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# DETERMINATION OF BIOACTIVE COMPOUNDS IN SAUROPUS ANDROGYNOUS (L.) MERR., THROUGH IR IRRADIATION

**S. SANTHOSH KUMAR[1*], D. BADHMAPRIYA[2], AND S. KALAIMATHI[1]**

[1]Department of Physics, Kanchi Mamunivar Govt. Institute for Post Graduate Studies and Research Lawspet, puducherry - 605 008. U. T. of Puducherry, INDIA.
[2]Department of Chemistry, Bharathiar University, Coimbatore – 641046, Tamilnadu, INDIA.
[*]santhosh.physics@gmail.com

## ABSTRACT

Plants are reported to possess a lot of beneficial effects in traditional systems of medicine. One of the commonly used multivitamin *plant Sauropus androgynous* is a potential medicinal plant belongs to the family Euphorbiaceae. The bioactive compounds Amine Salt, Carbondioxide, Alkene, Sulfone, Alkyl aryl ether and Amines are found to be present in the leaves of *Sauropus androgynous* through IR irradiation. The present study is also compared with previously reported studies from India and Indonesia. The commonly available active groups are identified since the variation of presence of chemical composition according to the origin of the samples collected. The possible medicinal values of the active groups detected are discussed in the context of pharmaceutical interest.

**Keywords*:*** Sauropus Androgynous, Bioactive Compound, Multivitamin, FT-IR Analysis.

## INTRODUCTION

The whole world is slowly relying upon traditional medicines especially drugs based on plants due to the heavy side effects of chemical drugs. But it is customary that chemical form of drug is highly effective during critical conditions. Hence deriving the knowledge about chemicals in plants as a whole or parts is highly essential in designing a modern drug from natural product. In this context we have taken a commonly used multivitamin plant, *Sauropus androgynus* (L.) Merr. in this study. It is commonly known as Star gooseberry, belongs to the family Euphorbiaceae (Bermawie, 2004; Backer et al., 1981; Conqruist, 1981; Tjitrosoepomo, 1991; Heyne, 1987) which is one of the most popular herbs in South Asia and Southeast Asia. Interestingly, this herb has been used in India in cooking and is commonly called the "multivitamin" plant due to its high nutritive value and inexpensive source of dietary protein.

It can grow as hedges in the yard, or in the vegetable garden, locally named as Thavasikkeerai in Tamil. It is herbaceous with a height of 50 cm to 3.0 m (Conqruist, 1981; Tjitrosoepomo, 1991; Heyne, 1987). It is used for ornamental purposes also. Since a long time ago, it has been recognized as a facilitate breastfeeding for mothers and the leaves are consumed as a vegetable, so there is an impression in most of the people that only women who breast-feed consume Sauropus androgynus (L.) Merr. as a vegetable. Saroni et al., (2004) reported that consuming Sauropus androgynus (L.) Merr. by a breast feeding mother can increase the milk production by

50.7% higher compared to the group of mothers who were not given the leaf extract. Research studies indicated that it as a traditional medicinal plant, as facilitating breastfeeding, proved beneficial as antioxidants (Zuhra et al., 2008; Nahak and Sahu, 2010; Yahdillah, 2009). Antioxidants can neutralize free radicals, which in prevents infection and degenerative diseases. The leaves of S. androgynus, as an antioxidant, it contains vitamin C and is relatively high , ≈85.65% (9) or 92.43 to 92.18 mg / 100g (Zuhra et al., 2008) . Other compounds which act as natural antioxidants are flavonoids. It is reported by Selvi et al. (2011) that it has the highest flavonoid content (831.7 mg / 100 g). It is also a potential antimicrobial or antifungal, due to the presence of secondary metabolites such as alkaloids, flavonoids, phenols, and glycosides and also can be used as an aphrodisiac. (Andini, 2014). In general the potential use of S.androgynus in traditional communities showed that it has benefits as food (vegetables, dye cake, goat food), beverages (breast milk for babies), medication (fever and cough) and food coloring (Hayati, 2016). Kalpana and Krishnapura (2017) were evaluated the protein and micronutrient content of *S. androgynous* leaves at different stages of its maturity. Bunawan et al.(2015) in their review article stated that, this multivitamin plant is widely used in traditional medicine for wound healing, inducing lactation, relief of urinary disorders, as an antidiabetic cure, fever reduction and can also be used as coloring agent in food. Santoso and Fenita (2016) and Bidura et al. (2017) found that supplement of this leaf to chickens improved the egg quality and its chemical composition.

Tradition medicine in modern pharmaceutical form may reach the end users considerably and hence it is highly essential to identify the chemical functional group present in the leaves of this plant and so a well suitable procedure, the FTIR analysis, is carried out in this work. The results obtained are compared with available literatures and the pharmaceutical applications of the functional group identified are also addressed. The photograph of the plant is given in Fig.1. for identification.

**Fig.1. The phtograph of *Sauropus androgynus* (L.) Merr.,(for identification).**

## MATERIALS AND METHODS

Using FTIR spectroscopic method the various bioactive compounds present in *Sauropus androgynous* collected from a local vegetable garden was detected and reported in this work even though many authors from different parts of the world are doing the FTIR analysis, it is worth to do the same since the active components present in the same plant at different places differs.

The plant leaves are collected from a vegetable garden located in Puducherry, Vazhakulam (11.9416$^{o}$N, 79.8083$^{o}$E) and the sample is prepared at the Central Instrumentation facility, kanchi Mamunivar Government Institute for Post Graduate Studies and Research, Lawspet, Puducherry. The collected leaves are well washed with distilled water and shadow dried at room temperature. The dries leaves are ground with mortar and pestle. It is further ground with KBr and pelletized in KBr press. These pellets in triplets are subjected to IR irradiation. The spectrum obtained is fine, without noise, due to the purity of the sample.

**FT-IR SPECTROSCOPY**

Fourier transform infrared spectrometry is a physico-chemical analytical technique that does not resolve the concentrations of individual metabolites but provides a snapshot of the metabolic composition of a tissue at a given time (Griffiths, and de Haseth,1986). FTIR can be employed to determine the structure of unknown composition and the intensity of the absorption spectra associated with molecular composition or content of the functional group (Surewicz et al. 1993). The FTIR method measures the vibrations of bonds within chemical functional groups and generates a spectrum that can be regarded as a biochemical or metabolic "fingerprint" of the sample (McCann et al 1992). By attaining FTIR spectra from plant samples, it might possible to detect the minor changes of primary and secondary metabolites (Yang and Yen, 2002 ). At present, particularly in phytochemistry, FTIR has been exercised to identify the concrete structure of certain plant secondary metabolites (Stehfest et al., 2005). But, on pharmacognosy FTIR is still a new tool to characterize and identify the commercial components from the adulterant (Helm et al., 1991; Naumann et al., 1991). FTIR method has been successfully utilized in the characterization of bacterial, fungal and higher plant (Timmins et al., 1998). FT-IR is one of the most widely used methods to identify the chemical constituents and elucidate the compounds structures (Goodacre et al., 2000), and has been used as a requisite method to identify medicines in Pharmacopoeia of many countries (Gundidza and Gaza**,** 1993; Ariharan et al., 2015(b); Ariharan et al., 2013).

Hence FTIR analysis is being done to determine the functional group present in the sample. Functional groups are structural units within organic compounds defined by specific atom and bond arrangements. Infrared is a powerful identification tool for functional groups because of the similar absorption frequencies for those groups in different molecules. The identification of functional groups is a cornerstone of IR spectroscopy and organic chemistry.

**RESULTS AND DISCUSSION**

The absorption of copper ions by *Sauropus androgynous* collected from Indonesia was analysed using FTIR spectrum by Ginting et al. (2015) and reported that it is an effective biosorbent to remove Cu(II) ion from aqueous solution. Ariharan et al. (2015(a)) analysed its active components in comparison with a pharmaceutically prepared polybion (multivitamin capsule) by FTIR spectroscopy and have reported that the plant sample contains Alkaylhalides (558.79), Misc. Esters(1024.24), Misc. phosphonate (1237.96), Amines (1315.20), Misc.sulphone (1390.07), Amides (1614.71), Alkenes(2916.53), and Carboxylic acid (3243.53). From these analyses it is observed that Alkayl halides, Amines, and amides were the common functional groups present in both samples.

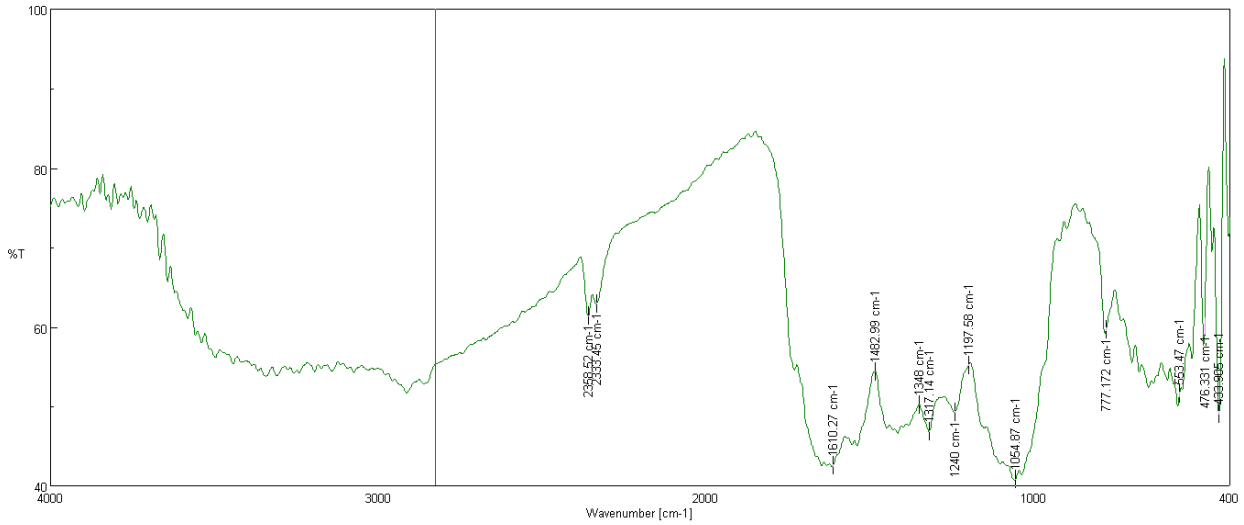


**Fig.2. The FTIR spectrum of *Sauropus androgynous* (leaf)**

The FTIR spectrum for *Sauropus androgynous* leaf as a raw powder is given in Fig.2. The various functional groups identified are compared with Ginting et al. (2015) and Ariharan et al. (2015(a)) and are presented in Table.I.

**Table. 1. The active functional groups obtained at the respective absorption frequencies of *S. androgynous* and identification of common functional groups in comparison with Ariharan et al., 2015(a) and Ginting et al., 2015.( Benzene derivatives are not discussed).**

| Sl. No. | Absorption ($cm^{-1}$) | | | Group | Compound Class |
|---|---|---|---|---|---|
| | Ariharan et al., 2015 (India) | Ginting et al., 2015 (Indonesia) | Present study | | |
| 1. | 3243.94 | 3223.05 | -- | O-H stretching | Carboxylic acid |
| 2. | 2916.53 | 2928.26 | 2920.00 | N-H stretching | Amine Salt |
| 3. | -- | -- | 2358.52 | O=C=O stretching | Carbondioxide |
| 4. | 1614.71 | 1655.00 | 1610.27 | C=C stretching | Alkene |
| 5. | 1390.07 | -- | -- | S=O stretching | Misc. Sulfone |
| 6. | 1315.20 | -- | 1317.14 | S=O stretching | Sulfone |
| 7. | 1237.96 | -- | 1240.00 | C-O stretching | Alkyl aryl ether |
| 8. | 1024.24 | -- | 1054.87 | C-N stretching | Amine |

From the Table 1, it is identified that the Indian plant *Sauropus androgynous* has more common functional groups than with Indonesian plant. Amine Salt, Alkene, Sulfone, Alkyl aryl ether and

Amine are common in Indian origin whereas Amine Salt and Alkene are available in the plant from both the countries. The compounds present in it could have adverse health effects also, such as heavy metal toxicity and induce lung injury when fresh consumption and or over-consumption of *S. androgynous* leaves. The antioxidative components of *S. androgynous* leaves have scientifically shown a vast health benefit to the human being, from test tubes to *in vivo* studies (Khoo, 2015).

**APPLICATIONS OF THE FUNCTIONAL GROUPS**

Amines are organic compounds and functional groups that contain a basic nitrogen atom with a lone pair. These are the derivatives of ammonia, where in one or more hydrogen atom have been replaced by a substituent such as an alkyl or aryl group. Amine salts are produced when an amine is neutralized by acid. Important amines include amino acids, biogenic amines and aniline. They play a very significant role in the survival of life as they are involved in creating amino acids. Amino acids are the building blocks of proteins in human beings. Many vitamins are also made from amino acids. Amines are largely used in pharmaceutical industry ( Sparkman et al. 2011). Morphine and Demerol are used as analgesics (pain killers). Novocaine is used as anesthetic and Ephedra is a very common decongestant. Tetramethyl ammonium iodide is used for disinfecting drinking water. In daily life activities amines are used for pest control and tanning of leather. They find large applications in man-made dyes. Methamphetamines and amphetamines are recreational drugs. They are basic in nature with pH value above seven. Being basic in nature they are neutralized by the action of acids. The neutralization reaction result in the formation of alkyl ammonium salts which has many industrial uses. Choline is one of these salts which plays a significant role in the production of neurotransmitters in human body to make the brain function properly. Serotonin is a primary neurotransmitter, it controls the feeling of hunger and the speed with which the brain functions generally. Amines are also used in making azo-dyes (Murugesh babu, 2013) and nylon apart from medicines and drugs.

Medical carbon dioxide ($CO_2$) has various medical purposes. It is used as a pure gas or in specialised mixtures with other gases in stimulating breathing, anaesthesia and sterilisation of equipment (Rushing, 2018). It can be used as an insufflation gas for minimal invasive surgery, such as laparoscopy, endoscopy and arthroscopy, to enlarge and stabilise body cavities for better visibility of the surgical field. In its liquid phase, medical carbon dioxide can be used to provide temperatures down to -76° C, for cryotherapy or for local analgesia. Other applications of medical carbon dioxide include transient respiratory stimulation and encouragement of deep breathing and coughing to prevent or treat atelectasis.

Alkenes are the raw materials for the manufacture of chemicals like alcohols, aldehydes etc. A number of neurotropic agents contain a conjugated alkene group incorporated in an iminostilbene or dibenzosuberene ring system (Fernandes, C. S et al., (2018). Alkenes are suitable functional groups to carry out bioorthogonal ligations because there are no naturally occurring functional groups; they have good compatibility with water and high selectivity. It was demonstrated that highly strained alkenes (electron-rich dienophile), such as transcyclooctene and norbornene, can react rapidly with tetrazines. This approach was successfully employed to functionalize thioredoxin and to label the cell surface of living cells (Testa, B. (2007). Propylene glycol which is an alkene is used as a solvent in many pharmaceuticals, including oral, injectable and topical formulations,which are insoluble in water (Torbina et al., 2019). These are also used as general

anesthesia. Ethene is a plant hormone which controls growth, seed germination and fruit development. Therefore, ethene is used for artificial ripening of fruits, flower maturation, etc.
Sulfones are widely used as solvents, polymers, and biopharmaceutical agents. The chemistry of sulfones has been explored due to their importance as synthetic intermediates for the production of a wide range of chemically and biologically active molecules. Sulfones are widely used as solvents, polymers, and biopharmaceutical agents. Researchers have also determined many therapeutic activities of sulfone containing compounds, including antibacterial, antifungal, antimalarial, cysteine protease inhibitor, anti-HIV, anti-proliferative, anti-cancer, etc. (Ahmad and Shagufta, 2015 ).

## CONCLUSION

The FTIR studies show *Sauropus androgynous* leaves contain Amine Salt, Carbondioxide, Alkene, Sulfone, Alkyl aryl ether and Amines. The medicinal values of these functional groups are discussed. Also it has an adequate amount of macronutrients and having most of the micronutrients. It is detected that *Sauropus androgynous* from India has Amine Salt, Alkene, Sulfone, Alkyl aryl ether and Amine whereas Amine Salt and Alkene are available in both Indian and Indonesian origin. This study may give an insight into the pharmaceutical industry in preparing the drug. However, extra precaution should be taken for minimizing/eliminating the adverse health effects of intake of fresh *S androgynous* leaves.

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