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Availability and yielding of natural camphor *(Karpura)* from *Cinnamomum camphora* Nees & Eberm

Research Article

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Abstract

Karpura (natural camphor) has been mentioned since the Vedic era in various formulations for therapeutic and spiritual reasons. But from the late 19th century onwards, synthetic camphor replaced it due to its high price and unavailability of its plant material. This synthetic camphor is very low-priced as compared to a natural one. The cost-effective and unawareness about it's side effects lead to escalating the use of synthetic camphor. Formulations mentioned in Ayurveda are with natural camphor not with synthetic. But there is no proper method described for yielding of natural camphor from *Cinnamomum camphora* Nees & Eberm. plant. This is an effort to know the extraction of natural camphor from wood and leaves of *Cinnamomum camphora* Nees & Eberm. In the present study Clevenger apparatus was used to evaluate its yielding proportion. The yielding percentage of *Karpura* depends on the quality, quantity, part used and maturity of plant material. Moreover, the selection of proper apparatus and procedures is also vital for the quantitative extraction of *Karpura*. Though having a high price, it has a unique remedial activity which is entirely different from the synthetic one that is available in the market on the trade name of *Karpura.*

Key Words: *Karpura,* Natural camphor, *Cinnamomum camphora,* Steam distillation, Clevenger apparatus.

Introduction

Nature has provided a complete storehouse of medicinal plants and herbal remedies to cure and prevent ailments of mankind. The man has curiosity towards nature leads to the addition of knowledge about drugs over thousands of year. So, the use of medicinal plants is carried in India, China, Greek, etc (1).*Karpura* is one of the important medicinal plants used for therapeutic as well as holy purposes since ancient times in India. It was used with *Terminalia chebula* Retz. *(Haritaki)* in urine and stool incontinence *(Mutra-purish nirodha)* and this reference found in *Shaunkya Atharvaveda Samhita* (2). About 210 and 100 formulations made from natural *Karpura* have been mentioned in *Samhitas* and *Samgrahas* (prime literature of Ayurveda) for internal and external uses respectively. Some common formulations viz. *Khadiradi vati, Lavangadi vati, Netra anjana* have indicated in eye, oral, dental disorders, obstructive uropathy, anorexia and abdominal discomfort. India uses 98% of camphor for religious purpose whereas China used 98% for hygiene and therapeutic purpose (3).

In India, Assam, Karnataka, Kerala, Tamil Nadu, Uttar Pradesh and West Bengal are the residence of camphor laurel (4). *Karpura* (natural camphor) is produced from *Cinnamomum camphora* Nees and Eberm belongs to Lauraceae family through steam distillation procedures (5). But the raw material need for camphor production is not sufficient due to urbanization and deforestation. It requires in large scale raw material/ resources and that much is not available in India. Therefore the cost is high and at least 3 times of synthetic (6).So, to cope up with the lesser availability of camphor trees and the high price of natural camphor, the demand for synthetic camphor increasing day by day. Currently, a huge percentage of the world's camphor is now being produced synthetically and substituted natural camphor. On the basis of this demand, there is the uphill requirement of camphor had increased during 19th century (7). This eventually led to the creation of synthetic camphor. In 2019, the volume sales of synthetic camphor are prone to exceed 36 thousand tons (8). The synthetic camphor global market is anticipated to represent incremental opportunity worth US$ 249.3 Mn between 2018 and 2028 (9).

Food and Drug Administration (FDA) has listed few over-the-counter (OTC) camphor medicaments like ointments, balm and recognized antitussive, analgesic, anaesthetic, anti-acne, antifungal, cough/cold expectorant, nasal decongestant, oral disorders, insect

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bites, skin protectant, wart remover, blister/cold sore, analgesic male genital desensitizer and antipruritic agent (10). FDA has approved camphor concentrations ranging from 0.1 to 3 % for safe and effective topical use while Ayurveda recommended it for internal uses (11)(12).

Due to cost effectiveness of synthetic camphor, people emphasis for use of it. But the drugs of synthetic origin have side effects. Therefore, synthetic substitution for natural camphor raises a question, whether it is safe for internal as well as external uses and its therapeutic utility. Substitution concept is mentioned in Ayurveda under the context of *Abhavapratinidhi dravya*. If any drug is unavailable, another drug having same action can be used instead of basic drug (13). This article is an effort to estimate the percentage of yield of *Karpura* from *Cinnamomum camphora* Nees and Eberm.

Materials and Methods

Collection and Authentication of camphor wood and leaves:

3 kg fresh wood and leaves were procured in the month of October 2018 from Herbal Garden, Jogindar Nagar, district Mandi, Himachal Pradesh and authenticated from FRLHT (Foundation for Revitalization of local Health Traditions), Bengaluru. The voucher Specimen No. 4393 dated 10 July 2019. 3 kg material kept for shade drying for 15 days. After shade dry the material weighed 2.5 kg. Then the material stored in airtight container for present study.

Camphor yielding procedure started with Clevenger apparatus:

Five batches with different quantity have been carried out for obtaining natural camphor from 2.5 kg raw material. Initially In first cycle, 450 gm of wood chips was taken in 5 litre round bottom flask and 3.5 litre water poured into it. Then Clevenger apparatus was fixed on round bottom flask properly with some lubricant applied on it. Whole assembly was put on heating mantle.

Before starting the heating mantle stop cock valve knob of measuring tube closed. Loose cotton plug was placed on other side of the opening which was just beneath the condenser to avoid the loss of camphor fumes. Then, switched on the heating mantle and maintain the temperature at 100^{o}C. After continuous boiling at 100^{o}C for several hours, camphor vapours from flask moved to the condenser where inlet (lower) and outlet (upper) was attached. Condenser cools down the camphor vapours and these vapours turns into camphor oil and distillate. In measuring tube, camphor oil floats on distillate. When there was no further extraction of oil then switched off the heating mantle. After 10 minutes when assembly became lukewarm, distillate poured in beaker and camphor oil collected in another beaker. This collected camphor oil converted to solid state within 10 minutes as it has natural property to sublimate. As assembly got cold, the remaining oil converted to crystals. So that to remove the camphor n-hexane is poured in it from another opening which is below the condenser. Crystals were dissolved in n-hexane and collected in beaker to get camphor crystal from this mixture. To evaporate the n-hexane, cock of beaker kept slightly opened at room temperature. After 48 -72 hours n-hexane evaporates completely and got camphor crystals (Figure 3). In same way another four batches have been carried out.

Observations & Results

It was observed that in batch number first and fifth 450 gm chipped wood was used. From that 6.3 gm and 6.9 gm *Karpura* was extracted respectively. Whereas in batch second 450 gm crushed leaves were used and 4.1 gm *Karpura* obtained. However 500 gm chipped wood used for third batch and got 5.5 gm *Karpura*. In fourth batch, 600 gm the mixture of wood and leaves were used and 7.2 gm *Karpura* acquired from it (Table 1). On the basis of organoleptic observations natural camphor has aromatic smell, bitter taste and appeared as white waxy crystals (Table 2).

Figure no.1 Wood and Leaves – Shade dry

Fig no.2: Clevenger apparatus assembly with round bottom flask (5 litre), Heating mantle, beaker and Stand

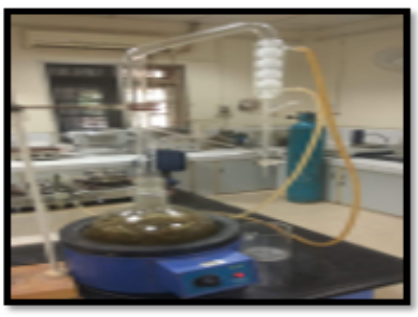


Fig no. 3: Yielded *Karpura* crystals

Table No. 1: Yielding quantity from wood and leaves

S.No.	Cycle	Material used	Quantity	Media	Temperature	Time Duration	Output
1	First	Chipped wood	450 gm	Water	100° C	12 hours	6.3 gm
2	Second	Crushed leaves	450 gm	Water	100° C	12 hours	4.1 gm
3	Third	Chipped wood	500 gm	Water	100° C	12 hours	5.5 gm
4	Fourth	Chipped wood + leaves	600 gm	Water	100° C	12 hours	7.2 gm
5	Fifth	Chipped wood	450 gm	Water	100° C	12 hours	6.9 gm

Table No. 2: Organoleptic characters of natural camphor

Organoleptic characters	Natural camphor
Touch (*Sparsha*)	Waxy smooth
Appearance (Rupa)	White crystals
Taste (Rasa)	Bitter taste followed by cold sensation
Smell (*Gandha*)	Aromatic

Discussion

For research purpose tried to procure Camphor yields from natural source (*Cinnamomum camphora*) throughout India and from other countries also but it was impossible to getting it. As *Cinnamomum camphora* species near to extinction, it is very difficult to yield the natural camphor from this species and therefore Camphor from natural sources is scarce in India nowadays. Camphor tree belongs to China, Taiwan, Vietnam and Japan. They produce the majority of world's natural camphor and exports since yet. It is used as flavoring agents, industrial products, in therapeutics and pharmaceutical (14)(15). High pricing and demand of natural camphor shows the way for substitution with synthetic camphor which is cost effective and easily available in markets. In this study it is observed that *Karpura* yielded from leaves was faster than the wood but more quantity acquired from wood. Though same amount of leaf and wood was taken, 6.3 gm *Karpura* was extracted from wood whereas 4.1 gm *Karpura* extracted from leaves. More time is required for extraction of oil from wood chips because they are harder than leaves so that more time is needed for full extraction. The previous study done by Rao B.S.et al., indicated the comparison of different parts of plant as root yields more camphor than wood and leaves (16). But use of root leads to exploitation of plants that is one reason camphor tree comes under endangered category. Moreover, it is observed that yielding of camphor quantity differs in two batches of same quantity of raw materials may be it is due to loss of camphor. In order to check the loss, cotton plug should be kept properly i.e. neither too loose nor too tight. Because too tight cotton plug increases the pressure and prohibited the deposition of camphor in measuring tube, it completes the cycle and goes to round bottom flask. There were no changes observed in odour, taste of *Karpura* yielded from wood and leaves. But changes in colour observed. Whitish yellow and bright yellow coloured *Karpura* yielded from leaves and woods respectively Figure 4(a) and 4(b).

Fig no 4(a) *Karpura* extracted from leaves

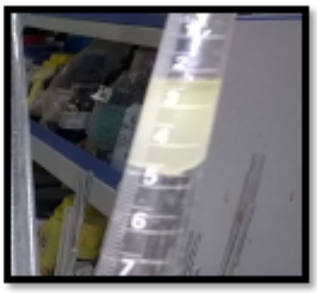
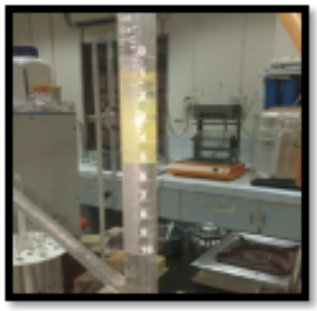


Fig no 4(b) *Karpura* extracted From wood



Percentage of *Karpura* yielding depends on materials quality, quantity, part used and maturity. Quality of drug is directly proportional to the active ingredient which is responsible for its therapeutic efficacy. Selection of proper apparatus, procedure and precautions have also played important role in quantity of extraction of *Karpura*. As camphor belongs to the volatile group, it should be preserved and stored in an air tight container at room temperature to avoid the evaporation and loss. For getting *Karpura* from 2.5 kg raw material, five batches had been carried out because small intake capacity of apparatus. On the basis of observations, it is tentatively calculated that for getting 1 kg *Karpura* approximately 75 kg raw material is required. The camphor extracted 30 gm only from 2.5 kg plant material. So, that the productive percentage is only 1.2 %.

Conclusion

Yielding percentage of *Karpura* from natural resources is very less and that much raw material is not available due to deforestation. But the camphor sold in the market on the name of natural camphor is synthetic one. As the demand for camphor is so high as compared to raw drug availability and to fulfil the demand use of synthetic camphor is only the solution. However researches proved that synthetic camphor is unsafe for internal use so that we can use it for only topical purpose. There is no awareness about the use of natural / synthetic camphor for therapeutic utility. Need

of more research on natural and synthetic *Karpura* for their chemical constituents, safety and efficacy.

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