FT-IR Spectroscopic Analysis of Ocimum-Gratissmium Leaves

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Abstract – The potential of vibrational spectroscopy method (Fourier Transform Infrared) FT-IR for the identification of functional groups in ocimum -gratissimum leaf powder (clove basil) is described. Infrared spectroscopy provides accurate information on molecular vibrations in a short time. FT-IR analysis of ocimum-gratissimum leaves show the presence of some functional groups with corresponding intensity peaks O-H stretching or hydrogen bonding for alcohols or phenols groups of active compounds. C-H stretching which was correspond to alkanes and alkynes, C=O stretching was denoted for amides and esters, C-H (CH2X) which is assumed alkyl halide groups of bio active compounds. C-H bending denoted for alkynes. The spectral studies of FT-IR denoted the functional groups of bio-active components like eugenol, alkanes, esters, alkyl halides, amides, carbohydrates, hydroxyl and others.

Index Terms – Ocimum-Gratissimum leaf, alkyl halide groups, micro-organisms, functional groups.

1. INTRODUCTION

Ocimum gratissimum, also known as clove basil,African basil and in Hawaii as wild basil is a species of *Ocimum*. It is native to Africa.

Medicinal plants have been widely used throughout the human history. Large number of chemical compounds are found in the plants which is used for certain biological functions and these chemical compounds play a vital role in defending against the pathogenic attack from insects, fungi, viruses etc. Plants comprise the largest component of the diverse therapeutic elements of traditional health care practices both in human and animal. Nearly all cultures and civilizations from ancient times to the present day have used herbal medicines which are medicinal sources to cure infections. Medicinal plants have many advantages to the health of individual and the communities. The medicinal advantages of some plants fall in the presence of some chemical compounds that produce fixed physiological actions in the human body. Some of these biologically active ingredients are tannins, flavonoids, alkaloids and phenolic compounds.

2. LITERATURE SURVEY

Plants secondary metabolites have recently been referred to as phytochemicals. Phytochemicals are naturally occurring and biologically active plant compounds that have potential disease inhibiting capabilities (Rukayadi et al., 2006; Yoshikawa et al., 2007; Hameed et al., 2015a; Al-Marzoqi et al., 2016). It is believed that phytochemicals may be effective in combating or preventing disease due to their antioxidant 128 J. Pharmacognosy Phytother. effect (Halliwell and Gutteridge, 1992; Altameme et al., 2015a). Plant materials have played an important role in traditional methods of field crop and stored grain protection against insect pest infestation since time immemorial (Ogendo et al., 2003; Al-Marzoqi et al., 2015). Ocimum species contains a wide range of essential oils rich in phenolic compounds and a wide array of other natural products including polyphenols such as flavonoids and anthocyanins. The genus Ocimum comprises more than 150 species and is considered as one of the largest genera of the Lamiaceae family (Holm, 1996; Hameed et al., 2015b). Ocimum basilicum L. (sweet basil) is an annual herb which grows in several regions all over the world. The plant is widely used in food and oral care products. The essential oil of the plant is also used as perfumery (Bauer et al., 1997; Chiang, 2005). Kéita et al. (2000) reported O. basilicum and O. gratissimum to be potential insecticides. The leaves and seeds are rich in essential oils, which are repellent, toxic or growth inhibitory to many insects. A high degree of polymorphism in the genus Ocimum determines a large number of subspecies, different varieties and forms producing essential oils with varying chemical composition offering variable level of medicinal potential. Essential oils extracted from Ocimum plants have been reported to possess interesting biological properties. These volatile oils have been applied in perfumery, to inhibit growth of microorganisms, in food preservation and in aromatherapy. The potential uses of O. basilicum, Ocimum canum Ocimum gratissimum and Ocimum sanctum essential oils, particularly as antioxidant and antimicrobial agents have also been explored (Politeo et al., 2007; Koba et al., 2009; Zhang et al., 2009; Hameed et al., 2015c; Altameme et al., 2015b; Hussein et al., 2016a).

3. MATERIALS AND METHODS

The aim of this study was to identify the various functional groups present in the sample. Clove basil fresh (ocimum gratissimum) leaves were collected from local area of

Hyderabad, Telangana state, India and identified in the department of Botany, R.B.V.R.R. Women's College, Narayanaguda, Hyderabad, Telangana State.

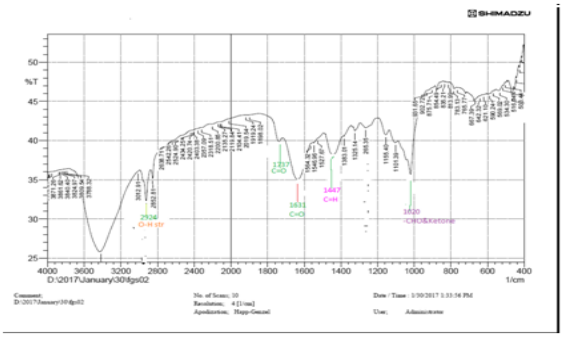
Fresh leaves were washed under the running tap water to remove unnecessary solid dust particles and dried under shade at room temperature. Dried leaves were powdered in electric grinder and powdered sample was stored in the air tight bottle for further analysis.

FTIR : FTIR is the most powerful tool for identifying the types of chemical bonds (functional groups) present in compounds. The wavelength of light absorbed is characteristic of chemical bond as can be seen in the annotated spectrum. The powdered sample of ocimum-gratissimum leaves was loaded in FTIR spectroscope with a scan range from 400 to 4,000cm^{-1} in the mid IR region with a resolution of 4cm^{-1}.

Bruker Alpha FT-IR Spectrophotometer

4. RESULTS AND DISCUSSIONS

The FTIR spectrum of ocimum-gratissimum leaves are given in the figure. The data on the peak value and the probable functional groups present in the leaf powder are presented in the table.



FTIR spectrum of o-gratissimum leaf powder

Evaluation of FTIR spectrum:

Sl. No.	Peak range in cm^{-1}		Types and functional group	Bonding pattern
1	3809		H_{2O}	O-H
2	2924		Carboxylic acid.	O-H stretching
3	2852		Alkyl	C-H stretching
4	1737		Ester	C=O stretching
5	1631		Amide	C=O stretching
6	1444		Aromatic(eugenol)	C-H bending
7	1325	Finger	Alkyl halide	C-F stretching
8	1265	Print	Alkyl halide	C-F stretching
9	1155	Region	Alkyl halide	C-F stretching
10	1101		Alkyl halide	C-F stretching
11	1020		Glycogen(acetol functional group, carbohydrate)	CHO & ketone
12	813		Methyl eugenol	C-H bending
13	0534		Alkyl halide	C-Br stretching
14	0516		Alkyl halide	C-Br stretching

FTIR spectral data interpretation : The characteristic band at 3809 cm^{-1} (for O-H group), 2924 cm^{-1} (for C-H stretching), 2852 cm^{-1} (for C-H stretching), 1631 cm^{-1} (for C=O stretching), 1444 cm^{-1} (for C-H bending), 1020 cm^{-1} (for glycogen) were exhibited by the sample.

5. CONCLUSION

From the results obtained in the present study, it could be concluded that, the various functional groups observed probably indicate the presence of eugenol, carbohydrates-glycogen, amides, esters and alkyl halides. Among the functional groups observed in the sample, O-H group has got the ability of forming hydrogen bonding capacity probably indicates inhibitory activity against micro organisms.

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