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PHYTOCHEMICAL AND FT-IR SPECTROSCOPIC ANALYSIS OF THE ROOT BARK OF *SARCOCEPHALUS LATIFOLIUS* (SMITH BRUCE)

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ABSTRACT

This research work was aimed at quantitative phytochemical screening and bioactive functional groups analysis of the crude extracts of the root bark of *Sarcocephalus Latifolius* (Smith Bruce) present. The phytochemical screening revealed the presence of carbohydrate, glycoside, tannin, saponins, resin, flavonoid, alkaloid, triterpenoid, anthraquinone, and terpenoid, and the absence of steroid and phlobatannins for all the extracts. The quantitative analysis gave 5.25% of alkaloid, 15.69% of flavonoid, 10.2% of saponins and 2.05 of tannin. The FT-IR analysis showed major peaks at 2854.74 cm^{-1} (alkanes), 1656.84 – 1651.12 cm^{-1} (alkenes), 1589.4 – 1450.52 cm^{-1} (aromatic ring), 3417.98 – 3394.84 cm^{-1} (phenols and alcohol), 2924.18 – 2723.58 cm^{-1} (carboxylic acid, O-H stretch), 1735.99 – 1651.12 cm^{-1} (ketone, C=O stretch), 2731.29 – 1697.41 cm^{-1} (aldehyde, C-H Stretch), 1041.6 – 1033.88 cm^{-1} (Ester, C-O Stretch), 1226.77 – 1172.76 cm^{-1} (Ethers, C-O Stretch) and 3417.98 – 3394.83 cm^{-1} (N-H bend). The presence of these prominent functional group may be responsible for the extracts bioactivity and may equally account for the varied ethno medicinal uses of the plant in folk medicine.

KEYWORDS: *Phytochemical, FT-IR, Root Bark, Sarcocephalus, Quantitative, Metabolite*

INTRODUCTION

Medicinal plants have been identified and used throughout human history and in virtually all cultures as a primary source of medicine. The use of plant seeds, barks, root, leaves, fruits or flowers for medicinal purposes have widely been reported. Medicinal plants have been used for the treatment of several human diseases over the century and have been very important in the health care delivery system of every nation at one stage or the other (Oluma *et al*, 2004).

Sarcocephalus latifolius (Smith Bruce) is of the Rubiaceae family, of genus *Sarcocephalus* and species *latifolius*. The Hausas call it *Tafashiya* or *Tuwon biri*, Igbo's call it *Ubuluinu. Sarcocephalus* is a genus of tropical evergreen trees and shrubs. It is often used by traditional healers in Sierra Leone and neighboring countries as tonic and fever medicine, chewing stick for dental health, toothaches, dental cures, septic mouth, malaria, diarrhea and in the treatment of dysentery (Etkin *et al*, 1990 and Lamidi *et al*, 1995). The leaves are used in the treatment of fever, while the roots and bark used for the treatment of venereal disease, wounds and as odontalgic remedy (Pedro Abreu and Antonio Pereira, 1998). It is a shrub or small spreading tree that is widely distributed in the Savanna and commonly found in tropical Africa. Many studies demonstrate that *S. Latifolius* has some medicinal properties (Iwueke and Nwodo 2008, Isah *et al*. 2012).

The plant kingdom represents an enormous reservoir of biological valuable molecule to be discovered. Among the numerous plant species, only a small percentage has been used for medicinal purposes and very few of the phytochemical, biological and pharmacological activities have been investigated.

Though, several reports are available on the phytochemical constituents but quantitative analysis of the phytoconstituent and FTIR profile of the extract knowledge of the root bark of *Sarcocephalus latifolious* is scanty. Therefore, in the present study, the root bark of *Sarcocephalus latifolious* were considered for its phytochemical constituents, quantification of some important phytochemicals that is present and FTIR profile of the extracts.

MATERIALS AND METHODS

Sample Collection and Preparation

The matured root bark of the plant was collected in March 2017 from Crusher, Zone 8, Lokoja, Lokoja Local Government Area of Kogi state, Nigeria and was identified at the herbarium of Biological sciences, Faculty of Sciences, Federal University Lokoja, Nigeria with the voucher number 0034. The root bark was air dried for two to three weeks. This was pulverized with mortar and pestle to fine particles and stored in an air tight polythene bags and stored for further analysis.

Extraction Procedure

The pulverized dried sample (250g) was extracted by maceration using petroleum ether, Chloroform, Ethyl acetate and methanol respectively.

Phytochemical Screening

Standard methods (Harbone, 1973; Trease and Evans, 1989 and Sofowora 1993) were employed in the phytochemical screening of the plant part. While the quantitative analysis of the percentage composition of alkaloid, flavonoid, saponins and tannins were also carried out using the method (AOAC, 1984 and AOAC, 1980).

Fourier Transform Infra-Red Spectroscopy (FT-IR) Analysis:

Various extracts of the root bark of the plant was subjected to FT-IR spectroscopic analysis to determine the functional groups present in them.

RESULTS AND DISCUSSION

Percentage Extract

Methanol was found to extract more of the constituents (3.999%) followed by petroleum ether (0.636%), Chloroform (0.633%) and Ethyl acetate (0.61%). as shown in Table 1.

Table 1: Amounts of Extracts from 250g Powdered Root Bark of *Sarcocephalus Latifolius*

Solvent medium	Weight of extracts (g)	Percentage extract (%)
Petroleum ether	1.589	0.636
Chloroform	1.583	0.633
Ethyl acetate	1.53	0.61
Methanol	9.997	3.999

Phytochemical Screening

The root bark of *Sarcocephalus latifolius* showed the presence of carbohydrates, anthraquinones, cardiac glycoside, saponins, triterpenes, flavonoids, tannins, terpenoid, resin and alkaloids for all the extracts. Phlobatannins and steroid were absent in all the extracts while glycoside was present in petroleum ether, chloroform and methanol extracts but absent in the ethyl acetate extract as shown in Table 2.

Table 2: Preliminary Phytochemical Screening of the Root Bark of Sarcocephalus *latifolius*

Property tested	Petroleum ether extract	Chloroform extract	Ethyl acetate extract	Methanol extract
Carbohydrate	+	+	+	+
Glycoside	+	+	_	+
Anthraquinones	+	+	+	+
Cardiac glycoside	+	+	+	+
Saponins	+	+	+	+
Steroid	_	_	_	_
Triterpenes	+	+	+	+
Flavonoids	+	+	+	+
Tannins	+	+	+	+
Alkaloids	+	+	+	+
Phlobatannins	_	_	_	_
Resin	+	+	+	+
Terpenoid	+	+	+	+

KEY: + = Present – =Absent

Quantitative Analysis

The quantitative analysis of the root bark of *Sarcocephalus latifolius* indicate that it contain 5.28% of alkaloid, 10.2% of saponins, 2.05% for tannin and 15.69% for flavonoid as shown in Table 3.

Table 3: Quantitative analysis of the Root Bark of *Sarcocephalus latifolius.*

Plant metabolites	Quantity (g)	Percentage (%) quantity
Alkaloid	0.0528	5.28
Flavonoid	0.1569	15.69
Saponins	0.102	10.2
Tannin	0.0205	2.05

From the results presented in the table above, the plant showed the presence of vital phytochemical compounds that are of medicinal value. Investigations of mode of action according to Enzo (2007) indicated that tannins and flavonoids increase colonic water and electrolyte reabsorption while other phytochemicals act by inhibiting intestinal mobility. This explains the anti-diarrheal use of *S. latifolius* root bark in traditional medicine (Enzo, 2007). In addition, tannin has astringent properties, hastens the healing of wounds and inflamed mucous membrane and had being used for healing of wounds, varicose ulcers, hemorrhoids, frost-bite and burns (Igboko, 1983 and Maiduyi, 1983). The biological functions of flavonoids include protection against allergies, inflammation, platelets aggregation, microbes, ulcer and tumor (Okwu and Okwu 2004). Alkaloids are the most efficient therapeutically significant plant substance (Njoku and Akumefula, 2007). Pure isolated alkaloids and the synthetic derivatives are used as the basic medicinal agent because of their analgesic, anti-plasmodic and bacterial properties where they showed marked physiological effects when administered to animals (Njoku and Akumefula, 2007). This may justify the use of *Sarcocephalus latifolius* root bark extract in the treatment of pain, malaria, and enteric fever in folk medicine. Anthraquinones have wide application as immunosuppressive, immuno stimulant, anti-ulcer, antioxidant (Sun *et al*, 2000). Saponins has been shown to affect sex hormones like oxytocin which is implicated in the onset of labour in women and subsequent release of milk (Okwu and Okwu 2004). Cardiac glycosides have anti-inflammatory activity (Shah *et al*, 2011), protect against lethal endotoxemia and are used in cardiac treatment of congestive heart failure (Matsumori *et al*, 1997). From the quantitative phytochemical screening conducted, the plant have shown to be rich in flavonoid as it contains 15.69 %. Tannin is the least abundance among the tested phytochemicals accounting for only 2.05 % of the plant.

Fourier Transform Infrared Spectroscopy (FT-IR) Analysis

The functional groups were analysis of the extracts using FT-IR showed the wavelengths ranged from 510cm^{-1} to 3500cm^{-1}.The peak 2354.74cm^{-1} and 1450.52cm^{-1} could be due to the presence of alkane and secondary amine respectively in all the extract. The band 1658.84cm^{-1} is due to alkene in the petroleum ether and chloroform extract and the band 1651.12cm^{-1} in the methanol extract. This functional group is absent in the ethyl acetate extract. The peak at 1450.52cm^{-1} shows the presence of aromatic ring in the petroleum ether, chloroform and ethyl acetate extract and 1589.4cm^{-1} for the methanol extract. The peak observed at 2924.18cm^{-1} represents carboxylic acid present in the petroleum ether, chloroform and methanol extract and that of 2723.58cm^{-1}standsfor the ethyl acetate extract. The band 1735.99cm^{-1} is attributed to ketone compounds and this is present in the petroleum ether, chloroform and ethyl acetate extract and 1651.12cm^{-1} for the methanol extract. The petroleum ether, chloroform and ethyl acetate extract show the presence of ether at 1172.76cm^{-1} while that of the methanol extract is at 1226.77cm^{-1}. The peak 2114.05cm^{-1} is due to alkyne group present in the methanol extract, the primary amine is observed at 3356.25cm^{-1} for the petroleum ether extract, 3417.98cm^{-1} for chloroform and methanol extract and 3394.83cm^{-1} for the ethyl acetate extract. Nitro group is observed for only the chloroform and methanol extract at 1589.4cm^{-1} and 1512.24cm^{-1} respectively. The band due to aldehyde is observed at 2731.29cm^{-1} for the petroleum ether and chloroform extract, 2723.58cm^{-1} for ethyl acetate extract and 1697.41cm^{-1} for methanol extract. The spectra observed for petroleum ether and chloroform extract at 1033.88cm^{-1}, ethyl acetate extract at 1041.6cm^{-1} and methanol extract at 1026.16cm^{-1} is due to the presence of ester. Phenol is indicated at 3356.25cm^{-1} for petroleum ether and methanol extract, at 3417.98cm^{-1} for chloroform extract and at 3394.84cm^{-1} for ethyl acetate extract. The band 3356.25cm^{-1}, 3356.26cm^{-1}, 3394.83cm^{-1} and

3417.98cm^{-1} for all the extracts respectively, is due to amide. The spectra are as shown in figures respectively and the summary in Table 4.

Table 4: FTIR profile of the root bark extracts of Sarcocephalus latifolius (Smith Bruce)

Functional group	**Absorption Cm^{-1}**				**Type of vibration**
	Pet. ether extract	Chloroform Extract	Ethyl acetate Extract	Methanol Extract	
Alkanes	2854.74	2854.74	2854.74	2854.74	H-C-H asymmetric and symmetric stretch
Alkenes	1658.84	1658.84		1651.12	C-C=C asymmetric stretch
Aromatic ring	1450.52	1450.52	1450.52	1589.4	C-C=C symmetric stretch
Phenols and Alcohols	3356.25	3417.98	3394.84	3356.25	O-H Stretch
Carboxylic acid	2924.18	2924.18	2723.58	2924.18	O-H Stretch
Ketones	1735.99	1735.99	1735.99	1651.12	C=O stretch
Aldehyde	2731.29	2731.29	2723.58	1697.41	C-H Stretch off C=O
Esters	1033.88	1033.88	1041.6	1026.16	C-O Stretch
Ethers	1172.76	1172.76	1172.76	1226.77	C-O Stretch
Primary amines	3356.25	3417.98	3394.83	3417.98	N-H Stretch
Secondary amines	1450.52	1450.52	1450.52	1450.52	N-H Stretch
Amides	3356.25	3356.26	3394.83	3417.98	N-H Stretch
Alkyne				2114.05	C=C Stretch
Nitro group		1589.4		1512.24	N=O Stretch

The FT-IR results confirmed the presence of phenols, alkanes, aldehydes, ketones, amines, amides, alkenes, carboxylic acids, alcohols, alkynes, ethers, nitro group and esters in various root bark extracts of *Sarcocephalus latifolius*. Aromatic amines are used in rubber, textile and dye industries. Many amine-rich proteins are bound to DNA and some neurotransmitters are amines including epinephrine, dopamine. Alkynes have been isolated from a wide variety of plant species, fungi, corals, bacteria and marine sponges. Some pharmaceuticals are also alkynes such as the contraceptive norethynodrel. Some acids like tartaric acid contain alkynes. Alkynes are highly bioactive nematocides. They possess antifungal, antitumor and antiviral properties (Walker *et al*, 1992). Phenols are of great importance as they protect the human body from the oxidative stress, which cause many diseases including cancer, cardiovascular problems and ageing (Robards et al, 1990). They are of great importance as cellular support material as they form the integral part of the cell wall structure. They exhibit antimicrobial, anthelmintic, anti-apoptotic and antidiarrheal activities (Cowan, 1999). They have been found to be useful in the preparation of some antimicrobial compounds such as Dettol and cresol. The alkanes are found in the plant cuticle and epicuticular wax of many species. They protect the plant against water loss, prevent the leaching of important minerals by rain and protect against microorganisms and harmful insects (Baker *et al*, 1982).

Amines and amides are the main groups of protein synthesis. Carboxylic acids are biologically very important in the formation of fat in the body and act as strong antibacterial agents. They serve as main pharmaceutical products in curing ulcers, jaundice, headache, fever, pain in liver, wound in cattle, treatment of edema and rheumatic joint pains. Aldehydes are used in the production of resins when combined with phenols (Reuss *et al*, 2005).

CONCLUSION

From this research work it could be observed that the plant contain some vital phytochemicals that are of great pharmacological importance. Hence the use of this plant in folk medicine.

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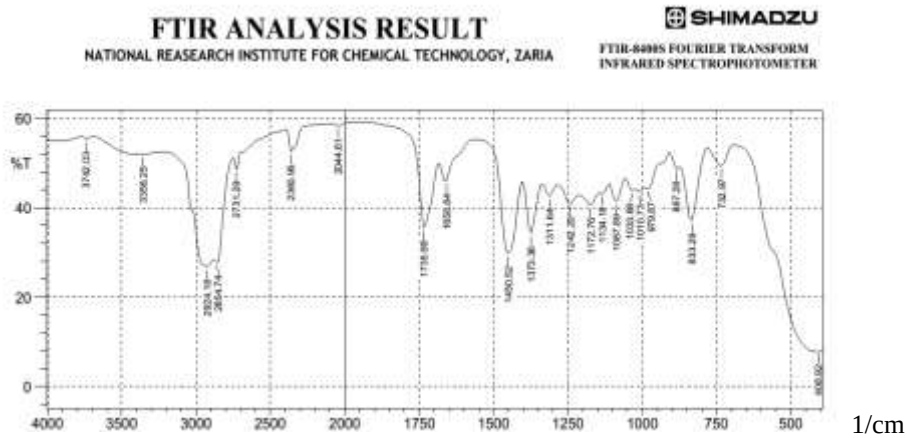

Fig. 1: FTIR Spectrum of Petroleum ether extract

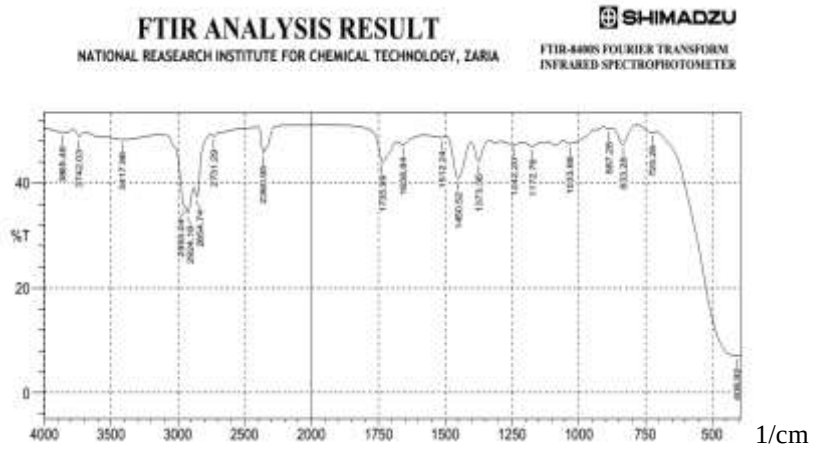

Fig. 2: FTIR Spectrum of Chloroform extract

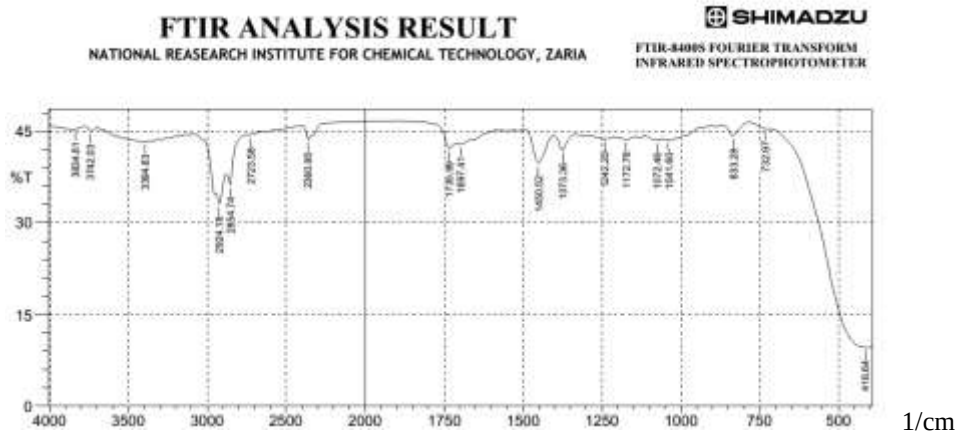

Fig. 3: FTIR Spectrum of Ethyl acetate extract

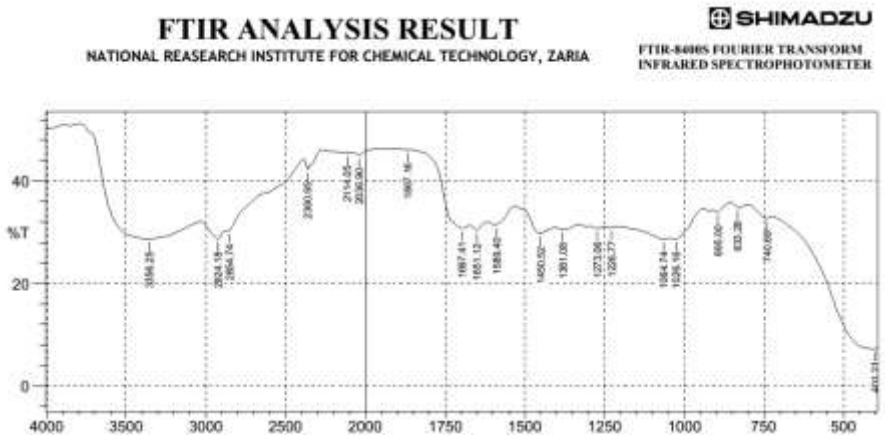

Fig. 4: FTIR Spectrum of Methanol extract

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