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Spectroscopy Studies on the Status of Aloin in *Aloe vera* and Commercial Samples

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Abstract

This study was carried out at Department of Physics and Department of Horticulture, Annamalai University, Annamalai Nagar, Tamil Nadu, India to identity and characterize the phenolic antroquitones (Aloin-A and B) from Aloe Vera samples. Among the leweth different samples forms of Aloe vera. The Aloe vera sap contain more aloin of 4 hydroxy aloin. *Aloe vera* leaf, gel,root commercial gel and commercial soap samples were characterized by FT-IR and UV Spectroscopy techniques. The result were discussed the above studies.

Key Words: *Aloe vera*, Aloin-A and Aloin-B, FT-IR(Fourier Transform Infrared Spectroscopy), UV(Ultra Violet Spectroscopy) techniques

Introduction

Aloe vera L. (*Aloe barbadensis* miller) is an important medicinal plant belongs to the family Liliaceae. It has larger demands and is traded in medicinal drug markets of the world for flavouring liquid and a source of 'aloin' (4.5 to 25 per cent). In recent times, herbal remedies are gaining their prominence, because of the observation that the efficacy of allopathic medicines such as antibiotics which once had near universal objectiveness against serious infections is on the wane. Over the years, infectious agents have developed resistance to synthetic drugs and the herbs and their active constituents are now being increasingly used to treat various diseases. The ability of herbal medicine to object body systems depends on the chemical constituents that it contains. Aloe products have long been used in health foods and for medical and cosmetic purposes. These products range from aloe drink to aloe gels, powders, capsules, creams etc. for both internal and external uses for a wide variety of indications. Aloe has a wide range of medicinal application such as would healing effect, reduces blood sugar in diabetes, sooths burns, eases inpestiual problem, reduces arthritic swelling, ulcer curatine object, stimulates immunes response against cancer etc. Anthraquinotes derivatives in Aloe vera gel play an important role in the treatment of tumors, diabetes, ulcer and cancer[1,2,3]. Keeping this fact in view, the resent study was undertaken to isolate the phenolic anthroquinones from the methnolic extract from *Aloe vera* leaf gel.

Materials and Methods

The leaf, gel, root were collected from department of Horticulture, faculty of Agriculture, Annamalai University, Tamil Nadu and Commercial gel and commercial soap were collected Siddha Medical Stores. The five samples were collected. The leaf, gel, root, commercial gel and commercial soap samples were crushed and cold macerated in acetone for three days. The acetone was evaporated from the extract was filtered to clarity. The fixed extract thus obtained was tested for its FT-IR spectral studies. The three different treated samples of leaf, gel, root, commercial gel and soap were collected from department of Horiculture, faculty of Agriculture, Annamalai University and Retial Pharamaceutical stores. The sample are dissolved from acetone [4]. The spectra of all samples of leaf and stem are recorded under indentical conditions in the 4000 – 400 cm^{-1} region using fourier transform infrared spectrometer (spectrum RX-I, FT-IR system, perkineliner model) available in the CISL Lab or Department of Physics, Annamalai University. In the case of UV spectral measurements, the acetones extracts of five different sample of Aloe vera, leaf, gel, root, commercial gel and commercial soap were subjected to UV spectral analysis. It has been carried out using SH1MAD2U UV – 1650 spectrometer with a wavelength ranges at 200-600 nm. The UV spectrometer available in the Department of Chemistry, Annamalai University, Annamalai Nagar, Tamil Ndu has been used.

Results and Discussion

The Fourier Transform Infrared Spectra of all the leaf, Gel, Root, commercial gel and soap are shown in fig. (2.1 – 2.5).

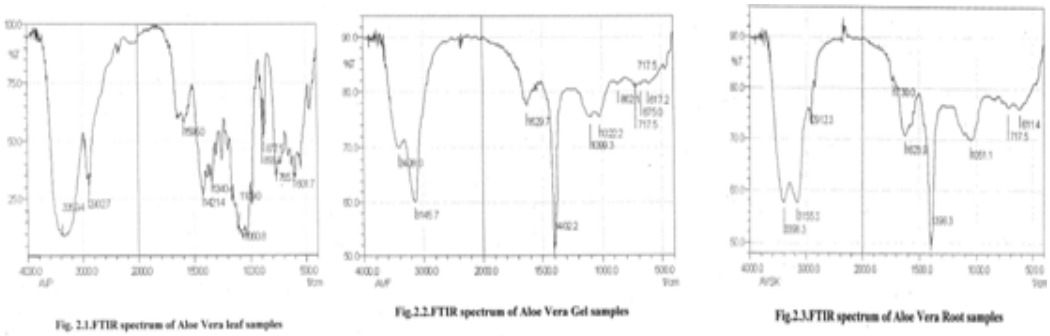

Fig. 2.1.FTIR spectrum of Aloe Vera leaf samples

Fig.2.2.FTIR spectrum of Aloe Vera Gel samples

Fig.2.3.FTIR spectrum of Aloe Vera Root samples

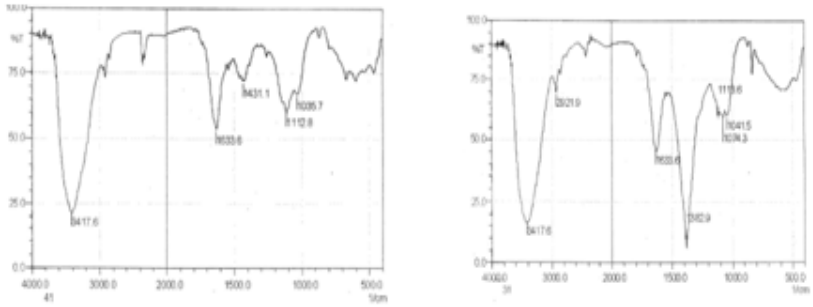

Fig.2.4. FTIR spectrum of Aloe Vera Commercial Gel samples

Fig.2.5.FTIR spectrum of Aloe Vera commercial soap samples

In all the samples absorption bands occur at 2852 cm^{-1}, 2925 cm^{-1}, 1630 cm^{-1}, 2852 cm^{-1}, 1420cm^{-1}, 1319 cm^{-1}, 1245 cm^{-1}, 1100 cm^{-1}, 780 cm^{-1} and 465 cm^{-1}. Tables (2.1 – 2.5) shows the observed frequencies in cm^{-1} of different bonds along with their tentative assignments to the probable chromophoric groups likely to be present in all the leaf, gel, root, commercial gel and soap. The FT-IR spectrum displayed are typical of plant materials and exhibit only the bands expected of from their proteins, amino acids and ether. A strong broad absorption band around 3300-3250 cm^{-1} found in all the samples may be due to the presence of hydrogen bonded N-H stretching, characteristic of amino acids [5,6,7,8,9,10].

The absorption band at 2900-2850 cm^{-1} is due to the symmetrical and asymmetrical C-H stretching of the CH_2 groups [11,12,13]. This band is also characteristic of the presence of aliphatic (-CH) groups in these compounds. The absorption band at 1750-1655 cm^{-1} is characteristic of C=O stretching indicates the presence of Carbonyl groups [14,15,16,17,18,19]. The strong absorption band at 1620-1610 cm^{-1} is due to C = C stretching which indicates the presence of Vinyl ether and Aloin compound (Jag Mohan (1998). The strong band at 1637 cm^{-1} may be characteristic of amino acid – I and another medium band at 1419 cm^{-1} may be characteristic of amino acid–III. The presence of 165 band is characteristic of amino acid group I and band at 1550 is characteristic of amino acid group II as given by[20,21,22,23]. The absorption in the region 1360-1320 cm^{-1} is due to the symmetric stretching of NO_2 which characterizes aromatic nitro compounds. The absorption band at 1240 cm^{-1} is due to the stretching vibrations of C-O groups of esters and phenols.[24] have also reported similar results. The absorption band in the region 1160-1100 cm^{-1} corresponds to the stretching vibrations of C = S. The strong absorption band at 780 cm^{-1} is due to the C-H out of plane deformation. The absorption in the region 1530-1450cm^{-1} corresponds to the anti-symmetric stretching of N = N-O.

Quantitave analysis

To estimate quantitatively due changes in the leaf and stem, extinction coefficient (K) is calculated. It can be calculated using the relation:

$$K = \frac{DA}{m}\ cm^2 / mg$$

Where D = Optical densities of the absorption band, log I_o / I

A = Area of the pellet (in cm^2)

m = mass of the sample in the pellet (in mg)

The extinction coefficient (K) values for the bands at 3426.01 cm^{-1} peaks represents phenolic OH groups and 1625.09 cm^{-1} are represents carbonyl groups found from the spectra of aloe vera samples are given in table (2). From the table 2 it is seen that the band at 3426.01 cm^{-1} has extinction coefficient varying from 39.120-165.589 cm^2/mg in all the five samples. But in commercial aloe vera soap samples the extinction coefficient (K) values are higher in 165.589 cm^2/mg Phenolic OH compounds and leaf samples contains lower values in 39.120 cm^2/mg Phenolic OH compounds whereas other samples contain moderate values of Phenolic OH compounds.

Table – 2: Extinction coefficient (K) values of *Aloe vera* and commercial samples Aloin (Phenolic compounds)

Absorption Band (cm^{-1})	Extinction coefficient (k) cm-2 / mg				
	Leaf	Gel	Root	Commercial Gel	Commercial Soap
3426.01 (Phenolic OH)	39.120	42.235	25.528	146.147	165.589
1625.09 C = O	42.748	49.562	35.445	195.325	208.363

From the table 2 it is seen that the band at 1625.09 cm^{-1} has extinction coefficient varying from 42.748 – 208.363 cm^2 / mg in all the five samples.

But in commercial aloe vera soap samples the extinction coefficient (k) values are higher in 208.363 cm^2 / mg of carbonyl groups C = O compounds and leaf sample contain lower values in 42.748 cm^2 / mg of carbonyl groups C = O compounds whereas other samples contain moderate values of carbonyl groups C = O compounds.

The wave length 3426.01 cm^{-1} indicates the presence of Aloin (Phenolic OH compounds in leaf, gel, root, aloe vera commercial gel and commercial soap samples from table (2) it is found Aloin level is maximum in commercial soap samples and it is comparatively low in leaf samples.

The wave length 1625.09 cm^{-1} indicates the presence of carbonyl compounds in all five sample. From table (2) it is found carbonyl level is maximum in commercial soap sample and it is comparatively low in leaf sample the similar result are discussed the above researchers (Rajendran et al., 2007).

The UV- Visible spectra of all the leaf, gel, root and commercial gel and soap samples are shown in fig (3.1-3.5).

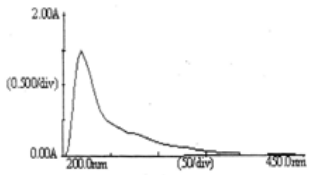

Fig. 3.1 UV spectrum of Aloe vera leaf sample

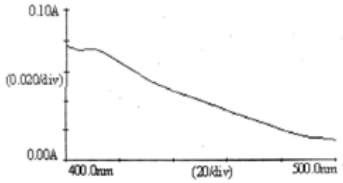

Fig. 3.2 UV spectrum of Aloe vera gel sample

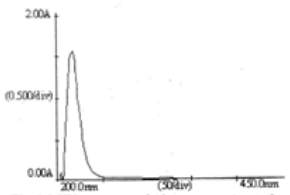

Fig. 3.3 UV spectrum of Aloe vera root sample

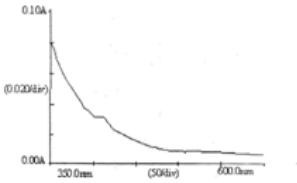

Fig. 3.4 UV spectrum of Aloe vera commercial gel sample

Table 3.1 UV spectral studies of *Aloe vera* samples

S. No.	Chemical status	UV absorption peaks (nm)	Leaf	Root	Gel	Commercial gel sample	Commercial soap sample
1.	Aloin	280	Present	Absent	Present	Present	Present
2.	Phenolic compound	330	Present	Present	Present	Present	Present
3.	Corbonyl group	425	Present	Present	Present	Present	Present

From the table 3 and Fig. 3.3 the UV/visible spectra of Aloe vera root sample of two peaks at 330 and 425 nm. This peak shows the presence of phenolic compound and carbonyl groups from the table 3 and fig. 3.4 and UV / visible spectra of aloe vera commercial gel consists of three peaks at 280 nm, 330 nm and 425 nm. These wavelength corresponds to the presence of Aloin, phenolic compound and carbonyl groups.

It is seen that from the table 3 and fig. 3.5 the UV / visible spectra of commercial soap three peaks corresponding to the wave length 280 nm, 330 nm and 425 nm, these wavelength corresponds to the presence of Alorin, phenolic compound and carbonyl groups.

From the table 3.1 and fig. 3.1 – 3.5 is found that aloin status phenolic compound and carbonyl group. But Aloe vera leaf, gel, commercial gel and soap sample contain aloin and phenolic carbonyl group and absence of Aloin for root samples only. The aloin compounds most used for medical purpose particularly for skin treatment and production of beauty creams products. Five different samples of Aloe vera leaf, gel, root, commercial gel and commercial soap collected from Department of Horticulture, Faculty of Agriculture, Annamalai University are taken up for the present investigation.

FT-IR spectroscopic techniques have been adopted to study the quantity of organic constituents present in the aloe vera leaf, gel, root, commercial gel and commercial soap. UV studies were also performed absorption peaks of chromophoric group and their result are summarized as follows: FT-IR spectra of the Aloe vera leaf, gel, root, commercial gel and

commercial soap exhibit the absorption bonds of chromophoric group characteristic of phenolis, amino acide, proteins, chlorophylls and especially aloin. From the quantitative analysis of these organic constituents it is found that the levels of total phenolic compounds and amino acids are higher in commercial gel and commercial soap samples than leaf, gel and root samples.

UV spectral studies of *Aloe vera* leaf, gel, root, commercial gel and commercial soap sample exhibit the absorption bonds of phenolic carbonyl group and aloin samples. The *Aloe vera* leaf, gel, commercial gel and commercial soap samples exhibit the absorption bands of phenolic, carbonyl groups contain aloin, Root samples the absence of aloin compounds.

Aloe has been traditional used world wide as a folk remedy for various diseases because of its multiple biological activities. The number of preparations containing aloe extracts is vast and consists of pills, capsules, creams, powders, and aqueous solutions. In our country, the preparations are often crude, consisting of the plant itself or aqueous infusions, but in the commercial products now available worldwide, the preparations often contain stabilizers and preservatives, since some components are subject to oxidation. The heterogeneous nature of Aloe vera products may contribute to the diverse biologic and therapeutic activities that have been observed. The variations in the composition of Aloe vera often results in products with different chemical and physical properties, making the comparison of products virtually impossible.

Conclusion

It is vital that Aloe products be certified as to content and identification of compounds. Only then will this allow for an accurate comparison of products as well as their efficacy in the clinical setting. All the investigation found that commercial soap and commercial gel samples extremely increase aloin and phenolic compounds. It is found that the aloin content may have higher shelf life then cashew. So that it can be even be exported as medicinal valuable compound like cashew. Further work in this direction can be taken up no find other factors which may improve the Aloin and phenolic compounds content.

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