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Research Article

PHYSICO CHEMICAL EVALUATION AND CHARACTERIZATION OF DIFFERENT TYPES OF CAMPHOR USED IN AYURVEDIC FORMULATIONS

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ABSTRACT

Classical Ayurvedic Texts refer to the use of Kapur in many Ayurvedic Medicines. Ayurvedic Pharmacopoeia of India records Natural Camphor obtained during steam distillation of the leaves and barks of *Cinnamomum camphora* as the correct variety to be used in different Ayurvedic Formulations. Dravyaguna vijnana by Dr. J. L. N. Sastry recognises the presence of different types of Camphor. Dr. K. M. Nadkarni's Indian Materia Medica records three varieties of Camphor. At present in India two varieties of Camphor are used for the manufacture of Ayurveda Medicines. Both have camphor like smell and sublimes on heating. Both varieties of Camphor were subjected to Physico chemical, Thin Layer Chromatography (TLC) and GCMS Studies. It was observed that one variety known as "Chooda Karpura" is chemically Camphor and the other variety called "Pacha Karpura" is chemically Borneol.

Keywords: Camphor, Borneol, Physico Chemical Values, TLC, GCMS

INTRODUCTION

In Ayurveda only one variety of Karpura was referred up to the period of Dhanvantari Nighantu. The Indian Materia Medica refers to three varieties of Karpura namely Formosa camphor, Borneo camphor and Ngai camphor[1]. It is mentioned that the second variety was highly prized in India and was sold at a very high price. The Camphor found on tree pits and branches of trees were referred as Natural camphor (Apakva karpura) where as that obtained by distillation with water of the wood / tree / plant was called Pakva variety. Raj Narahari has referred about 14 different varieties of karpura. Camphor and Borneol are isolated as a volatile oil with other ingredients like Pinene, Camphene, Linalool, Nerol, iso Bornyl acetate etc and are purified by sublimation. One of the reasons for the different types of camphor can be traced to the originating tree from where it was extracted. Camphor and Borneol are now extracted from many plants. Modern studies and published results have proved that, the product obtained from *Cinnamomum camphora* Nees and Eberm (Family: Lauraceae) is chemically natural Camphor[2] and that formed in the stems of *Dryobalanops aromatica* Gaertn (Family: Dipterocarpaceae) is natural Borneol[3]. In Kerala, India one variety of karpura is referred as 'chooda karpuram' and that used in formulations like Elaneer kuzhambu and Karpuradi kuzhampu is referred as 'pacha karpura'. Their other regional names are given in Table 1.

MATERIALS AND METHODS

Samples of two varieties of 'chooda karpura' and 'pacha karpura' available from market were taken for study. The samples were authenticated by the R and D Laboratory of Sreedhareeyam and a reference number was assigned. One authentic sample of natural d - Camphor was purchased from M/s Sigma Aldrich India Ltd., Bangalore, India as a reference sample. The photographs of the three samples are given in Figure 1.

Determination of the Melting Point

The commercial samples were purified by sublimation. Pure sample thus obtained was powdered. Melting point was determined as referred in Ayurvedic Pharmacopoeia[4]. The melting point of the authentic sample of natural camphor purchased from M/s Sigma Aldrich Ltd., Bangalore, India and that of Chooda Karpura was found to be between 175 - 179^0 C. However the melting point of the sample of pacha karpura' was between 208 - 210^0 C

Specific Rotation

Specific rotations of all samples of camphor were determined by a Polarimeter as described in Ayurvedic Pharmacopoeia[5]. Specific rotation was determined by

preparing a 10 % w/v solution of all three samples in alcohol. The authentic sample of natural d - camphor purchased from M/s Sigma Aldrich India Ltd., Bangalore, India exhibited a specific rotation of $^{+}41$ to $^{+}44^{0}$. However the samples of chooda karpura and pacha karpuram did not exhibit any optical rotation.

UV Absorption maxima

Weigh accurately 100 mg of samples of chooda karpura and pacha Karpura. Dissolve in 20 ml spectroscopic grade chloroform. Estimate the absorbance values at different wave lengths. The sample of chooda karpura and the authentic sample of natural d - camphor exhibited absorption maxima at 292 ňm where as the sample of pacha karpura did not exhibit any absorption maxima at this wave length. (Figure 3)

Thin Layer Chromatography (TLC)

Carry out TLC on a 10 cm x 10 cm pre coated TLC plate with silica gel 60 F_{254} of 0.2 mm thickness.[6] Dissolve 10 mg from all three samples separately in methanol and apply 10 µL at a height of 10 mm from the bottom. The mobile phase is a mixture of Toluene: Ethyl acetate (8: 2). After development allow the plate to dry in air. Spray the plate with vanillin : sulphuric acid reagent and heat at 110^{0}C and view under UV 366 nm The plate developed a pink colour and R_f values of the authentic sample of d - camphor and chooda karpura were 0.52 where as that of pacha karpura was 0.64. (Figure 2)

Molecular Weight by GCMS

The samples of chooda karpura and pacha karpura and Standard d – Camphor were subjected to molecular weight determination using GCMS. The molecular weight of chooda karpura corresponded to 152 and that of pacha karpura corresponds to 154. The molecular weight of d – Camphor purchased from M/s Sigma Aldrich also corresponded to 152.

Table 1: Regional Names of Two Varieties of Karpura now used in India

No.	Language	Type - I	Type - II
1	English	Camphor	Borneo camphor
2	Sanskrit	Karpura	Karpura
3	Hindi and Marathi	Kapur	Bhimseni Kapur
4	Gujarati, Bombay	Kapur	Bhimseni Kapur
5	Telugu	Karpooram	Pacha Karpooram
6	Tamil	Karpooram	Pachai Karpooram
7	Malayalam	Chooda Karpooram	Pacha Karpooram

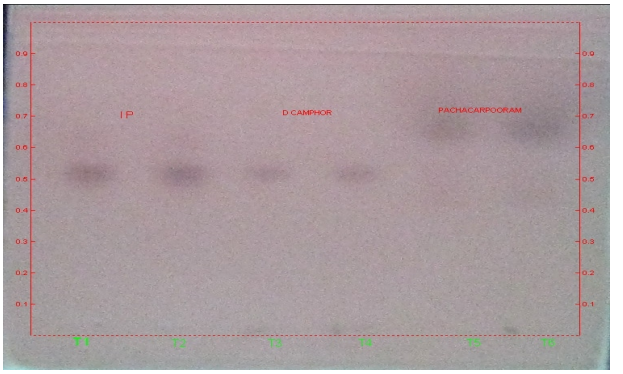
Table 2: Description and Properties of Two Types of Karpura and D - camphor

No	Physico Chemical Tests	Standard d - Camphor	Chooda Karpooram, Kapur d l - Camphor[3]	Pacha Karpooram Bhimseni Kapur d l - Borneol[4]
1	Description	Colourless or white crystals		
2	Odour	Penetrating and Characteristic		
3	Taste	Pungent and Aromatic		
4	Source	Sigma Aldrich	Synthetic	Synthetic
5	UV Absorption maxima	292 nm	292 nm	Nil
6	Melting range	175 – 179 ^{0} C	175 – 179 ^{0} C	208 – 210 ^{0} C
7	Specific Rotation	+ 39 to 41 ^{0}	NIL	NIL
8	Molecular Weight by GCMS	152	152	154
9	Chemical name	d – Camphor	dl - Camphor	dl - Borneol
10	Molecular Formula	$C_{10}H_{16}O$	$C_{10}H_{16}O$	$C_{10}H_{18}O$

Natural Camphor **Synthetic Camphor** **Synthetic Borneol**

Figure 1: Photograph of Samples of d – camphor, Chooda Karpura and Pacha Karpura

Visualisation: After derivatisation with Anisaldehyde: Sulphuric acid under UV 366 nm



T1 and T2: Test solution of 'Chooda Karpura' (Synthetic Camphor)
T3 and T4: Test solution of d - Camphor from Sigma Aldrich
T5 and T6: Test solution of 'Pacha Karpura' (Synthetic Borneol)

Figure 2: Comparative TLC Profile of Camphor, Synthetic (Chooda Karpura), D-camphor (Standard) and Borneol Synthetic (Pacha Karpura)

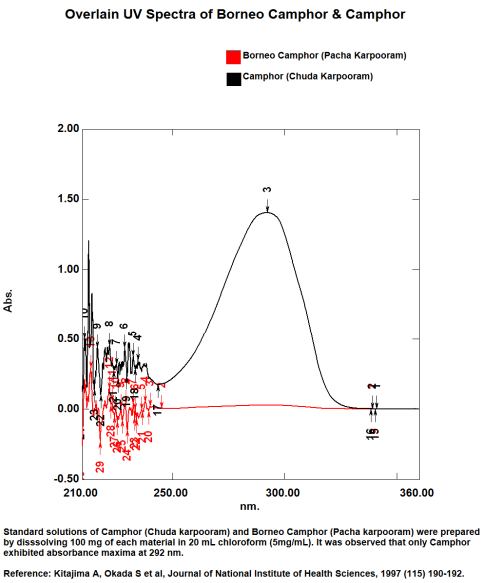


Figure 3: UV Absorption Spectra of Different Camphor Samples

RESULTS AND DISCUSSION

Camphor and Borneol are widely distributed in the essential oils of medicinal plants from various parts of the World[7]. The physico chemical parameters observed for the three samples are given in Table 2. The melting point observed for authentic sample of d - camphor purchased from M/s Sigma Aldrich India was in the range 175 - 179^0 C. The melting point of 'chooda karpura' was also in the same range. The Thin layer chromatogram showed an R_f value of 0.52 for d - camphor and 'chooda karpura'. Molecular weight determination by GCMS gave 152 for d - camphor and 'chooda karpura'. Both d - camphor and 'chooda karpura' also exhibited UV absorption maxima at 292 nm. However the specific rotation of d - camphor was in the range of 41 to 44 where as 'chooda karpura' did not show any appreciable specific rotation. From the above results it is concluded that Chooda Karpura is chemically racemic or synthetic camphor. Borneol has camphor like smell, has a molecular weight of 154.25 and its melting point is reported to be in the range of 206 – 208[3]. Synthetic borneol do not exhibit specific rotation. The melting range of 'pacha karpura' was in the range of 208 – 210, and it showed molecular weight of 154 by GCMS, R_f value of 0.64 and no UV absorption maxima. From the parameters obtained for melting point, molecular weight, specific rotation, UV absorption maxima and TLC Studies it is concluded that 'pacha karpura' is chemically synthetic Borneol. It is reported that drugs permeate the cornea through the transcellular or para cellular route[8]. Passive diffusion is a method by which most drugs

permeate the cornea[9]. It has been reported that, model drugs containing natural Borneol and synthetic Borneol when co administered to isolated intact rabbit corneas, both synthetic Borneol and natural Borneol increased corneal penetration of model drugs[10]. It was also observed that Borneol did not damage corneal epithelial tissue. In another study toxicity, of d – camphor, l – camphor and their racemic mixtures were tested in mice. At 100 mg / Kg body weight d – camphor was non toxic, while the synthetic form induced different kinds of toxic behavioural effects[11,12]. Pacha Karpura is predominantly used in ocular preparations like Elaneer kuzhambu and Karpuradi kuzhambu. The above studies support the use of pacha karpooram or synthetic Borneol in ocular preparations like Elaneer kuzhambu and Karpuradi Kuzhampu rather than Chooda karpooram or synthetic Camphor.

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