THINK INDIA JOURNAL

ISSN:0971-1260
Vol-22-Issue-34-December -2019

Analysis of functional groups from various plants using Fourier transforms infrared spectroscopy

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Abstract

Medicinal plants are used from ancient time due to presence ample amount of secondary metabolites however its utility in agriculture recently increased for managing insect and pest in may region of world. The present investigation carried out at School of Agriculture, Lovely Professional University to determine functional group using FT-IR spectra analysis. The FT-IR spectrum showed the presence of ester, amide, alcohol, alkane, nitril, aromatics and amine groups based on absorption peak in crud powder of Calotropis gigantean, Datura stramonium, Eucalyptus globules, Azadirachta indica, Ricinus communis and Mentha sp. Hence, the present study revealed that the photochemical compounds present in the plants responsible for the insecticidal activity. Further, characterization needs to be investigated in future.

Key word: FT-IR, *Calotropis gigantean, Datura stramonium, Eucalyptus globules, Azadirachta indica, Ricinus communis* and *Mentha*

Introduction

The great diversity of plants present in an ecosystem and has contain various secondary metabolites. Plants are used in many ways like as ornamental, timber industries, building materials as well as the source of medicines and psychoactive drugs from ancient time. Medicinal plants are richest source of drugs for traditional systems of medicine due to presence of flavonoid, alkaloid, phenol and tannins, carboxylic acids, terpenes and amino acids and inorganic acids (Kalaichelvi and Dhivya, 2017). These metabolites are playing important role in attractant, repellent, fumigation, antifeedant, growth regulator and deterrent effect has been evaluated against insect pest, phytophathogens and other organism (Isman, 2006; Hikal et al., 2017). Many recent research revealed that sole medicinal plant extracts or its metabolites has play an important in pest and disease management (Tembo et al., 2018; Hikal et al., 2017; Raghavendra, et al., 2016; Rana et al., 2016) also enhance insecticidal activity when used in combination with synthetic chemical (Malagatti et al., 2014; Kalinkar, et al., 2014). Recently, employment of bio-engineer nanomaterials more popularized among the researcher for sustainable pest and disease management strategy to reduce the pesticide pressure on crops (Banu et al., 2017; Bhattacharyya, 2016; Singh, 2015; Moorthi et al., 2014). Keeping above information and scope in mind the present investigation was aimed to determine functional group using FT-IR spectra analysis in commonly available medicinal plants.

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Materials and methods:

Collection of preparation of plant material: Fresh plant leaves were collected from different places of Lovely Professional University campus and Chhattisgarh, India. The collected leaves were surface sterile using tap water and shade dried under room temperature. Further, dry leaves were pulverized into fine powder using blender. The crude powder was stored in airtight container until further process (Table 1).

FT-IR Spectroscopy: 5 gm of fine powder materials of different plants (Table 1) were taken from each sample and mixed with 100mg KBr (FT-IR grade). The mixture was compressed to prepare a salt disc (3mm diameter). Investigation were carried out with a Perkin-Elmer Range on FT-IR-84005 Shimadzu, Japan, in the absorption range between 4000-500 cm^{-1}.

Table 1- Details of plant material used for extraction and its area of collection.

Sr. No.	Scientific Name	Common Name	Family	Area of Collection	Plant parts used
1	*Calotropis gigantean*	Akh, Madar	Apocynaceae	LPU Campus	Leaf
2	*Datura stramonium*	Datura	Solanaceae	Balod, Chhattisgarh	Leaf
3	*Eucalyptus globulus*	Eucalyptus	Myrtaceae	LPU Campus	Leaf
4	*Azadirachta indica*	Neem	Meliaceae	LPU Campus	Leaf
5	*Ricinus communis*	Caster	Euphorbiaceae	LPU Campus	Leaf
6	*Mentha sp.*	Mint	Lamiaceae	Phagwara local market	Leaf

Result

The present study the FT-IR spectrum was used to identify the functional group of the active components based on the peak value in infrared region. The results of FT-IR peak values and functional groups in used medicinal plants were represented in table 2, 3,4 and 5. Crud powder of *C. Gigantean*, presence of strong intensity represent the alcohol group at 3417.98 cm^{-1} absorption peak, strong intensity of alkane group (C-H) at 2932.86 cm^{-1}, medium intensity nitrile group (C-N) at 2361.91cm^{-1}, strong intensity carbonyl group (C=O)at 1734.06 cm^{-1}, strong intensity amide group (C=O) at 1654.01 cm^{-1}, medium-weak intensity aromatic group (C=C) at 1545.03 cm^{-1}, variable intensity alkane group (-C-H) at

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1422.55 cm^{-1}, medium weak intensity amine group (C-N) at 1320.32 cm^{-1}, strong intensity ether group (C-O) at 1246.06 cm^{-1}, strong intensity alkyl halide group (C-F) at 1055.10 cm^{-1} and strong intensity alkyl halide group (C-CL) at 669.32 cm^{-1} (Table 2 and Fig. 1)

A thirteen function groups were observed in between peak ranged 516.94 - 3371.88 cm^{-1} in *D. Stramonium* crude leaf powder (Table 3). Absorption peak at 3371.68 cm^{-1} found strong intensity representing the presence of alcohol group (O-H), alkane group (C-H) at 2928.04 cm^{-1}, nitrile group (C-N) at 2363.84 cm^{-1}, amide group (C=O) at 1649.19 cm^{-1}, aromatic group (C=C) at 1541.18 cm^{-1}, alkyl halide group (C-F) at 1397.47 cm^{-1} and 1318.39 cm^{-1}, amide group (C-N) at 1248.95 cm^{-1}, alcohol group (C-O) at 1107.18 cm^{-1} and 1059.92 cm^{-1}, alkyl halide group (C-CI) at 781.20 cm^{-1} and 619.17 cm^{-1} and alkyl halide group (C-Br) at 516.94 cm^{-1} (Table 3 and Fig. 2). In eucalyptus (*Eucalyptus globules)* leaf powder observed six different function groups in between intensity ranged from 516 to 2922 cm^{-1} by FT-IR (Table 3 and Fig. 2). At 2922.25 cm^{-1} and 2428.46 cm^{-1} this strong intensity representing the presence of acidic (O-H) group; strong intensity for ester (C=O) group was observed at 1736.96 cm^{-1}; medium –weak intensity at 1514.17 cm^{-1} and 1455.34 cm^{-1} was observed for aromatic (C=C); strong intensity at 1316.46 cm^{-1} exhibits alkyl halide (C-F) and strong intensity for alcoholic (C-O) at 1051.24 cm^{-1} and at 516.94 cm^{-1} strong intensity observed alkyl halide (C-Br) group (Table 4 and Fig. 3).

Neem (*Azadirachta indica*) crude leaf powder analysed in FT-IR and different compounds like alcohol (O-H), alkane (C-H), nitrile (C-N), alkene (C=C), alkane (-C-H) and amine (C-N) groups at 3382.29 cm^{-1} , 2926.11 cm^{-1}, 2361.91cm^{-1},1647.26 cm^{-1}, 1449.55 cm^{-1} and 1317.43 cm^{-1} absorption peak were observed respectively. Medium- weak intensity amine (C-N) group at 1258.59 cm^{-1}, strong intensity alkyl halide (C-F) group at 1065.71cm^{-1}, strong intensity alkane (=C-H) group at 823.63 $cm^{-1}$and strong intensity alkyl halide (C-CI) group at 668.36 cm^{-1} also observed in neem leaf powder (Table 5 and Fig.4).

In castor (*Ricinus communis*) leaf powder, a strong intensity of alcohol (O-H) group exhibited at 3391.94cm^{-1} absorption peak, strong intensity alkane (C-H) at 2930.93 cm^{-1}, variable intensity alkyne (-C=C-) at 2362.99 cm^{-1}, variable intensity alkene (C=C) 1656.91cm^{-1}, medium –weak intensity of aromatic (C=C) group at 1547.93 cm^{-1}, variable intensity alkane (-C-H) at 1396.51cm^{-1}, strong intensity of acid (C-O) group at 1233.52 cm^{-1}, strong intensity alcohol (C-O) 1058.96 cm^{-1} and strong intensity alkyl halide (C-CI) at 665.46 cm^{-1} observed in FT-IR analysis (Table 6 and Fig. 5). Total twelve function groups were

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observed in mint (*Mentha longifolia*) crude powder. Absorption peak at 3869.33cm^{-1} and 3729.53cm^{-1} exhibited strong intensity indicated the presence of alcohol (O-H) group, strong intensity alkane (C-H) at 2944.44 cm^{-1}, medium intensity nitrile (C-N) observed at 2362.88 cm^{-1}, variable intensity alkene (C=C) observed at 1641.48 cm^{-1}, medium-weak intensity of aromatic (C=C) observed at1518.03cm^{-1}, variable intensity alkane (-C-H) group observed at 1396.54 cm^{-1}, medium to weak intensity of amine (C-N) group observed at 1263.42 cm^{-1}, strong intensity alkyl halide (C-F) observed at 1061.85 cm^{-1}, strong intensity alkene (=C-H) group observed at 812.06 cm^{-1} and strong intensity alkyl halide (C-CI) group was observed at 666.43 cm^{-1} in mint leaf powder (Table 7 and Fig. 6).

Discussion

The FT-IR analysis of some medicinal plant extract showed the absorption peak at different values. The strong absorption peak represents the different functional groups in tested plant powder which responsible for toxic effect on insect pests and disease. Different functional groups like as acid (O-H), ether (C=O), aromatic (C=O), alcohol (C-O), alkane (C-H), nitrile (C-N), amide (C=O), amine (C-N), carbonyl (C=O), ester (C=O) found in crud powder of indigenous plants used in present study which analysed in FT-IR spectroscopy. Many researchers were also analysed plant parts by of FT-IR spectrum and resulted that the medicinal plants having potential to induced insecticidal, nematicidal and antimicrobial activities due to presence of functional groups as well as secondary metabolites (Subramanian *et al.*, 2017; Amorin, 1999; Anis et al., 2000; Venkanna *et al.*, 2013; Radhakrishnan *et al*., 2015). Present result found in agreement with Venkanna *et al* (2013) who stated that the *D. stramonium* have antimicrobial properties due to presence of alcohol, alkynes, esters, amines and alkane functional groups. In *Eucalyptus globules* contained alcoholic (O-H) and amide, carbonyl (C=O) and ether (C-O) functional groups were responsible for antimicrobial activity against different fungus and bacteria (Subramanian *et al.*, 2017).

Presence of different functional groups in leaf of *C. gigantean* like alcohol (O-H), alkanes (C-H), carbonyls (C=O) and amines (C-N) which responsible to induce antimicrobial and antioxidant activity (Radhakrishnan *et al*., 2015), anti- mycoplasmal (Muraina *et al*., 2010), antifungal activity (Ghosh, 1988) and other antinematicidal activity (Amorin, 1999; Anis et al., 2000). Its chemical compound showed significant effective against diverse insect pests such as mosquito (Shahi *et al.*, 2010; Singh *et al.*, 2004), housefly (Morsy *et al.*, 2001), storage pest (Alam *et al.*, 2009) and lepidopteran pest (Upadhyay, 2013; 2014) which contain

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protein and other protease associated with insecticidal activity (Carlini and Grossi,2002; Freitas *et al.,* 2010). Also play defence role against herbivorous insects (Konno *et al.*, 2004; Ramos *et al.,* 2010) that act on enzyme and chitin inhibitor due to α- amylase (Farias *et al.,* 2007; Azarkan *et al.,* 1997).

In neem, mentha and castor leaf powder also found different function groups observed in present investigation and its metabolites diversely used in pest and disease management programme due to repellent, deterrent, fumigation and antifidant properties. Jain *et al* (2016) revealed that the mentha plant extract contained C=C aromatic group that makes toxic while presence of O-H band of phenols and alcohols were responsible to stabilize the azadirachtin content in neem (Sharma *et al*., 2017). Yusuf *et al* (2015) observed C=C and C-H absorption bond in castor which makes it toxic however significant excellent insecticidal activity showed against storage pest due to flavonoid (Upsani *et al*., 2003).

Acknowledgement

Authors are thankful to administration of Lovely Professional University, Phagwara for providing necessary facilities to conduct present investigation.

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Bibliography

Alam, M.A., Habib, M. R., Farjana Nikkon Khalequzzaman, M. and Karim M. R. (2009). Insecticidal activity of root bark of calotropis gigantean L. aginst *Tribolium castaneum. World journal of zoology.* 4(**2**):90-95

Amorin, D. A., Borba, H. R., Carauta, J. P., Lopes, D. and Kaplan, M. A. (1999). Anthelmintic activity of the latex of *Ficus* species. *Journal of Ethnopharmacology*, 64(3), 255-258.

Anis, M., Sharma, M. P., and Iqbal, M. (2000). Herbal ethnomedicine of the Gwalior forest division in Madhya Pradesh, India. *Pharmaceutical Biology*, 38(4): 241-253.

Azarkan, M., Amrani, A., Nus, M., Vandermeers, A., Zerhouni, S. and Smolders, N., (1997) Carica papaya is a rich source of a class II chitinase. *Phytochemistry*, 48:1319-1325.

Banu, A.N., Raut, A.M. and Balasubramanian, C. (2017). Bioengineered nanoparticles synthesized using *Ipomoea pes-tigridis* for improved antimicrobial activity against drug resistant microbes. *International Journal of Zoology and Applied Biosciences*. **2** (6); 338-34

Bhattacharyya, A., Duraisamy, P., Govindarajan, M., Buhroo, A.A. and Prasad, R. (2016). Nano-biofungicides: emerging trend in insect pest control. In: *Advances and Applications Through Fungal Nanobiotechnology* (pp. 307-319). Springer, Cham.

Carlini, C. R. and Grossi-de-Sá, M. F. (2002). Plant toxic proteins with insecticidal properties. A review on their potentialities as bioinsecticides. *Toxicon*, 40(11): 1515-1539

Farias, L. R., Costa, F. T., Souza, L. A., Pelegrini, P. B., Grossi, M.F. and Neto, S. M. (2007). Isolation of a novel Caricapapaya α amylase inhibitor with deleterious activity toward *Callosobruchus maculates*. *Pesticide Biochemistry and Physiology*,87:255-260.

Freitas, C. D., Souza, D. P. D., Araújo, E. S., Cavalheiro, M. G., Oliveira, L. S., and Ramos, M. V. (2010). Anti-oxidative and proteolytic activities and protein profile of laticifer cells of *Cryptostegia grandiflora*, *Plumeria rubra* and *Euphorbia tirucalli*. *Brazilian Journal of Plant Physiology*, 22(1): 11-22.

Ghosh, N. C. (1988). Comparative Materia Medica. Calcutta: Hannemann Publication. Co. Pvt. Ltd.

Hikal, W.M., Baeshen, R.S. and Said-Al Ahl, H.A. (2017). Botanical insecticide as simple extractives for pest control. *Cogent Biology*, *3*(1), p.1404274.

Isman M. B. (2006). Botanical insecticides, deterrents, and repellents in modern agriculture and an increasingly regulated world. *Annual Review of Entomology*. 2006;51:45–66. doi: 10.1146/annurev.ento.51.110104.151146.

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Jain, P. K., Soni, A., Jain, P. and Bhawsar, J. (2016). Phytochemical analysis of Mentha spicata plant extract using UV-VIS, FTIR and GC/MS technique. *Journal of Chemical and Pharmaceutical Research*. 8(**2**): 1-6.

Kalaichelvi, K., and Dhivya, S.M. (2017). Screening of phytoconstituents, UV-VIS Spectrum and FTIR analysis of Micrococca mercurialis (L.) Benth. *International Journal of Herbal Medicine*, 5(6), pp.40-44.

Kalinkar, A.S., Raut, A. M. and Undirwade, D.B. (2014). Effect of Synergist in Combination with Organophosphate against *Helicoverpa armigera* Hubner of Different Strain. *Trends in Biosciences.* **7**(18): 2719-2722.

Konno, K., Hirayama, C., Nakamura, M., Tateishi, K., Tamura, Y., Hattori, M. and Kohno, K. (2004). Papain protects papaya trees from herbivorous insects: role of cysteine proteases in latex. *The Plant Journal*, 37(3): 370-378.

Malagatti, S. Y., Undirwade, D.B., Raut, A. M. and Bagade A. B. (2014). Biorational management of churda murda disease vectors on Chilli. *Journal of Plant Disease Sciences*. **9** (2):219-225.

Moorthi, V., Balasubramanian, P.C., Avery, P.B., Selvarani, S., Kubendran, T., Rathinakumar, T. and Banu, A.N. (2014). Pathogenicity and proteome production of *Isaria fumosorosea* (= *Paecilomyces Fumosoroseus*)(WISE) isolates against lemon butterfly, *Papilio demoleus* (Papilionidae: lepidoptera). *African Journal of Biotechnology*, *13*(43): 4176-4182

Morsy, T. A., Rahem, M. A. and Allam, K. A. (2001) Control of Musca domestica third instar larvae by the latex of Calotropis procera (Family: Asclepiadaceae). *Journal of the Egyptian Society of Parasitology*, 31:107-110.

Muraina, I. A., Adaudi, A. O., Mamman, M., Kazeem, H. M., Picard, J. and McGaw, L. J. (2010). Antimycoplasmodial activity of some plant species from northern Nigeria compared to currently used therapeutic agent. *Pharmaceutical Biology*, 48:1103-1107.

Radhakrishnan, S., Alarfaj, A. A. and Annadurai, G. (2015). Estimation of phytochemical analysis and invitro antioxidant activity of calotropis gigantea extract: wound healing activity and its biomedical application. *International Journal of Pharmaceutical and Sciences and Research*, 6(7): 3053-3060

Raghavendra, K.V., Gowthami, R., Lepakshi, N.M., Dhananivetha, M. and Shashank, R., (2016). Use of botanicals by farmers for integrated pest management of crops in Karnataka. *Asian Agri-Hist*, *20*, pp.173-180.

Ramos, M. V., Grangeiro, T. B., Freire, E. A., Sales, M. P., Souza, D. P. and Araújo, E. S. (2010). The defensive role of latex in plants: Detrimental effects on insects. *Arthropod Plant Interactions*, 4(1):57 67.

ISSN:0971-1260
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Rana, M., Dubey, K. and Gairola, K. (2016) Antifungal Activity of Some Plant Extracts Against Anthracnose of Soyabean. *Advances in Life Science*, 5(1);218-220.

Shahi, M., Hanafi, Bojd, A. A., Iranshahi, M., Vatandoost, H. and Hanafi, B. M. Y. (2010). Larviciudal activity of latex and extracts of Calotropis procera (Gentianales: Asclepidiaceae) against *Culex quinquefasciatus* and *Anopheles stephensi* (Dipetra: Culiciodae). *Journal of Vector Borne Diseases*, 47:185-188

Sharma, R., Kumari, R., Prabha, A., Kumari, A. and Phool Kumar Patanjali. (2017). Stabilization of azadirachtin in neem oil using prosopisjuliflora (leguminoseae) as a botanical synergist. *International Research journal of Natural and Applied Sciences*.4(**7**):2349-4077

Singh, M., Joshi, V., Sharma, R.C. and Sharma, K. (2004). Ovipositioning behaviour of *Aedes aegypti* in different concentrations of latex of *Calotropis procera*: Studies on refractory behaviour and its sustenance across gonotrophic cycles. *Dengue Bulletin*, 28:184-188.

Singh, S., Singh, B.K., Yadav, S.M. and Gupta, A.K., (2015). Applications of nanotechnology in agricultural and their role in disease management. *Research Journal of Nanoscience and Nanotechnol*, *5*(1):1-5.

Subramanian, A., Nishanthini, K. and Poonkothai, M. (2017). Antimicrobial activity and phytochemical screening of the leaf extracts of *Eucalyptus globulus. International Journal of Current Pharmaceutical Research,* 9(**5**): 85-89.

Tembo, Y., Mkindi, A.G., Mkenda, P.A., Mpumi, N., Mwanauta, R., Stevenson, P.C., Ndakidemi, P.A. and Belmain, S.R., (2018). Pesticidal plant extracts improve yield and reduce insect pests on legume crops without harming beneficial arthropods. *Frontiers in Plant Science*, *9*.

Upadhyay, R. K. (2013). Bio-efficacy of latexes from plant species *Thevetia nerifolia*, and *Artocarpus heterophyllus, Ficus glomerata* and *Calotropis procera* on survival, feeding, development and reproductive behavior of *Spodoptera litura* (F.) Noctuidae (Lepidoptera:). *International Journal of Chemical and Bio-chemical Sciences* ,4:86-98.

Upadhyay, R. K. (2014). Ethnomedicinal, pharmaceutical and pesticidal uses of *Calotropis procera* (Aiton)(Family: Asclepiadaceae). *International Journal of Green Pharmacy*, 8(3); 135-146.

Upasani, S. M., Kotkar, H. M., Mendki, P. S., and Maheshwari, V. L. (2003). Partial characterization and insecticidal properties of Ricinus communis L foliage flavonoids. *Pest Management Science: Formerly Pesticide Science*, 59(**12**): 1349-1354.

Venkanna, B., Uma, A., Suvarnalaxmi, Ch., Chandrasekharnath, N., Prakasham, R. S., Jayalaxami, L. (2013). Antimicrobial property of Datura leaf extract against

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methicillin- resistant staphylococcus aureus isolated from urethral and skin suppurative infection. *Current Trends in Biotechnology and Pharmacy*, 7(3): 782 -792.

Yusuf, A.K., Mamja, P., Ahmed, A.S. and Agunwa, U. (2015). Extraction and characterization of castor seed oil from wild ricinus communis linn. *International Journal of Science, Environment and Technology*. 4(**5**): 1392-1404.

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Table 2- Functional groups present in leaf powder of *Calotropis gigantean*.

S.No.	Observed peak value	Visible intensity	Functional Group	Vibration type	Area
1	3417.98	Strong	O-H(Alcohol)	Stretch	2.639
2	2932.86	Strong	C-H(Alkane)	Stretch	81.674
3	2361.91	Medium	C-N(Nitrile)	Stretch	6.438
4	1734.06	Strong	C=O(Carbonyl)	Stretch	8.838
5	1654.01	Strong	C=O(Amide)	Stretch	4.91
6	1545.03	Medium- weak	C=C(Aromatic)	Stretch	3.718
7	1422.55	Variable	-C-H(Alkane)	Bending	1.627
8	1320.32	Medium-Weak	C-N(Amine)	Stretch	6.33
9	1246.06	Strong	C-O(Ether)	Stretch	17.159
10	1055.10	Strong	C-F(Alkyl Halide)	Stretch	31.404
11	669.32	Strong	C-CL(Alkyl Halide)	Stretch	4.435

Table 3- Functional groups present in leaf powder of *Datura stramonium.*

S.no	Observed peak value	Visible intensity	Functional Group	Vibration Type	Area
1	3371.68	Strong, broad	O-H(Alcohol)	Stretch	26.128
2	2928.04	Strong	C-H(Alkane)	Stretch	319.484
3	2363.84	Medium	C-N(Nitrile)	Stretch	19.915
4	1649.19	Strong	C=O(Amide)	Stretch	205.896
5	1541.18	Medium- weak	C=C(Aromatic)	Stretch	15.124
6	1397.47	Strong	C-F(Alkyl Halide)	Stretch	34.328
7	1318.39	Strong	C-F(Alkyl Halide)	Stretch	51.59
8	1248.95	Medium- weak	C-N(Amide)	Stretch	52.016
9	1107.18	Strong	C-O(Alcohol)	Stretch	65.465
10	1059.92	Strong	C-O(Alcohol)	Stretch	3.576
11	781.20	Strong	C-CI(Alkyl Halide)	Stretch	59.327
12	619.17	Strong	C-CI(Alkyl Halide)	Stretch	25.677
13	516.94	Strong	C-Br(Alkyl Halide)	Stretch	72.295

Table 4- Functional groups present in leaf powder of *Eucalyptus globules.*

S.No	Observed peak value	Visible Intensity	Functional Group	Vibration type	Area
1	2922.25	Strong	O-H (Acid)	Stretch	8.154
2	2428.46	Strong	O-H(Acid)	Stretch	0.433
3	1736.96	Strong	C=O (Ester)	Stretch	1.523
4	1514.17	Medium – weak	C=C(Aromatic)	Stretch	3.257
5	1455.34	Medium – weak	C=C(Aromatic)	Stretch	1.426
6	1316.46	Strong	C-F(Alkyl Halide)	Stretch	12.763
7	1051.24	Strong	C-O(Alcohol)	Stretch	18.415
8	516.94	Strong	C-Br(Alkyl Halide)	Stretch	2.187

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Table 5- Functional groups present in leaf powder of *Azadirachta indica.*

S.No	Observed Peak value	Visible intensity	Functional group	Vibration type	Area
1	3382.29	Strong	O-H(Alcohol)	Stretch	1.328
2	2926.11	Strong	C-H(Alkane)	Stretch	21.992
3	2361.91	Medium	C-N(Nitrile)	Stretch	6.777
4	1647.26	Variable	C=C(Alkene)	Stretch	12.183
5	1449.55	Variable	-C-H(Alkane)	Bending	2764
6	1317.43	Medium- weak	C-N(Amine)	Stretch	4.682
7	1258.59	Medium- weak	C-N(Amine)	Stretch	13.992
8	1065.71	Strong	C-F(Alkyl Halide)	Stretch	42.596
9	823.63	Strong	=C-H(Alkane)	Bending	5.354
10	668.36	Strong	C-CI(Alkyl Halide)	Stretch	4.287

Table 6- Functional groups present in leaf powder of *Ricinus communis.*

S.No.	Observed peak value	Visible intensity	Functional Group	Vibration Type	Area
1	3391.94	Strong	O-H(Alcohol)	Stretch	35.507
2	2930.93	Strong	C-H(Alkane)	Stretch	74.619
3	2362.99	Variable	-C=C-(Alkyne)	Stretch	6.173
4	1656.91	Variable	C=C(Alkene)	Stretch	3.651
5	1547.93	Medium- Weak	C=C(Aromatic)	Stretch	6.631
6	1396.51	Variable	-C-H(Alkane)	Bending	3.992
7	1233.52	Strong	C-O(Acid)	Stretch	8.332
8	1058.96	Strong	C-O(Alcohol)	Stretch	47.821
9	665.46	Strong	C-CI(Alkyl Halide)	Stretch	5.221

Table 7- Functional groups present in leaf powder of *Mentha longifolia.*

S.No.	Observed peak value	Visible Intensity	Functional Group	Vibration type	Area
1	3869.33	Strong	O-H(Alcohol)	Stretch	0.715
2	3729.53	Strong	O-H(Alcohol)	Stretch	0.74
3	2944.44	Strong	C-H(Alkane)	Stretch	10.169
4	2362.88	Medium	C-N(Nitrile)	Stretch	5.666
5	1641.48	Variable	C=C(Alkene)	Stretch	1.317
6	1518.03	Medium-Weak	C=C(Aromatic)	Stretch	1.618
7	1396.54	Variable	-C-H(Alkane)	Bending	0.911
8	1263.42	Medium- Weak	C-N(Amine)	Stretch	13.244
9	1061.85	Strong	C-F(Alkyl Halide)	Stretch	24.162
10	812.06	Strong	=C-H(Alkene)	Bending	5.277
11	666.43	Strong	C-CI(Alkyl Halide)	Stretch	4.047

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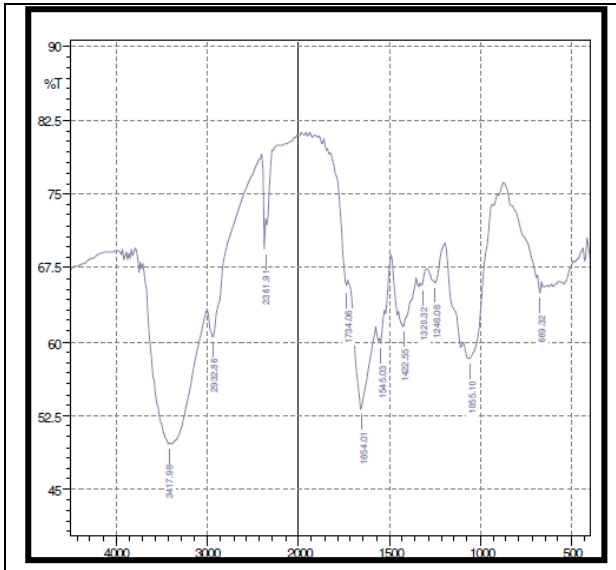

Fig 1: FT-IR spectra of *Calotropis gigantean* crud powder

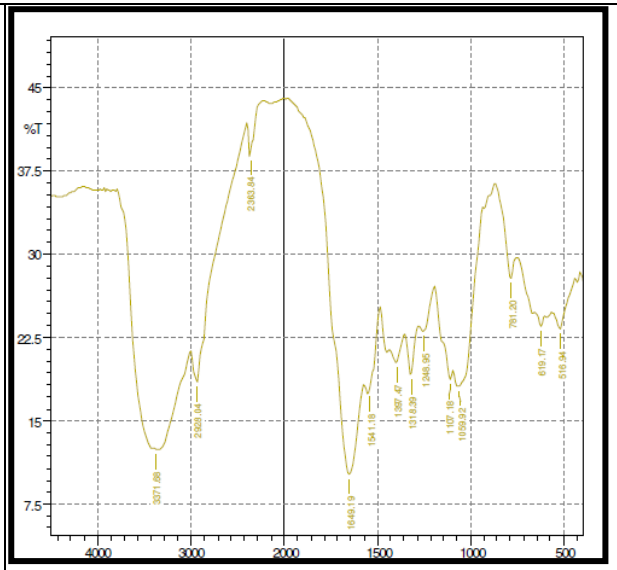

Fig 2: FT-IR spectra of *Datura stramonium* crud powder

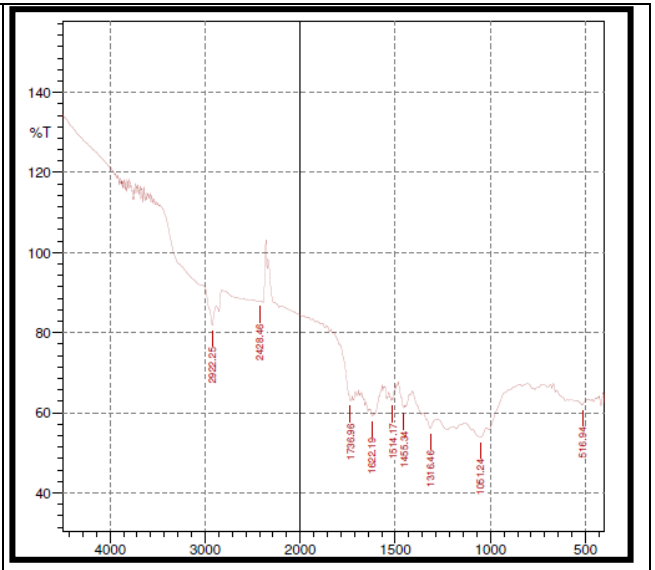

Fig 3: FT-IR spectra of *Eucalyptus globulus* crud powder

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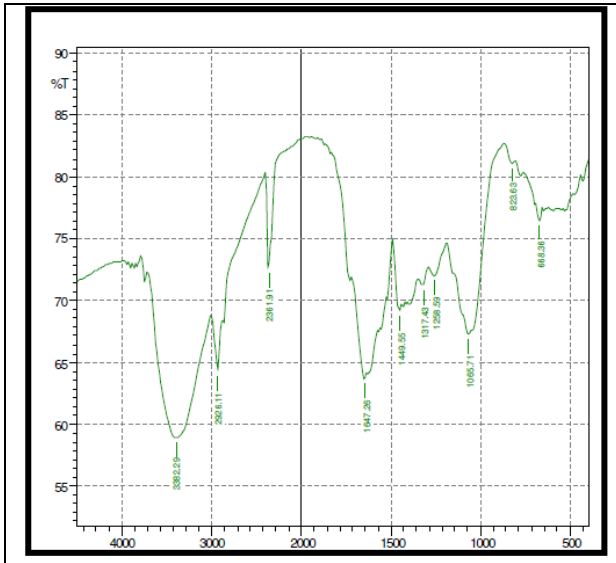

Fig 4: FT-IR spectra of *Azadirachta indica* crud powder

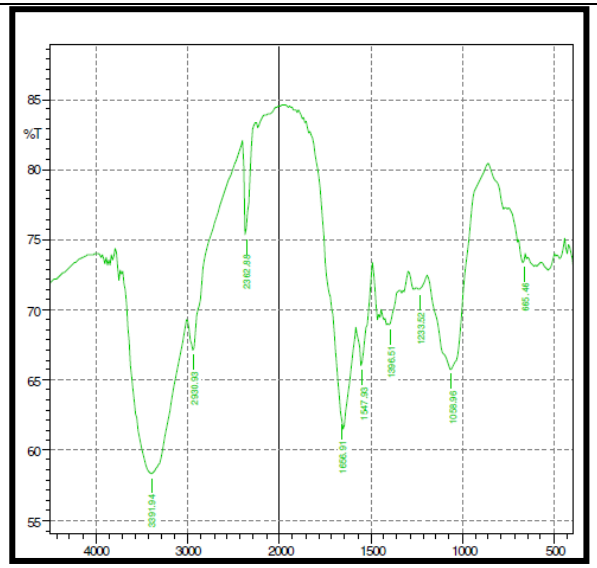

Fig 5: FT-IR spectra of *Ricinus communis* crud powder

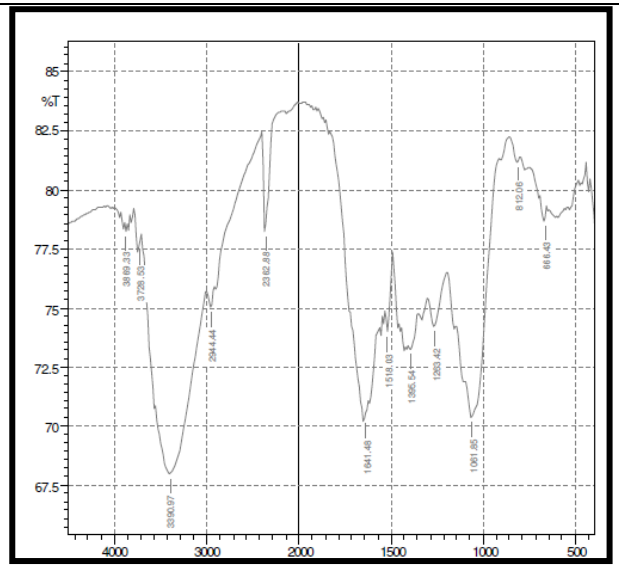

Fig 6: FT-IR spectra of *Mentha sp.*crud powde

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