Variation in FTIR spectrum of Dried and Carbonized Acorus Calamus

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Abstract: Herbal drugs and cures have seen a steep rise in demand and the awareness to the age old practices of administering plant based drugs is increasing. However the scientific proof for the efficacy of these drugs is still not available in most cases. The Food and Drug Administration (FDA) of the US has still banned a few herbal drugs as toxic while these are still used in India citing medicinal properties. A scientific analysis is likely to prove the efficacy of these drugs. Acoruc Calamus is considered here.

Key Words: Acorus Calamus, Cabonizing, Drying, FTIR

I. INTRODUCTION

Medicines extracted from herbs were said be highly effective in ancient times. The onset of chemically based drugs and the dominance of westernized outlook over the nature cure methods have eroded the belief in the herbal drugs. Of late there have been many spurious drugs with a claim of being purely herbal. Many herbs that have been used as drugs over centuries have now been labelled toxic and non-usable. Often with time this toxicity label is again peeled off to give the drug a renewed interest. This work is a beginning of a long termed research to scientifically analyse and prove the efficacy of herbal drugs. Acorus Calamus (Vacha) is considered here. Acorus Calmus banned by FDA, still very rich in medicinal values. Vacha – Acorus Calmus has been used in Ayurvedic medicines since the times of Charka and Sushruta. It is used for various ailments in various parts of the globe, which include Persia, Egypt, and Europe etc. The term 'vacha' indicates its property of making speech clear. Vacha is considered from time immemorial as an important medhya drug, which improves cognitive and memory power.

Administering the paste of A.calamus in honey to infants is one of the first post-natal practices of Indian mothers for the proper intellect of the child [1]. The drug is used in the name Wuz in various preparations in Vajturki medicine. It is also reported as an effective drug in chronic diarrhoea, abdominal obstructions, dyspepsia, infantile disorders and bronchial asthma. Being anervine tonic, it is very effective in epilepsy, delirium, convulsions, depression and other mental disorders. Madan B R et al [2] have clinically established the Anticonvulsant, antiveratrinic, and antiarrhythmic effect of A. calamus .

II. MATERIALS AND METHODS

II a. Drying and carbonizing of Acorus Calamus

There have been several reported studies on the medicinal activities and the phyto constituents of Acorus Calamus. An effort is made here to study the variation in composition in dried species and also the change in composition when the species is carbonized. The values for the fresh species is taken from literature. Acorus Calamus is reportedly of high medicinal value especially for infantile colic when it is carbonized while the same species has been reported to cause allergies when consumed without carbonization. A paste of Acorus Calamus is also used for external application in case of infantile colic.

The Physics behind drying is that when water is removed from the cell, the cohesive forces pull the cells closer leading to a shortening of the cell perimeter. The question remains that if this removal of water and the subsequent change in the forces has an effect on the chemical composition and the biological say. Most of the plants are said to gain medical values on drying, a claim that has not been substantiated scientifically.

Several volatile compounds have been reported in the previous studies and the major constituent reported is β-Asarone. It has been said that drying of acorus calamus rhizome for anytime between 3 months to 1 year renders beta asarone ineffective. Beta abalone has been discussed over a long period of time with most of the researchers reaffirming its toxicity and some refuting it.

It has also been reported that the chemical content and composition varies with the elevation of land where found, ploidy and the climatic variations. Ogra et al[3] have reported that the ploidy level follows a pattern depending on the geographical distribution. But for medicinal value and treatment these specifications are seldom followed and the rhizome of acorus calamus which is commercially available makes no such demarcated marketing.

III. RESULTS AND DISCUSSIONS

III a. FTIR Spectrum of Fresh, Dried and Carbonized Acorus Calamus

FTIR spectrum was obtained for commercially procured Acorus calamus which was reportedly dried over a period of 2 years. Spectrum was also obtained for the carbonized species of Acorus Calamus. The FTIR spectrum of the dried species in given in Fig.1 and the carbonized species in Fig 2.

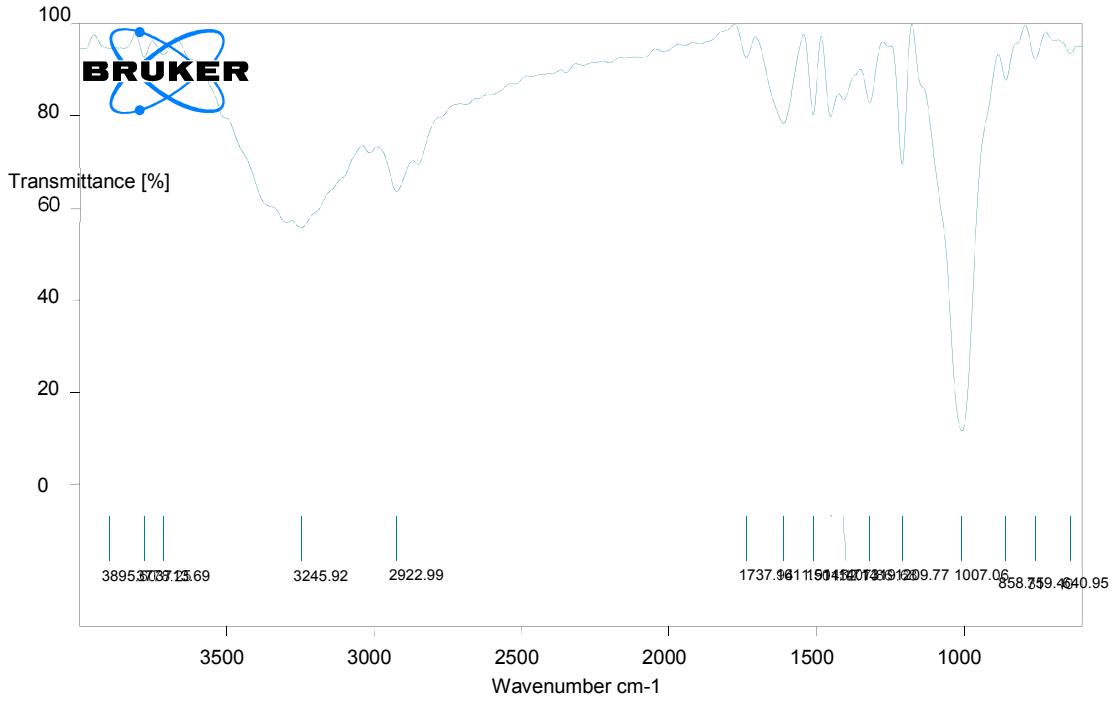

Fig 1 Spectrum of Dried up Species

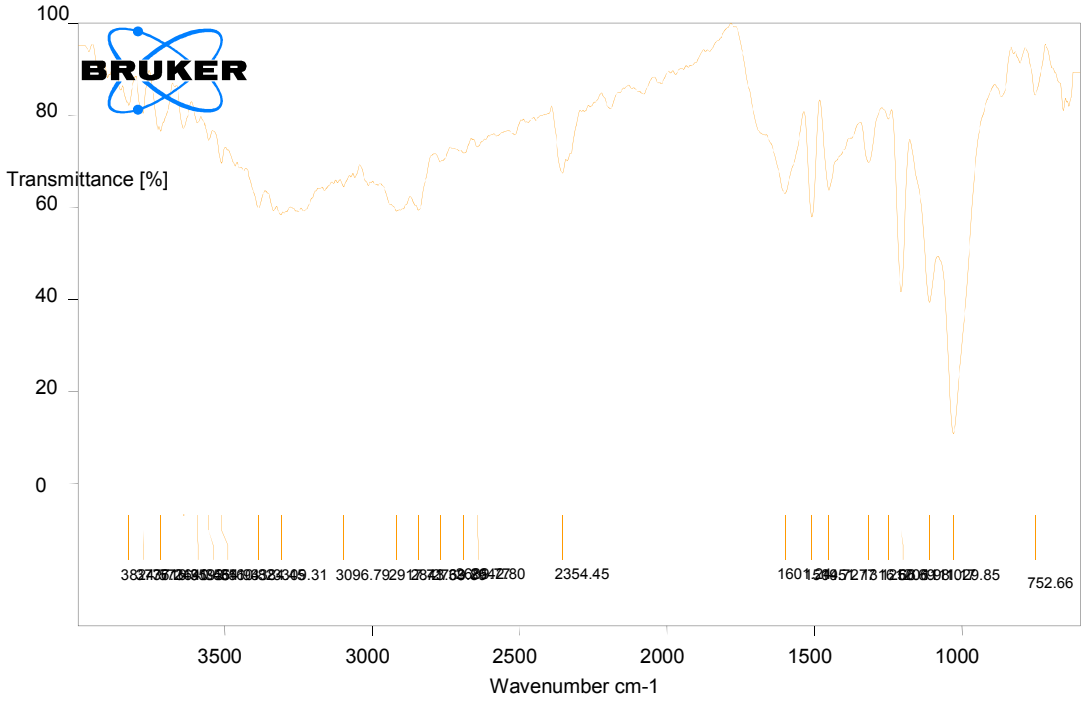

Fig 2 Spectrum of dried cabonized species

The dried species exhibited a peak at 3273.96, a value comparable to that obtained by Jayachandra et al.[4] This peak is attributed to OH stretching and is assigned to glycosides and its derivatives by Nadeem et al[5] in their work in fresh species of Acorus Calamus and their sample exhibits a peak at 3431.27 .Mamta et al[6] reported a peak at 3363.97 for fresh species. Compared to the reported peaks in the fresh species, the dried sample has a peak which is broadened indicating the loss of water and it is observed that tiny peaks are forming when the root is carbonized perhaps there is a change in the functional group on carbonization. This raises a question as to whether there is a change in the composition when heated.

Fresh sample exhibited peaks at 2930.91 and 2871.90 characteristic of CH stretching of the aromatic ring and the alkyl attachment as reported by Nadeem et al [5] and was reported at an almost identical value at 2943.94 and 2831.97 by Mamta et al[6]. Though mild shifts are observed in the dried sample it can be considered that the CH bonds do not undergo much of changes on drying (2920.19 and 2849.20) or on heating (2921.43 and 2841.78). However Jayachandra et al[4] observed only a single peak for CH stretching at 2910.

In the dried sample, tiny twin peaks observed in the 2300 range which seems to split into more peaks on heating. These were not observed in the fresh species. The dried sample at has a peak at 1729.47 indicating a very strong C=O stretch which was observed at an almost identical value of 1726.96 by Mamta et al for the freshsample. This peak seems to be almost non-existent for the heated sample.

Several split peaks are observed in the dried sample in the 1500 range and that persists in the heated sample with the peaks getting more pronounced. This region attributed to C-C stretch in aromatic rings and is devoid of any marked peak as against those reported for fresh samples[6,7] Nadeem et al[5] report a peak at 1032 attributing it to ether linkage. It is reported at 1025 by Mamta[6]. This peak is non-existent in the dried sample and it again becomes very well pronounced at 1027.79 on heating.

An unreported peak at 1008 is observed in the dried sample and this also disappears when heated. Dharmendra kumar[7] in his thesis has indicated the presence of tetra substituted benzene in fresh sample and this is also found in the dried and heated samples.

IV. CONCLUSION

It is observed that certain changes are seen in the FTIR spectrum on aging and also on carbonizing. A phytochemical analysis was not carried out as there have already been several reported studies. It is further needed to compare the dried species in various ploidy levels and also carry out docking studies to ascertain the toxicity levels in Acorus Calamus.

References

[1] KB Jyothy., Srihari Sheshagiri .,Kalpana Patel., S Rajagopala.; 2014. A critical appraisal on Swarnaprashana *in children. Ayu., 35(4): 361-365*

[2] Madan BR., Arora RB., Kapila K.; 1960. Anticonvulsant, antiveratrinic, and antiarrhythmic actions of Acoruscalamus*, an Indian indigenous drug. Archives internationales de pharmacodynamie et de thérapie., 124:201–211.*

[3] R.K. Ogra., Prashant Mohan Puriya., Upendra.K.Sharma., Madhu Sharma., A.K.Sinha., P.S. Ahuja.; 2009. Indian Calamus(AcorusCalamus L) not a tetraploid., Current Science., 97(11): 1644-1647

[4] N. Jayachandra Reddy., M. Rani., Gupta Arvind Kumar., S. Sudha Rani.; 2014. Biological activities of green silver nanoparticles synthesized with Acorouscalamus rhizome extract. European Journal of Medicinal Chemistry. 85:784-794

[5] Nadeem Mohani.,Mansoor Ahmad., Mehjabeen.,Noor Jahan.; 2014.Evaluation of phytoconstituents of three plants Acoruscalamus linn, Artemisia absinthium Linn and Bergeniahimalaicaboriss by FTIR spectroscopic analysis., Pak. J. Pharm. Sci., Conference Issue., 27(6):2251-2255

[6] Mamta Saxena and Jyoti Saxena.; 2012. Evaluation of Phytoconstituents of Acorus Calamus by FTIR and UV-VIS Spectroscopic Analysis. International Journal of Biological & Pharmaceutical Research, 3(3): 498-501

[7] Dharmendra Kumar.; 2012. Phytochemical investigation and pharmacological screening of some indian medicinal plants school of pharmaceutical sciences. Ph.D Thesis. Shobit University, Meerut