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UV-Visible and FTIR Spectroscopic studies of fine powders of *Azadirachta indica* leaves

Dr. Sutheertha. S. Nair

Asst.Professor, Deparment of Physics, H.H.M.S.P.B.N.S.S.College for women, Neeramankara, Thiruvananthapuram

ABSTRACT

The present paper discusses about the UV-visible absorption and FTIR spectroscopic analysis of the fine powders of *Azadirachta indica leaves (neem). F*rom the UV –Visible spectroscopic analysis the band gap of the fine structured powder were determined. Various vibrational modes present in fine powdered *Azadirachta indica leaves* were also determined using FTIR analysis. Different vibrational modes of the fine powders were compared with the corresponding vibrational modes present in leaf extracts of *Azadirachta indica.*

Key words : UV –Visible spectroscopic analysis, FTIR studies

1.INTRODUCTION

In human society from time immemorial medicinal plants have played an important role in prevention and control of diseases. *Azadirachta indica (neem)* is a fast growing, evergreen tree found commonly in India, Africa and America. Each and every part of the tree has been used as traditional medicine for house-hold remedy against various human ailments from antiquity [1]. Leaves of *Azadirachta indica* plant has many medicinal values such as antibacterial, antioxidant and anticancer and so on.

It is a highly esteemed tree with several beneficial properties and applications, especially known for its incredible therapeutic and ethnomedicinal values for mankind. It has been used in different medicinal systems: Ayurveda, unani, homeopathic medicine, therefore considered as cynosure of modern medicine. Medicinal properties of Neem and Neem extracts, covering a wide range of indications and ailments.

Neem has found to contain a vast array of biologically active compounds, which are chemically diverse and have got an enormous therapeutic potential. Not only this, many reviews have already appeared from time to time on its constituents in general. A huge number of compounds have been isolated from different parts of Neem and several reviews have also been published on the

chemistry and structural diversity of these compounds.[2,,4-9]. The compounds have been divided into two major classes: isoprenoids and others [9]. The isoprenoids include diterpenoids and triterpenoids containing protomeliacins, limonoids, azadirone and its derivatives, gedunin and its derivatives, vilasinin type of compounds and Csecomeliacins such as nimbin, salanin and azadirachtin. The nonisoprenoids include proteins (amino acids) and carbohydrates (polysaccharides),sulphurous compounds, polyphenolics such as flavonoids and their glycosides,dihydrochalcone, coumarin and tannins, aliphatic compounds, etc. The details of the chemistry of various compounds falling under these groups have already been reviewed [8-9]. The present study is an analysis of different vibrational modes of the fine powder present in leaf extracts of *Azadirachta indica.*

2.EXPERIMENTAL

Green leaves of A*zadirachta indica* were collected and cleaned with distilled water. The leaves were dried in the sun . Dried samples were then made in to fine powder. 20gm of the prepared sample were taken for the UV-visible absorption and FTIR analysis.

3. RESULTS AND DISCUSSION

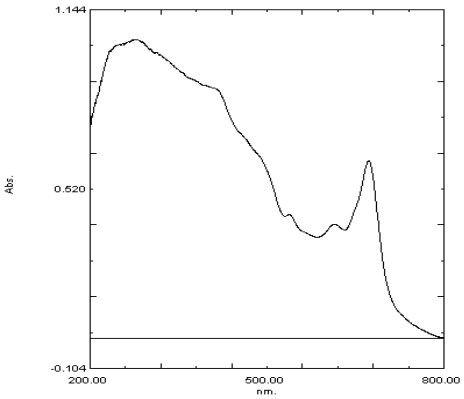

Fig. 1 The UV-Visible spectrum of fine powders of *Azadirachta indica leaves*

Figure 1 shows a strong absorption peak near 700 nm. Moreover the absorption bands are broader at shorter wavelength region. The spectral data recorded showed the strong cut off at 800nm, where the absorbance value is minimum.

When a beam of light propagates through a sample which has the ability to interact with the electromagnetic radiation, part of the radiation is absorbed by the sample and rest of it is transmitted through the sample. In UV-Visible spectroscopy, light is used to populate the unoccupied electronic states of the sample and the transitions between the valence and conduction bands. The basic principle for this type of spectroscopy is to irradiate the sample with a continum spectrum of light with intensity in the ultraviolet and visible region. When fine particles absorbs energy an electron is promoted

from the Highest Occupied Molecular Orbital (HOMO) to Lowest Unoccupied Molecular Orbital (LUMO). It must be noted that occupied molecular orbital with the lowest energy are the σ orbitals, then at a slightly higher energy are the π orbitals orbitals and non-bonding orbitals (those with unshared pair of electrons) at still a higher energy. The highest energy orbitals belong to π * and σ * i.e. the unoccupied or as otherwise known as the anti bonding orbitals.The band gap energy of Azadirachta leaves were calculated from the UV spectrum and was found to be 1.8eV.

The FTIR spectrum of fine powders of *Azadirachta indica leaves* is shown in figure 2

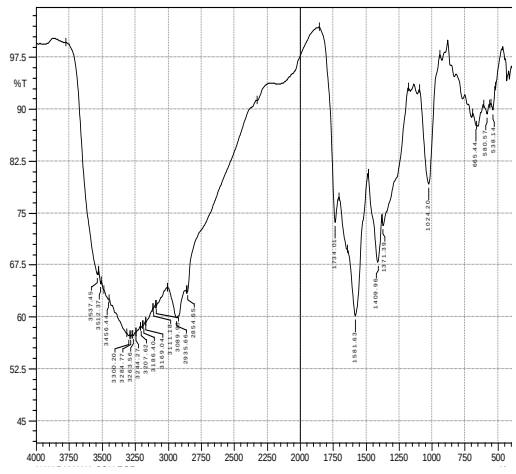

Fig.2 FTIR spectrum of fine powders of *Azadirachta indica leaves*

The activated *Azadirachta indica* leaves consist of mainly three dissimilar kinds of phenolic compounds such as 4-chlorophenol (4-CP), 4-nitrophenol (4-NP) and phenol (P). *It was reported that Azadirachta indica* extract shows bands at 1742 and 1636 cm^{-1}. The first band is characteristic of stretching vibrations of the carbonyl functional group in ketones, aldehydes and carboxylic acids. The second absorption at 1636 cm^{-1} corresponds to the amide I band. From fig 2 the band corresponding to the stretching vibrations of the carbonyl functional group in ketones, aldehydes and carboxylic acids are found to be at 1734cm^{-1} and 1636 cm^{-1} respectively.

There is an intense broad absorbance at 3284cm^{-1} which is attributed to the O–H stretching modes of vibration in hydroxyl functional group in alcohols and N–H stretching vibrations in amides and amines. The corresponding bands are found to be at 3412cm^{-1} for *Azadirachta indica* leaf extracts.

Moreover, the band at 1024cm^{-1} can be assigned to C–O stretching vibrations. This band of C-O stretching vibrations in leaf extract was reported to be at 1059 cm^{-1}. The absorption peak at 2930cm-1corresponds to C–H stretching vibration modes in the hydrocarbon chains, which was found to be at 2936 cm^{-1} for the leaf extracts of azadirachta indica. From all these vibration modes of frequency it was observed that the bands of fine powders used in the present study

were shifted to longer wavelength region or shorter energy region compared to the corresponding bands of leaf extract, This was due to fine structure of the sample used in the study. The observed phenomena can be explained on the basis of red shift which was observed in fine structured particle.

4.Conclusion

The present paper discusses about the UV-visible absorption and FTIR spectroscopic analysis of the fine powders of *Azadirachta indica leaves*. From the UV –Visible spectroscopic analysis the band gap of the fine structured powder were determined. Various vibrational modes present in fine powdered *Azadirachta indica leaves* (neem leaves) were determined using FTIR analysis. Different vibrational modes were compared with the corresponding vibrational modes present in leaf extracts of *Azadirachta indica*

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