dried. They were cut into small pieces. The determination of volatile oil was made by distilling the cut *mentha* leaves with water, collecting. The distillate in a flash. The oil was separated from the aqueous part of the distillate with the help of a separating funnel using petroleum ether as solvent. The volatile oil thus obtained was rectified by redistillation. The oil was then dried over anhydrous sodium sulphate, filtered and stored in suitable bottles (3, 5).

The physico-Chemical Characteristics such as specific gravity, refractive index and optical rotation were determined following the methods given by A.O.A.C. Griffin and Jacobs (1,6,7).

Isolation of menthol was carried out by cooling the oil to a low temperature. For this purpose the natural volatile oil was first freed from moisture, filtered and poured into suitable container. The oil was then placed into a freezing mixture for 24 hours. The dementholized oil was then drawn off through a drain cock at the bottom of the container, where as the menthol crystals remaining in the vessel were dissolved in solvent ether with warming and recooled in the freezing mixture as before. It was then left to dry at normal temperature for several days in an oven where any adhering solvent or oil was evaporated (5).

Results and Discussion

The yield of oil from the leaves of *Mentha arvensis* L., was found to be 0.5%. It was encouraging enough as compared to oil yield of meadow mint (0.3 to 0.4%) reported by Ellis and Morris and that reported by Guenther (0.2 to 0.3%) in case of Italian mint. The oil yield determined in the laboratory from the leaves of *Mentha arvensis* L., is much low as compared to the yield (0.6–2.0%) reported by Sobolveskaya in case of Russian peppermint.

Similarly the menthol yield (30%) determined in the laboratory from the oil of *Mentha arvensis* L., is much low as compared to those reported (48.5 to 68%), by Guenther in case of *Mentha piperita* var *vulgaris* and as compared to those reported (70.5 to 87.4) in case of *Mentha arvensis* L., and as compared to those reported (48.0 to 65.0%) by Guenther in case of *Mentha piperita* L. The low menthol yield obtained in the laboratory in case of *Mentha arvensis* L., is probably due to, the improper time of collection of the samples, poor soil conditions, locality and age of the plant for these factors greatly effect the oil and menthol yield of *Mentha* spp.

The observed physico-chemical characteristics of the oil of *Mentha arvensis* L., are compared with those of oil from exotic species, reported in literature (Table I).

Physico-chemical constants	<i>Mentha arvensis</i> (Lab. Work)	<i>Mentha piperita</i> var. <i>vulgaris</i> (Guenther)	<i>Mentha arvensis</i> (Guenther)	<i>Mentha Piperita</i> , L. (Guenther)
Specific gravity 15°C	0.8980	0.901 to 0.921	0.8990 to 0.9091	0.900 to 0.920
Refractive index at 20°C	1.4554	1.460 to 1.463	1.46012 to 1.46469	1.460 to 1.4640
Optical rotation	-31°2' to 38°32'	-21°0' to 33°0'	-30°2' to 37°32'	18°0' to 34°0'
Menthol	30%	48.5 to 58.0%	70.5 to 87.4%	48.0 to 65%
Menthone	—	9.0 to 12.0%	2.9 to 12.3%	9.0 to 25.0%

It is evident from the above table that the physico-chemical characteristics of the oil from *Mentha arvensis* L., compare favourably well with those of *Mentha piperita* and other *Mentha* spp. This indicates that this oil is of fair standard.

Conclusion

It appears from the study that oil yield is quite satisfactory (0.53%) in *Mentha arvensis* L., in comparison to meadow mint and Italian mint. The steam distillation process yielded good recovery of oil. The physico-chemical characteristics of the oil of *Mentha arvensis* compare well with those of oil from other *Mentha* spp.

It was also concluded that this oil could be used for flavouring pharmaceuticals, tooth pastes, dental creams and confectionary products like those of oils from other species.

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