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Full Length Research Paper

Qualititative analysis of organically farmed pulse varieties using FTIR (fourier transform infrared) spectroscopy

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Organic farming is increasing in proportion every year with almost all cash crops being produced by it. Pulses also can be produced using organic farming. Four different samples of moong dhal grown by conventional farming and organic farming were collected and analyzed qualitatively using FTIR (fourier transform infrared) spectroscopy. Samples were conventional moong dhal, cheaper and easily available in market, organic white, organic green leaf and organic green complete moong dhal have been taken. Peak difference was observed in two major areas in the composition confirming the presence of additional functional group. Peaks of wavelength 2498 cm^{-1} which was present in conventional moong dhal and 550 cm^{-1} present in organic green leaf moong dhal showed significant difference when compared with other wavelengths as they are absent in any other of the sample. The effect of organic farming in case of moong dhal seemed to make no significant difference in their composition in comparison with the moong dhal produced by conventional faming.

Key words : Moong dhal, farming, composition, ingredients, organic.

INTRODUCTION

From early civilization we have known of the various aspects of conventional farming. Later on since 20th century the dimensions of farming keep on modulating in terms of productivity and cost- effectivness and a new term was coined called organic farming which follows a strict set of rules dealing with what can or cannot be used in regard to fertilizer, pesticides etc. (Bidwell et al., 1986). The main difference between them is the amount of labour involved, organic farming typically takes more labour to produce the same kind of crop as in intensive farming, due to lack of industrially produced pesticides and fertilizers. while they are organic pesticides and fertilizers, there is no wide variety and efficacy of products as for intensive (Gyeye et al., 2003) So, hard labour must be used to counter the effects of pests and to apply the larger volume of organic fertilizers (Haitong et al., 2000). These fertilizers may or may not affect the quality of components that are compositionally present in a typical farming products. Here the sample is taken as different kind of moong dhal originated from conventional and organic farming. The study of chemical composition of moong dhals are important for understanding their property and behaviours like carcinogenicity, hypersensitivity or fatigueness etc. The infrared spectrum originates from the vibrational motion of the molecule. The vibrational frequencies are a kind of fingerprint of the compounds. This property is used for characterization of organic and inorganic compounds present in pulses. The band intensities are proportional to the concentration of the compound and hence qualitative estimations are possible (Pan et al., 2007).

Fourier transform infrared (FTIR) spectroscopy can give routine, easy and rapid measurements which leads to ambiguous information about the component composition. Specially a precise wavelength scale of the fourier method is helpful here. A relatively good spatial resolution is important (Bekalo et al., 2001). Qualitative and

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quantitative analysis of compounds present in moong dhal is essential to compare the conventional and organic farming.

MATERIALS AND METHODS

The main material used for this study were different types of moong dhal. Conventional moong dhal, organic white moong dhal, organic green leafed moong dhal and organic green complete moong dhal were used. Varieties were collected from different sources of farming products near Adayar and Tambaram, suburbs of Chennai. A handful of each variety was soaked in water the previous night.

Sample preparation

100 mg of each sample were weighed and were homoginezed in a homogenizer. Samples were diluted with boric acid in 1:4 ratio (100 mg of sample and 400 mg of boric acid). They were then submitted to high pressure of about 203 MPa for 10 min obtaining a thick liquid at the bottom of the test tube leaving thinner layer above it (Buys et al., 1993). Samples were then introduced to FTIR. FTIR which was used had a scan range of 450 - 4000 cm^{-1}, resolution was 1.0 cm^{-1} . The Perkin Elmer spectrum FT-IR instrument consisted of globar and mercury vapor lamp as sources, an interferometer chamber comprising of KBr and mylar beam splitters followed by a sample chamber and detector. Entire region of 450 - 4000 cm^{-1} was covered by this instrument (Bruneau et al., 1999). The spectrometer worked under purged conditions. The interference pattern obtained from a two beam interferometer as the path difference between the two beams is altered, when fourier transformed, gave rise to the spectrum. The transformation of the interferogram into spectrum was carried out mathematically with a dedicated on-line computer (Figure 1). The sample of different moong dhal was inserted into the IR sample holder and attached with scotch tape. The spectrum was runned and displayed in computer monitor.

RESULTS AND DISCUSSIONS

The samples of different kinds of moong dhal were studied in terms of presence of functional group in its components. Individual analysis of the moong dhal were performed and the components were determined by spectroscopical graph interpretation (Karp et al., 1995).

Comparison of the conventional to the organic white moong dhal and organic green leaf moong dhal gave almost similar range of absorbance and transmittance peaks (Figures 2, 3, 4 and 5). Comparison of all the 4 varieties of moong dhal revealed that the absorbance peak of 2498 cm^{-1} and transmittance peak of 1502 cm^{-1} were not found in any of the variety of organic moong dhals which correspond to the functional group carboxylic acid which have strong intensity and broad shape peak, but carboxylic acids were present in organic white moong dhal at absorbance peak of 1155 cm^{-1}, transmittance peak of 2845 cm^{-1} (Table 1) and in organic green complete moong dhal at absorbance peak of 1156 cm^{-1} and transmittance peak of 2844 cm^{-1} (Table 2) in some other form with a composition of alcohol, ether and ester which shows that there are no marked difference in conventional and the organic moong dhal regarding to organic white

Figure 1. FTIR Instrument.

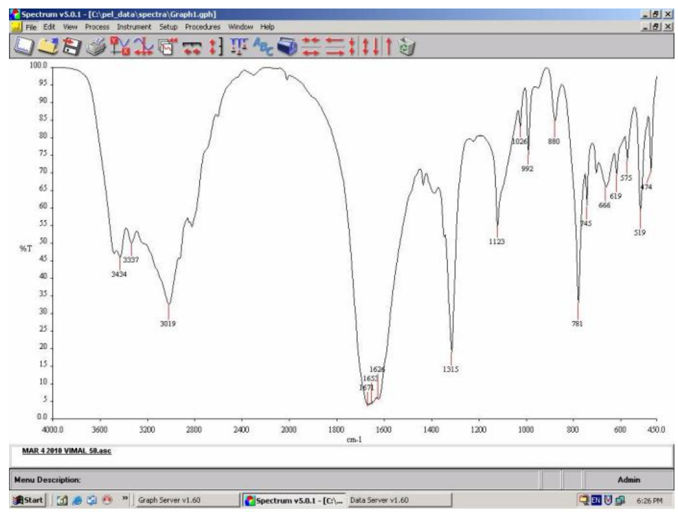

Figure 2. FTIR Tranmittance graph of conventional moong dhal.

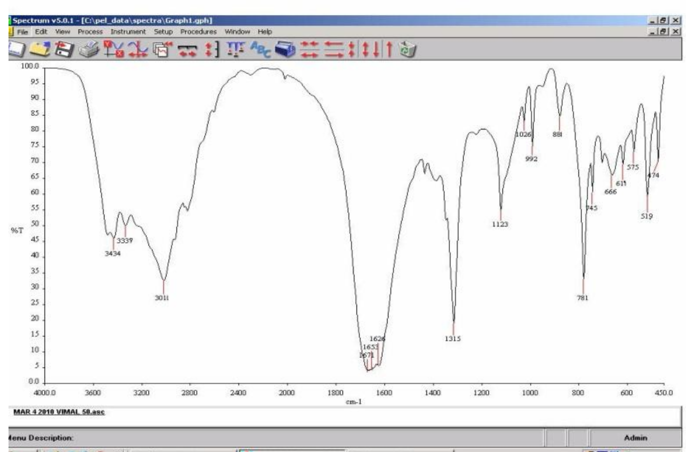

Figure 3. FTIR tranmittance graph of organic white moong dhal.

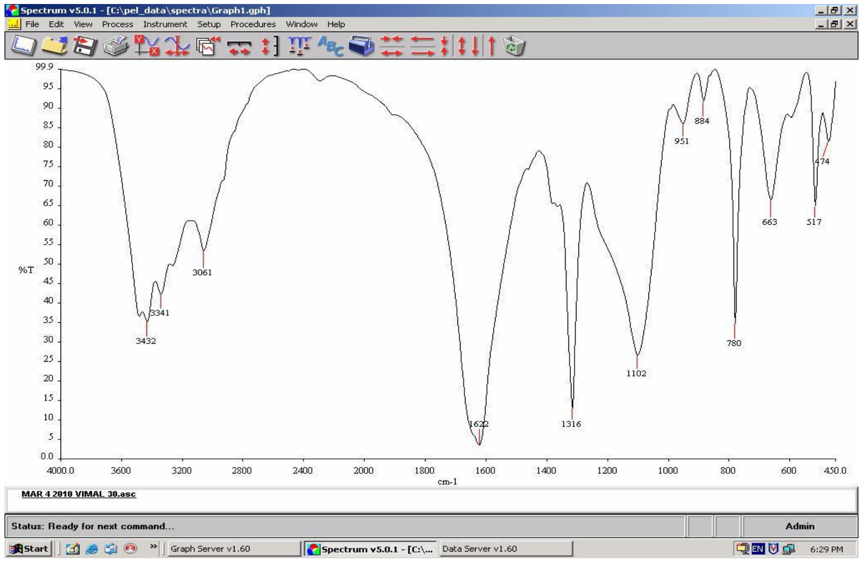

Figure 4. FTIR tranmittance graph of organic green leaf moong dhal.

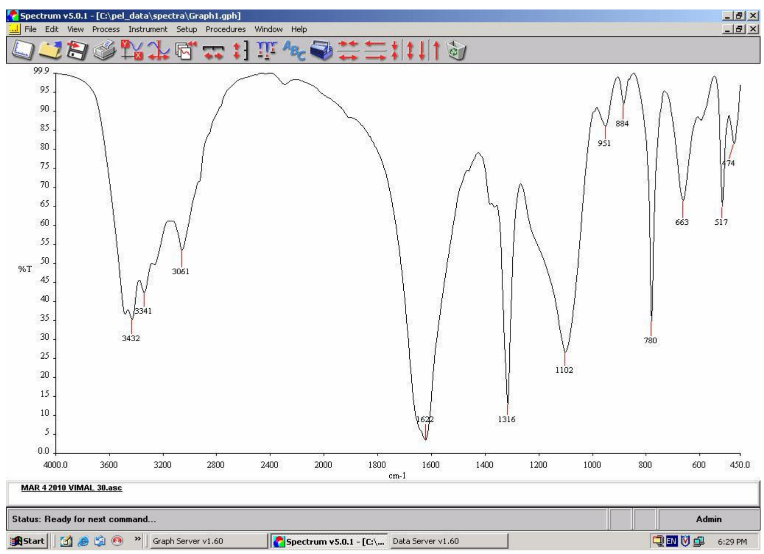

Figure 5. FTIR tranmittance graph of organic green complete moong dhal.

Table 1. Composition of conventional moong dhal.

Absorbane peak value (cm^{-1})	Transmittance peak value (cm^{-1})	Functional Group	Intensities	Shape	Formula
3388	612	Hydrogen Bonded – Alcohol/ Phenols	Weak	Broad	O-H
2498	1502	Carboxylic acid	Strong	Broad	O-H
2257	1743	Alkyenes	Strong	Sharp	C-H
1647	2353	Alkenes	Medium	Broad	C-H
1423	2577	Alkane (scissoring and bending)	Medium	Sharp	C-H
1191	2809	Alkohols, Ether, Carboxylic Acid, Ester	Medium	Broad	C-O
713	3287	Phenyl ring substitution bands	Strong	Sharp	C-H

Table 2. Composition of organic white moong dhal.

Absorbane peak value (cm^{-1})	Transmittance peak value (cm^{-1})	Functional Group	Intensities	Shape	Formula
3400	600	Hydrogen Bonded – Alcohol/ Phenols	Weak	Broad	O-H
2138	1862	Alkyenes	Strong	Sharp	C-H
1647	2353	Alkenes	Medium	Broad	C-H
1420	2580	Alkane (scissoring and bending)	Medium	Sharp	C-H
1155	2845	Alkohols, Ether, Carboxylic Acid, Ester	Medium	Broad	C-O
710	3285	Phenyl ring substitution bands	Strong	Sharp	C-H

Table 3. Composition of organic green leaf moong dhal.

Absorbane peak value (cm^{-1})	Transmittance peak value (cm^{-1})	Functional Group	Intensities	Shape	Formula
3391	609	Hydrogen Bonded – Alcohol/ Phenols	Weak	Broad	O-H
2258	1742	Alkyenes	Strong	Sharp	C-H
1644	2356	Alkenes	Medium	Broad	C-H
1416	2584	Alkane (scissoring and bending)	Medium	Sharp	C-H
1187	2813	Alkohols, Ether, Carboxylic Acid, Ester	Medium	Broad	C-O
711	3289	Phenyl ring substitution bands	Strong	Sharp	C-H
550	3450	Alkyenes	Strong	Sharp	C-H

Table 4. Composition of organic green complete moong dhal.

Absorbane peak value (cm^{-1})	Transmittance peak value (cm^{-1})	Functional Group	Intensities	Shape	Formula
3398	602	Hydrogen Bonded – Alcohol/ Phenols	weak	Broad	O-H
2127	1873	Alkyenes	Strong	Sharp	C-H
1644	2356	Alkenes	Medium	Broad	C-H
1416	2584	Alkane (scissoring and bending)	Medium	Sharp	C-H
1156	2844	Alkohols, Ether, Carboxylic Acid, Ester	Medium	Broad	C-O
723	3277	Phenyl ring substitution bands	Strong	Sharp	C-H

moong dhal and organic green complete moong dhal as they are very closely related in there properties.

On compairing conventional moong dhal to organic green leaf moong dhal it was found that the absorbance peak of 550 cm^{-1} and transmittance peak of 3450 cm^{-1} (Table 3) was found in organic green leaf moong dhal which is corresponding to the functional group alkyene of strong intensity and sharp shape which is the most altered observation as it is absent in any of the variety either conventional or organic moong dhal.

While the absorbance peak of 2498 cm^{-1}, transmittance peak of 1502 cm^{-1} corresponding to functional group carboxylic acid was not found in organic green leaf as such, but the functional group carboxylic acid waspresent at absorbance peak of 1187 cm^{-1}, transmittance peak of 2813 cm^{-1} was obtained in some other form with alcohols, esters and ethers (Table 4). The alkyene group that is present additionally in organic green leaf moong dhal can be tested further to study its properties and post effects on consumption by the HPTLC (High performance thin layer chromatography) method.

Conclusion

A marked difference was found in the value of absorbance and transmittance of conventional and organic green leaf moong dhal as the additional group alkyene was found to be present in organic green leaf moong dhal, but there was no change in functional group of carboxylic acid in any of them, although, the ranges of absorbance and transmittance varied to a wide extent. It was found in some other form in all organic moong dhal with a combination of alcohols, ethers and esters. Further studies can throw light on the different properties and factors involved in the presence of additional group and their impact.

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