

FT-IR PROFILE SCREENING OF BIOACTIVE CHEMICAL COMPONENTS IN AQUEOUS EXTRACT OF *ABRUS PRECATORIUS* LINN PLANT LEAF

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Received: 21 March 2020, Revised and Accepted: 5 April 2020

ABSTRACT

Objective: The FT-IR profile screening is aimed to focus on the bioactive chemical components analysis of aqueous extract of *Abrus precatorius* Linn plant leaves.

Methods: The profile screening for the bioactive chemical components analysis was performed with standard methods by using FT-IR spectral technique.

Results: The aqueous extract of the leaf were screened for the various bioactive functional chemical components. The spectrum of FT-IR showed the presence different functional groups of chemical constituents such as alcohols, phenols, carboxylic acids, amide, aldehydes, ketones, alkanes, alkenes, aromatics, esters, ethers, aliphatic amines, aromatic amines, peptides, nitro compounds, sulphone, phosphonate, phosphoramidate, phosphonic acid, phosphine, silane, amine oxides, aromatic substituted compounds, nitroso, sulphate ester and alkyl halides compounds, which showed 27 major characteristic bands of bioactive chemical components.

Conclusion: The results confirm the fact that leaf of *Abrus precatorius* Linn plant possesses different bioactive functional chemical components and generated the FT-IR spectrum profile for the medicinally important plant.

Keywords: - *Abrus precatorius* Linn, aqueous extract, FT-IR, chemical constituents.

INTRODUCTION

The various plants are richest resources of bioactive folk medicines. These plants have been traditionally used as different systems of medicine, food supplements, pharmaceuticals industries and chemical entities for synthesis of drugs [1]. The origin place of renewed systems of indigenous medicine like siddha, ayurvedha and unani is India. The medicines were traditionally used were prepared from an only one plant. The activity of medicine depends on the proper parts of plant use and its biological effect which in turn depends on the presence of required quantity dose and nature of secondary metabolite in a raw drug material [2]. The different chemical constituents are detected in crude dry powder of various medicinal plants, while different parts extracts like leaf [3-4], stem, fruits [5] and root [6-7] were screened for phytochemical constituents by FT-IR spectroscopic analysis technique [8]. The different active functional groups of chemical components in various extracts of medicinal plants were detected using spectroscopic method [9-10]. A survey of literature reported that the FT-IR screening of functional groups of chemical components was not done so far with the *Abrus precatorius* Linn medicinal plant. Therefore, the present study used to screen the bioactive functional groups of chemical components in the leaf of *Abrus precatorius* Linn plant.

MATERIAL AND METHODS

Collection of Plant leaves

A leafs of *Abrus precatorius* Linn was collected from the local area and authenticated by our institute botanist. The collected plant leafs were clean and washed with distilled water to remove the dirt and other impurities. The plant leafs was dried at room temperature in shade to retain their fresh green colour and also prevent the decomposition of bioactive chemical compounds. The dried plant leafs were milled to coarse powder and stored in air tight container for screening study.

Extraction of leafs material

A 5 g of leafs powder were extracted with aqueous solvent by Soxhlet apparatus. The extracts were evaporated to dryness and yielded quantities of leaf extracts were obtained and stored at 4°C for further studies taken to screen the bioactive chemical compounds.

FT-IR screening of aqueous extract

FT-IR is the most powerful tool for identifying the different types of functional groups present in bioactive compounds. The characteristic wavelengths of light absorbed by the chemical bonds can be seen in the annotated spectrum. The infrared absorption spectrum interpretation can be determined the chemical bonds present in a molecules. Dried powder materials of leafs extract was used for FT-IR screening study [11].

A 5 mg of dried powder of the extract was encapsulated in 50 mg of KBr pellet, in order to prepare translucent sample discs. The sample disc was loaded in FT-IR spectroscopy instrument and scanned for a resolution of 4 cm⁻¹ with range of 400 to 4000 cm⁻¹ [12].

RESULTS AND DISCUSSION

The spectral screening study of *Abrus precatorius* Linn leafs aqueous extract was carried out by FT-IR spectroscopy method. This extract reported 27 characteristic band values with various probable functional groups of bioactive chemical compounds (Fig-1).

FT-IR spectral data interpretation of aqueous extract

The leafs aqueous extract exhibited characteristic absorption band at 3427.51 cm⁻¹ related due to stretching vibrations of alcoholic O-H and phenolic ArO-H groups. The bands at 3375.43 cm⁻¹, 3304.06 cm⁻¹, 3192.19 cm⁻¹ and 3178.69 cm⁻¹ due to stretching vibration

carboxylic acids RCO-OH, C=C-CO-OH dimer of OH, phenolic ArO-H bond [13], alkynes C-H. The bands at 3128.54 cm^{-1} and 3053.32 cm^{-1} would be related to alkenes =C-H and carboxylic acids RCO-OH, C=C-CO-OH dimer of OH and aromatic Ar-H stretching vibrations. The band 2920.23 cm^{-1} and 2852.72 cm^{-1} due to stretching vibration in alkanes C-H of -CH₃, alkanes -CH₂- group and carboxylic acids RCO-OH, C=C-CO-OH dimer of OH; at 2673.34 cm^{-1} due to (O=)PO-H phosphonic acid. The band at 2316.51 cm^{-1} would be due to P-H of phosphine and Si-H of silane. The 1998.99 cm^{-1} band due to N=C in R-N=C=S stretching vibration. The bands 1587.42 cm^{-1} would be due to stretching vibrations in carboxylic acids R-CO-O-, nitroso N=O and aromatic ring Ar-C-C; at 1516.05 cm^{-1} due to aromatic nitro N-O compounds, N=O nitroso and N-O nitro asymmetrical stretching. The band 1379.10 cm^{-1} due to alkanes -CH₂- and -CH₃ groups, aliphatic nitro compounds N-O and S=O sulphate ester stretching.

The band at 1323.17 cm^{-1} due to alkyl halide C-F, amines Ar-N, S=O sulfone and nitro compound N-O symmetrical stretching. The bands at 1246.02 cm^{-1} , 1213.23 cm^{-1} , 1184.29 cm^{-1} , 1120.64 cm^{-1} , 1074.35 cm^{-1} , 1041.56 cm^{-1} and 1014.56 cm^{-1} could be due to alkyl halides C-F stretching, amines Ar-N stretching, S=O sulfone, amine oxide N-O aromatic, nitro compounds N-O symmetrical stretching, carboxylic acids -C-O- stretching, esters -C-O- stretching, alkyl halides C-H wagging, P=O phosphonate and phosphoramidate, P-H phosphine bending, ethers C-O, C=S thiocarbonyl and Si-OR stretching respectively. The band 964.41 cm^{-1} due to P-H phosphine bending, P-O-R esters and N-O amine oxides; at 862.18 cm^{-1} and 840.96 cm^{-1} would be related to aromatic 1,3,5 trisubstituted C-H out of plane, aromatic 1,2,4,5 tetrasubstituted C-H out of plane, S-OR esters, alkenes =C-H out of plane, alkyl halides C-Cl and aromatic para disubstituted stretching; whereas band at 663.51 cm^{-1} due to alkynes C-H bending and alkyl halides R-Br stretching [14].

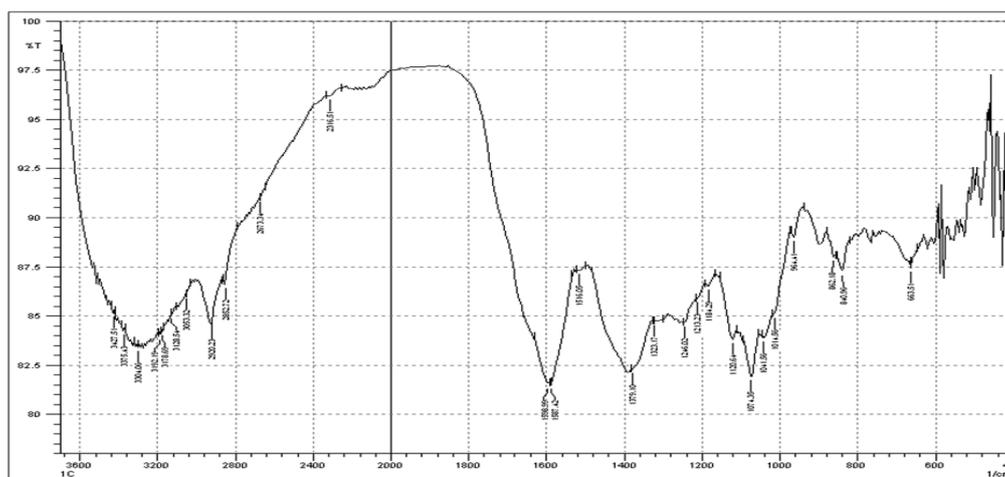


Fig.1: FT-IR spectrum of *Abrus precatorius* Linn leaf aqueous extract

The FT-IR spectrum interpretation data were confirmed the functional constituent's presence in the leaf aqueous extract. The different functional groups observed in the leaf extract probably indicate the presence of various bioactive compounds [15] such as alcohols, phenols, carboxylic acids, amide, aldehydes, ketones, alkanes, alkenes, primary amines, aromatics, alkyl halides, esters, ethers, aliphatic amines, aromatic amines, peptides, nitro compounds, sulphone, phosphonate, phosphoramidate, phosphonic acid, phosphine, silane, amine oxides, aromatic substituted compounds, nitroso, sulphate ester and alkyl halides compounds, which showed major characteristic bands of chemical compounds [16].

The result of this screening study coincided with the previously observed observations by various medicinal plant biologist and taxonomist [17-18]. The some of the researchers applied the FT-IR spectrum as a tool mostly for distinguishing closely associated medicinal plants and other organisms [19-26].

CONCLUSION

The result of the screening study presently generated the profile of FT-IR spectrum for novel bioactive chemical compounds marker tool to identify the medicinally important *Abrus precatorius* Linn plant, identify adulterate in the medicinal materials and even evaluate its qualities of medicinal materials. Advanced spectroscopic studies are required further for the structural elucidation and identification of active chemical compounds reported in the leaf aqueous extract.

REFERENCES

1. Ncube NS, Afolayan AJ, Okoh AI. Assessment techniques of antimicrobial properties of natural compounds of plant origin: Current methods and future trends. *African J Biotech* 2008; 7(12): 1797-06.
2. Savithramma N, Venkateswarlu P, Suhurulatha D, Basha SKM, Vekatramanadevi CH. Studies of *Boswellia ovalifoliolata* Bal. and

Herny-An endemic and endangered medicinal plant. *The Biocann* 2010; 5(3): 359-62.

3. Gaurav K, Karthik L, Bhaskara Rao KV. Phytochemical composition and in vitro antimicrobial activity of *Bauhinia racemosa* Lamk (Caesalpinaceae). *Int J Pharm Sci Res* 2010; 1(11): 51-8.
4. Larbie C, Nyarkoh CO, Adjei CO. Phytochemical and Safety Evaluation of Hydroethanolic Leaf Extract of *Tecoma stans* (L.) Juss. ex Kunth. *Evidence-Based Com Alt Med* 2019; 1-12.
5. Rajiv P, Deepa A, Vanathi P, Vidhya D. Screening for Phytochemicals and FTIR Analysis of *Myristica Dactyloids* Fruit Extracts. *Int J Pharm Pharm Sci* 2017; 9(1): 315-18.
6. Marandi RR, Britto SJ, Soreng PK. FT-IR, HPLC, GC-MS and wis of *Peucedanum dhana* buch.-Ham. Ex CB Clarke (*Bhojraj*): A rare and endangered medicinal plant of Chotanagpur, Jharkhand. *Int J Res Pharm Pharm Sci* 2018; 3(1): 119-26.
7. Kumari A, Kumar J. Phyto-chemical screening of Root Extracts of *Glycyrrhiza glabra* by Spectroscopic Methods (UV-VIS Spectrophotometer, FTIR & HPLC). *Int J Pharm Sci Drug Res* 2019; 11(6): 376-81.
8. Muruganantham S, Anbalagan G, Ramamurthy N. FT-IR and SEM-EDS comparative analysis of medicinal plants, *Eclipta alba* Hassk and *Eclipta prostrata* Linn. *Romanian J Biophysics* 2009; 19(4): 285-94.
9. Ragavendran P, Sophia D, Arul Raj C, Gopalakrishnan VK. Functional group analysis of various extracts of *Aerva lanata* (L.) by FT-IR spectrum. *Pharmacologyonline* 2011; 1: 358-64.
10. Pednekar PA, Raman B. Antimicrobial and antioxidant potential with FT-IR analysis of *Ampelocissus latifolia* (roxb.) planch leaves. *Asian J Pharm Clin Res* 2013; 6(1): 157-62.
11. Ashokkumar R, Ramaswamy M. Phytochemical screening by FTIR spectroscopic analysis of leaf extracts of selected Indian Medicinal plants. *Int J Curr Microbiol App Sci* 2014; 3(1): 395-06.
12. Sangeetha R, Pratheeba T, Ragavendran C, Natarajan D. Pouteria campechiana leaf extract and its bioactive compound myricitrin

- are mosquitocidal against *Aedes aegypti* and *Culex quinquefasciatus*. Asian Pac J Trop Med 2019; 12(7): 321-28.
13. Visveshwari M, Subbaiyan B, Thangapandian V. Phytochemical Analysis, Antibacterial Activity, FTIR and GCMS Analysis of *Ceropegia juncea* Roxb. Int J Pharmacog Phytochem Res 2017; 9(7): 914-20.
 14. Gawade B, Farooqui M. Screening of FT-IR Profile for Phytoconstituents in Hydroalcoholic Extract of *Abrus precatorius* Linn. Plant Leaf. Ecology and Fisheries 2020; 13(1): 109-12.
 15. Gawade B, Farooqui M. α -Amylase Inhibitory Activity of *Abrus precatorius* Linn. Leaves Ethanol Extract. Int J ChemTech Res 2018; 11(5): 488-94.
 16. Lu H, Cheng C, Tang X, Hu Z. Spectrum of *Hypericum* and *Triadenum* with reference to their identification. Acta Botanica Sinica 2004; 46(4): 401-6.
 17. Vanitha A, Kalimuthu K, Chinnadurai V, Jerun Nisha KM. Phytochemical screening, FTIR and GCMS analysis of aqueous extract of *Caralluma bicolor* - An endangered plant. Asian J Pharm Pharmacol 2019; 5(6): 1122-30.
 18. Alara OR, Abdurahman NH, Ukaegbu CI, Kabbashi NA. Extraction and characterization of bioactive compounds in *Vernonia amygdalina* leaf ethanolic extract comparing Soxhlet and microwave-assisted extraction techniques. J Taibah Uni Sci 2019; 13(1): 414-22.
 19. Ellis DI, Broadhurst D, Kell DB, Rowland JJ, Goodacre R. Rapid and quantitative detection of the microbial spoilage of meat by Fourier transform infrared spectroscopy and machine learning. App Env Micro 2002; 68(6): 2822-28.
 20. Kim SW, Ban SH, Chung H, Cho S, Chung HJ, Choi PS, Yoo OJ, Liu JR. Taxonomic discrimination of flowering plants by multivariate analysis of Fourier transform infrared spectroscopy data. Plant Cell Reports 2004; 23(4): 246-50.
 21. Lamprell H, Mazerolles G, Kodjo A, Chamba JF, Noel Y, Beuvier E. Discrimination of *Staphylococcus aureus* strains from different species of *Staphylococcus* using Fourier transform infrared (FTIR) spectroscopy. Int J Food Micro 2006; 108(1): 125-29.
 22. Rebuffo CA, Schmitt J, Wenning M, Von Stetten F, Scherer S. Reliable and rapid identification of *Listeria monocytogenes* and *Listeria* species by artificial neural network-based Fourier transform infrared spectroscopy. Appl Env Micro 2006; 72(2): 994-1000.
 23. Sahoo S, Chakraborti CK, Mishra SC, Nanda UN, Naik S. FT-IR and XRD Investigations of some Fluoroquinolones. Int J Pharm Pharm Sci 2011; 3(3): 165-70.
 24. Arockia sahayaraj P, Gowri J, Dharmalingam V, Shobana R, Angelin Prema A. Phytochemical screening by FT-IR spectroscopic analysis of leaf and stem Extracts of *Wedelia biflora*. Int J Nano Corr Sci Engg 2015; 2(5): 322-34.
 25. Gawade B, Jirekar DB, Ghumare PP, Farooqui M. FT-IR Screening of Phytochemicals in Leaf Aqueous Extract of *Abrus precatorius* Linn. Plant. Res Journey 2019; 168(A): 108-10.
 26. Kalaichelvi K, Dhivya SM. Screening of phytoconstituents, UV-VIS Spectrum and FT-IR analysis of *Micrococca mercurialis* (L.) Benth. Int J Herb Med 2017; 5(6):40-4.