The Cinnamon Industry in Sri Lanka

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Cinnamon is the most important spice produced in Sri Lanka and has been known to man since the earliest time. There are two varieties of cinnamon recognised in commerce. The authentic Ceylon cinnamon is *Cinnamomum zeylanicum*, the other variety is *Cinnamomum cassia*. The cassia of commerce is probably of the Chinese origin.

The Ceylon cinnamon has always been preferred to cassia as a famous Greek Physician has reported [1]:—

> "The finest cassia differs so little from the lowest quality of cinnamon that the first may be substituted for the second, provided a double weight of it be used".

Cinnamon was the first spice to be sought after in 15th and 16th centuries. It has been remarked [2] that:—

> "If the vagaries of wind and wave first brought the Portuguese to Sri Lanka, the lure of cinnamon kept them in the island".

The Portuguese forced the Sinhalese Kings to pay as tribute quantities the cinnamon bark collected from wild growing trees. When the Dutch took over Sri Lanka, they commenced for the first time cultivation of cinnamon on a plantation basis, and then enjoyed a monopoly of the cinnamon trade. The British were the next to take control of the island's cinnamon which had grown to about 40,000 acres of cultivated plantations by middle of the 19th century. Since this time, Sri Lanka has maintained its position as the principal country producing high quality cinnamon.

C. zeylanicum is a moderate size bushy evergreen tree of the family Lauraceae. Its dried inner bark rolled into 'quills' is the true cinnamon of commerce. In the native condition the cinnamon grows to a height almost 30–40 feet, but in cultivation it is maintained as a "coppiced" or a cut back bush. It has dark green leaves, glossy on the upper surface and pale ash-green beneath. The flowers are small and yellow, the berries are about 1/2 to 1 inch long, purplish in colour, ovoid and one-seeded.

Cinnamon thrives in the southern part of the island from the coastal region inwards where the soil is sandy and mixed with humus. It also can be cultivated in altitudes higher than sea level. Cinnamon is propagated by means of seedlings or by cuttings.

Preparation of Cinnamon

Cinnamon quills are prepared by peeling the stem bark of the coppiced shoots. The outer bark is first carefully scrapped off prior to the peeling. Peeling is a highly skilled operation and carried out by experienced personnel. The peeled bark which is light coloured is dried first in the shade and then in the sun. The bark curls as it dries and assumes the shape of a quill. During the drying, the smaller quills are inserted into the larger quills forming pale brown cylindrical coils. The quills are selected for export after grading. The three main grades are designated

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as "Continental Zero", "Mexican Zero", and the "Hamburgs". The fine quality quills are graded as 00000's and the coarsest are graded as zero. The remnants are also graded as "chips", "pieces", "quillings" and "fourths". The average yield per acre of cinnamon quills is about 40-50 kg and there are two main crops per year.

Production of Essential Oils of Cinnamon

The cinnamon plant is of special interest as three different types of essential oils can be obtained from it[3,4]. Cinnamon leaf oil has been distilled in the country for a very long time This oil is distilled in wooden stills into which steam is fed from an external boiler. More recently[5] modern stills made of tin coated mild steel have been used. Cinnamon leaf oil contains a large proportion of eugenol which finds uses in perfumery. It can also be utilised as a starting material in the production of vanillin. Cinnamon bark contains a different essential oil which is very much more expensive than the leaf oil. The main constituent of this oil is cinnamaldehyde. Cinnamon bark oil is used in perfumes and is an important food flavouring material. It is also an important constituent of liquors and beverages. The root bark also contains an essential oil very rich in camphor. But this is not prepared on a commercial basis yet. The bark oil is distilled in small metal stills about 50 kg. capacity made mostly of copper lined with tin. The bark is kept immersed in water which is then kept boiling; from the distillate which condenses, the oil separates into two fractions, one heavier and one lighter than water. Excellent quality cinnamon bark oil is now distilled in Sri Lanka. It contains 55-60 per cent cinnamaldehyde and possesses the aroma of the true Ceylon cinnamon.

Trade in Cinnamon

Cinnamon passes through number of hands in the course of its journey from the producer to the markets of the world[6]. Large producers sell their products to the local wholesale market which transfers it to a few exporters who deal with the International market. Cinnamon is the only spice item from Sri Lanka which has a wide-spread international market. Mexico has for many years been the main buyer. But, recently, the Mexicans have been buying less cinnamon and the U. S. market which had preferred cassia has shown an increasing interest in true Ceylon cinnamon. Also the Eastern European countries have become significant buyers thus enhancing the future of the Sri Lanka cinnamon industry.

The various export products from the cinnamon plant, the annual average total export value (1968-1972) is indicated below:

	Qty. kgX10^3	Value Rs.x10^6
Cinnamon quills	3,583	29.5
Cinnamon chips	893	2.8
Cinnamon leaf oil	33	0.9
Cinnamon bark oil	0.75	0.4

Source: Ceylon Customs returns

Sri Lanka, still maintains its position as the largest producer of cinnamon and its products, reaching an average of nearly 70% of the world market, during the last two years. The Seychelles is its nearest competitor. With the attention now being focussed in Sri Lanka on spices, it can be confidently predicted that the export of cinnamon and its products will significantly increase in the years to come.

Export of cinnamon from various producing countries('000 kg.)

	1968	1969	1970	1971
Sri Lanka	3991	4449	4195	4470
Seychelles	3039	1446	1339	1298
Malagasy Republic	443	2036	631	692
Sri Lanka's share	53%	49%	73%	68%

Source: Tropical Products, Quarterly, Volume XIII June 1972

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Essential Oils V

Improved Technology in the Field Distillation of Cinnamon Leaf Oil*

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Abstract : Cinnamon is grown today mainly along the southern coastal belt of Sri Lanka. Leaf oil distillation has to be carried out near the growing areas due to transportation problems. The traditional distillation outfits employ a condensing system consisting of a static water tank in which is immersed a coiled or straight tube which carries the distillate. This system is rendered useless in periods when there is a scarcity of water. The new still the Cisiril MANAKOKA designed recently, overcomes this problem. The still has a two-stage condensing system. In the first stage a " Latent-Heat-Exchanger " is employed. This is a 400 gallon tank of water through which passes the hot distillate, in a coiled tube. The water in the tank is maintained at boiling by acquisition of its latent heat from the hot vapours. The vapours are then led into a vane-type Air Condenser, via a pressure leveller, to complete the second stage of the cooling process. The still-body is constructed of mild steel, and has a charge capacity of 500 kg. The Latent-Heat-Exchanger is made of galvanised iron and the Air Condenser of aluminium. The still gives excellent results in terms of yield, quality of oil, and continuity of operation throughout all seasons.

1. Introduction

Cinnamon leaf oil and citronella oil are the two essential oils that have been commercially distilled in Sri Lanka for nearly half a century. Distillation of these oils commenced very much earlier, in fact during the period the island was under Dutch rule.[1] The distillation of both cinnamon leaf and citronella pose similar problems. Both are grown in the southern part of the island which is subject to periods of drought. This gives rise to an inadequate supply of water, and of times distillation has to be abandoned until the rains arrive to make the streams and rivulets water-borne again. By this time, much leaf material has withered and dried, with their oil content unharnessed. The distillation has to be carried out in the field and since the only economical means of transport in these areas is by bullock-drawn carts, stills have to be located in the growing areas.

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Some of the traditional distillation outfits for cinnamon leaf oil employ still-bodies made of wood. Vertical planks are arranged in the form of a cone, one fitting smugly into the other. They are held in place by metal circular bands running horizontally around the wooden vertical staves. These still-bodies are surprisingly leak-proof. The still-head generally made of copper is fitted on to the wooden body, and the edge rendered leak-proof by a sealing of soft clay. Steam from an external boiler is made to enter from the bottom, and the distillate condenses in a " coil-in water " condensing system. Accordingly large static tanks filled with water are required for the condensing operation. During the long rainless periods these water tanks are dried up by the blazing sun, and this halts distillation operations.

Metal still-bodies are also employed in certain areas. Here the steam is generated by heating water contained in the still-body itself, the raw material being placed on a grid above the surface of the water. In these cases too, the same type of condensing system is employed. The extensive use of copper in the construction of still-heads, condenser coils etc., results in a greenish coloured oil. This metal is used because local tinkers prefer to work with it, and it is long-lasting being resistant to deterioration by corrosion.

In connection with the improvement of local technology, it was felt that improved methods of distillation would greatly enhance the quality of essential oils produced in Sri Lanka and increase their potential in the world markets. The Cisirill family of stills were the result of the endeavours of the Ceylon Institute of Scientific and Industrial Research in this direction.[4] The Cisirill MANAKOKA[2] was developed as a field still, to serve the cinnamon and citronella areas in the south of Sri Lanka.

2. Features of the Cisirill Manakoka Still[3]

The still-body is of conventional design. It is cylindrical in shape and could be employed such as to be fed with steam from an external boiler or for direct heating. For conditions in Sri Lanka direct heating is preferred, the spent charge serving as the fuel. Accordingly, a perforated plate is provided in the still-body, and placed about nine inches above the base, so as to hold the charge. The still-head dispenses with the usual goose-neck type of exit pipe. Instead, a plain circular cap is fitted on the still-body and this makes charging and discharging more facile. A short pipe on the side of the still-body leads the distilled vapours into the condensing system. The unique feature of the Cisirill MANAKOKA is its condensing system, which has been designed so that only a small quantity of water is required at a time. It consists essentially of two main components, viz : a Latent-Heat-Exchanger (LHE) and an Air-Cooled Finned Condenser (AFC). The Latent-Heat-Exchanger (LHE) carries out the first part of the cooling operation. It consists of a tubular coil dipping in a tank of water of predetermined capacity (around 350 litres). As the hot vapours of oil and water pass through the LHE their heat is partly dissipated in maintaining the

water in this limited capacity tank boiling. Efficient cooling of the vapours result, as latent-heat for the boiling water is provided by the hot vapours. The AFC completes the cooling operation. The vapours which are partially cooled by the LHE are led into the AFC via an expansion chamber. The AFC consists of one inch aluminium tubing with fins at regular intervals. The AFC is an effective cooler and is most efficient if placed in such a manner as to make best use of even the slightest breeze, which is invariably present in the field. The tubes are joined together so as to enable effective cleaning possible. Flat tight fitting flange joints are used in order to ensure that there are no leaks. The distillate from the AFC is led into florentine vessels of conventional pattern in order to separate the oil from water.

3. Materials of Construction

The still-head, and still-body are both made of ten-gauge galvanized iron sheeting. Mild-steel could also be used, but the inside of the still-body must then be lined with tin. The vapour outlet is of galvanised piping and interposed between the LHE and AFC is the Expansion Chamber EC which is made of aluminium sheeting. This ensures that the distillate comes through the condenser at a uniform rate and not in gushes. The AFC is made entirely of aluminium. The fins are attached to the aluminium piping in such a manner as to give good contact and hence conduction. The receiving vessels could be of glass or aluminium.

4. Heating System

The Cisirill MANAKOKA can be heated either by leading steam into it from an external boiler or by direct heating. The latter is the preferred method in Sri Lanka due to the availability of a cheap fuel in the form of firewood and the spent charge itself. The firing chamber is a cylindrical brick and clay structure, well insulated, with provision for maximum heat retention. The total height of the chamber is around 0.9 to 1.0 m and it is divided into two compartments. The upper one, the firing chamber, is about 1.2 m in diameter with a space of about 0.6 m. from the grate to the base of the still. This compartment is provided with flue openings around the base of the still to heat the sides to a height of 0.15 m. The flue gases are directed out through the main flue outlet via a chimney. The residual ash from the spent fuel collects in the compartment below the fire grate. The intake of air into the fire chamber is regulated by means of a sliding hatch and by this means the rate of heating can be varied.

5. Economic Aspects

The still is cheaper to fabricate and instal than one of similar size of traditional design. This is substantially due to the fact that the costs of construction of a static water tank are comparatively high.

5.1. Costs of Fabrication and Installation—

Still unit	Rs.
Galvanised still-body with lid and other accessories	6,500.00
Galvanised Latent-Heat-Exchanger with aluminium coil ...	2,100.00
Aluminium expansion chamber	400.00
Aluminium air condenser with stand	3,800.00
Mild steel fire hatch	950.00
Mild steel chimney	1,450.00
Fire bars and still support	650.00
Total ...	15,850.00

Heating System	
Construction of furnace and shed to house still	5,500.00
Tools, implements, receiving vessels and other accessories ...	2,000.00
Contingencies (Royalty, transport etc.)	2,000.00
Total ...	25,350.00

The foreign exchange component would be around 30 per cent of the total cost that is Rs. 7600/- i.e. US $ 1266 approximately.

N.B.

These costs are as at the beginning of March 1973. It is estimated that the costs are now about 35% higher. (75% higher)

5.2. Cinnamon Leaf Oil

	Rs.
Collection and transport of raw material	30.00
Labour for distillation	12.00
Sundry expenses	7.50
Total ...	49.50

Average yield of oil/distillation is 2.25 litres (3 bottles)
Average income per month with 40 distillations at two per day is Rs. 90 x N.
(where N is the mean market value of a litre of cinnamon leaf oil)
The present market value (N) is Rs. 88/- per litre.
Hence average income per month at the present market value is Rs. 8020/-.

6. Field Performance of the still

A prototype full scale Cisirill MANAKOKA still was first installed at the Ceylon Institute of Scientific and Industrial Research to ascertain the performance of the still for the distillation of cinnamon leaf, citronella and eucalyptus. The preliminary trials gave promising results on 2 to 3 distillations of each of the raw materials. Period of distillation, fuel consumption (spent material) and yield of oil were consistent with expectations, the mean values being as follows :

Cinnamon leaf 6 hours distillation	0.75% yield of oil w/w
Citronella 5 hours distillation	0.85% yield of oil w/w
Eucalyptus globulus leaf 3½ hour distillation	0.85% yield of oil w/w

Three models of the Cisirill MANAKOKA are now in service at three centres in Sri Lanka, viz : Karandeniya, Walasmulla and Ohiya, for cinnamon leaf, citronella and eucalyptus distillation respectively.

The cinnamon leaf distillation unit at Karandeniya has been in operation since March 1973 and its performance has been closely studied. There had been a set back in operations during the initial three to four months due to such factors as shortages of raw material and managerial problems. However, since November 1973, distillations have been carried out regularly. In general, two distillations are carried out each day. Since the installation of this still, 350 distillations have been carried out to date giving a total yield of 725 litres of cinnamon leaf oil. This gives an average yield just over 2 litres per distillation for a mean charge of about 300 kg. of leaf. Yields of almost four litres per charge have been recorded on some occasions. Poor yields of 1 to 1.5 litres of oil per charge have also been obtained especially after rains when the leaf is wet. The yield also depends to a great extent on the quality and maturity of the leaf and also other factors such as climate, soil conditions and correct loading. However, making allowance for all these factors and from figures available for the distillations, the yield could be worked out on the basis of a mean value 2.3 to 2.5 litres per distillation on a charge of around 250—275 kg. leaf.

The price of cinnamon leaf oil has been rising very steadily over the last one year and at present it is in the region of Rs. 85 to Rs. 90 per litre (i.e. US $ 8 to 9 per litre). During mid 1973, a litre of oil was valued around Rs. 28 to Rs. 32. Taking an average of Rs. 48/- per litre for the period the still has been in operation, the gross income for 15 months has been in the region of Rs. 30,000/- (i.e. US $ 5000) thus making an average of over Rs. 2,000/- per mensem.

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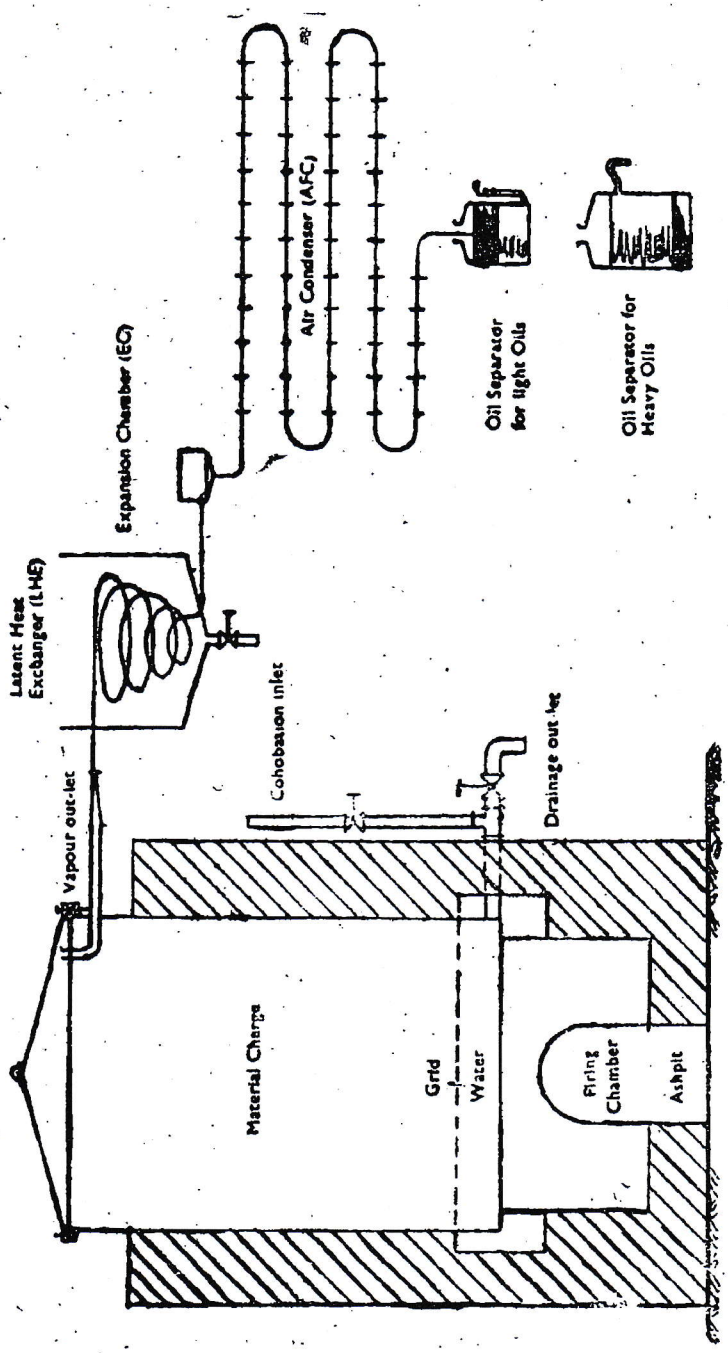

Diagramatic representation of the field still "*Cisirill Manaboka*" for distillation of essential oils.