Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
https://www.phytojournal.com
JPP 2023; 12(1): 200-204
Received: 06-10-2022
Accepted: 16-11-2022

Egunjobi TO
Department of Medical Microbiology, School of Basic Clinical Sciences, College of Health Sciences, Igbinedion University Okada, Edo State, Nigeria

Ugbomoiko D
Department of Medical Laboratory Science, College of Health Sciences, Igbinedion University Okada, Edo State, Nigeria

Erameh TO
Department of Medical Laboratory Science, College of Health Sciences, Igbinedion University Okada, Edo State, Nigeria

Nwaobi AC
Department of Medical Laboratory Science, College of Health Sciences, Igbinedion University Okada, Edo State, Nigeria

Mokwenye VN
Department of Medical Laboratory Science, College of Health Sciences, Igbinedion University Okada, Edo State, Nigeria

Aghatise EK
Department of Medical Laboratory Science, College of Health Sciences, Igbinedion University Okada, Edo State, Nigeria

Osula I
Department of Medical Laboratory Science, College of Health Sciences, Igbinedion University Okada, Edo State, Nigeria

Corresponding Author:
Egunjobi TO
Department of Medical Microbiology, School of Basic Clinical Sciences, College of Health Sciences, Igbinedion University Okada, Edo State, Nigeria

Phytochemical evaluation, total flavonoid assay, and antioxidant activity of *Sansevieria zeylanica* growing in Nigeria

Egunjobi TO, Ugbomoiko D, Erameh TO, Nwaobi AC, Mokwenye VN, Aghatise EK and Osula I

DOI: https://doi.org/10.22271/phyto.2023.v12.i1c.14575

Abstract
Plants naturally synthesize various phytochemical compounds that are useful in the treatment of many human diseases. This study aimed to ascertain the phytochemical compounds, total flavonoid assay, and antioxidant properties of *Sansevieria zeylanica* growing in Nigeria. The Soxhlet extractor apparatus and methanol were used to carry out the extraction process. Using standard techniques, the assessments of the phytochemical, total flavonoid concentration and antioxidant activity were carried out. The extracts of *S. zeylanica* contained biologically active substances such as glycosides, betacyanins, phenols, steroids, proteins, alkaloids, and flavonoids, according to the phytochemical study. Despite the leaf extract's 2.11 mg(GAE)/g total phenolic concentration, the root extract's 3.14 mg(QE)/g total flavonoid content showed better antioxidant activity. The bioactive compounds found in *S. Zeylanica* can be exploited as effective therapeutic agents in the synthesis of novel orthodox medications.

Keywords: Antioxidant, phytochemicals, *Sansevieria zeylanica*, total flavonoid content, total phenolic content

Introduction
Phytochemicals are chemicals that occur naturally in plants and are found in leaves, fruits, legumes, grains, vegetables, etc. These compounds are responsible for the odour, colour, and flavour of plants, and also form a vital part of their defence system [1]. In nature, these compounds are produced by plants as a defence against external nuisances including infectious microbes. This benefit can be extended to man and form the basis of the medicinal usage of plants [2, 3]. There are approximately 6,000 phytochemical compounds that have been isolated and characterized [4]. Aside from being used as therapeutic agents, these compounds are also used in the synthesis of drugs [5].
Alkaloids can interfere with DNA and protein synthesis resulting in cell death [6, 7]. They are used in killing cancer cells [8], and their antimicrobial property is linked to their ability to inhibit ATP-binding cassette (ABC) transporters [9]. Anthraquinones induce the release of gastrointestinal hormones and biosynthesis of histamine, serotonin, and prostaglandin PGE2. They also inhibit the absorption of water and increase peristalsis in the gut. Plants containing these compounds are used as purgative [8]. Some carotenoids can inhibit ABC transporters frequently over-expressed in tumour cells that are resistant to many drugs [10]. Isoflavones are phytoestrogens used in the prevention of certain cancers in menopausal women by inhibiting tyrosine kinases as well as their expression of antioxidant and estrogenic effects [8]. In the presence of ultraviolet radiation (UV), Furanocoumarins form crosslinks with proteins and DNA bases. Hence, they are important in the treatment of vitiligo and psoriasis, as they help to kill proliferating keratinocytes in the skin [8]. Lignins and lignans have cytotoxic and immunomodulatory effects by preventing cell division through the inhibition of microtubule formation [11]. Saponins are amphiphilic compounds that complex cholesterol presents in biomembrane leading to biomembrane leakage and cell death. Hence, their importance in traditional medicine in the treatment of infections [12]. Terpenes, due to their cytotoxic properties have antimicrobial activities against many human pathogens such as fungi, bacteria, etc. [13].
There are about 70 species of Sansevieria belonging to the subfamily of Nolinoideae in the order of Asparagales [14]. Though found mostly in Africa [15], these plants grow both in subtropical and tropical nations of the world [16]. Sansevieria species can thrive in areas with little rainfall [17] owing to the ability of the plants to store a great amount of water in their leaves. Sansevieria plants' roots and leaves are used to cure ear infections [22], diarrhea, viral hepatitis, jaundice, asthma [18-21] etc.

There is a data gap in the total flavonoid concentration and antioxidant properties of *S. zeylanica*, particularly those growing in Africa. Ascertaining the phytochemical components, total flavonoid assay, and antioxidant activity of *Sansevieria zeylanica* growing in Nigeria was the aim of this study.

Materials and Methods

Plant samples collection

After receiving approval from the institution's Research and Ethical Committee for the project, the *Sansevieria zeylanica* leaves and roots were collected from the garden next to the laboratory complex of the School of Clinical Medicine at Igbinedion University Okada (IUO) in November 2021.

Preparation of extracts

After drying, 132.23g and 54.81g of leaves and roots were ground up, and methanol was used as the extraction solvent in a Soxhlet extractor device. The extracts were kept at 4°C until they were used again.

Plant chemical analysis

Phytochemical profiling of the extracts was conducted for the following metabolites, as previously described [23, 24].

Saponins

Foam test for Saponins: A 1ml of the sample extract was combined with 5 ml of distilled water in a graduated cylinder, and the mixture was agitated for 20 minutes. When a layer of foam about 1 cm thick formed, saponin presence was established.

Phenols

Ferric chloride test for Phenols: Exactly 2ml of distilled water and 2 drops of 10% ferric chloride were added to 1ml of sample extract. Green or blue color formation suggested the presence of phenols.

Tannins

Ferric chloride test for Tannins: A 1ml of the sample extract was combined with 2ml of 5% ferric chloride. The emergence of a greenish-black or dark blue color was a sign of tannin content.

Glycosides

Sulphuric acid test for Glycosides: To 2ml of sample extract, 1ml of glacial acetic acid, 5% ferric chloride, and 2 drops of concentrated sulfuric acid was added. Glycosides can be detected by the development of a greenish-blue color.

Alkaloids

Mayer's test for Alkaloids: An equal volume of sample extract was mixed with 2ml of concentrated hydrochloric acid and 2 drops of Mayer's reagents. Alkaloids are present when a precipitate that is white or green forms.

Anthocyanins and Betacyanins

Sodium hydroxide test for Anthocyanins and Betacyanins: The sample extract and 1ml of 2N sodium hydroxide were heated at 100 ^{o}C for 5 minutes. The presence of anthocyanins and betacyanins is shown by the development of bluish-green and yellow colors, respectively.

Flavonoids

Sulfuric acid test for Flavonoids: When two drops of concentrated sulfuric acid were added to two milliliters of sample extract, the mixture became orange, indicating the presence of flavonoids.

Steroids and Phytosterols

Sulfuric acid test for Steroids and Phytosterols: A 1ml of chloroform and two drops of concentrated sulfuric acid were added to 1ml of sample extract. Steroids and phytosterols, respectively, are indicated by the development of brown and bluish-green rings.

Carbohydrates

Molisch's test for Carbohydrates: Two milliliters of the sample extract were combined with one milliliter of Molisch's reagent and a few drops of concentrated sulfuric acid. The formation of a reddish or purple ring signifies the presence of carbohydrates.

Proteins

Ninhydrin test for Proteins: A few drops of 0.2% Ninhydrin were heated for 5 minutes in 2ml of sample extract. The formation of blue color showed the presence of proteins.

Examination of water content

After weighing the fresh leaves and roots and recording the result as W_1, they were dried at 55°C until a consistent weight was attained and the new weight was recorded as W_2. Each sample was measured in triplicate. The following formula was used to determine the plant's water content:

Water content (%) = $[(W_1 – W_2) / W_1] \times 100$ [25].

Where,
W_1 = fresh weight
W_2 = dry weight

Total phenolic content

The Folin-Ciocalteu method, which uses gallic acid as the standard, was used to assess the total phenolic content [26]. A 10 ml of methanol and one milligram of gallic acid were combined to give a stock solution with a 100µg/ml concentration. From the stock solution, working solutions with different concentrations (8µg/ml, 4µg/ml, 2µg/ml, and 1µg/ml) were made. To 10 ml of distilled water, 3 ml of the Folin-Ciocalteu reagent, and an aliquot of 1 ml of each concentration of the working solution were added. The mixture was then let to sit at room temperature for 5 minutes. Each sample received 2ml of 20% (w/w) Na_2CO_3 before being left to stand at room temperature for an additional 30 minutes. Using distilled water as a blank, the absorbance at 765 nm was measured using a UV-VIS spectrophotometer (Spectrumlab 752pro). The results were given in mg of Gallic acid equivalent (GAE)/g of the dry plant material.

Total flavonoid content

Total flavonoid content was calculated using the previously described colorimetric method with aluminum chloride [27]. An estimation calibration curve was prepared using Quercetin as the reference. The total flavonoid content was calculated as mg of Quercetin equivalent (QE)/g of the dried plant.

Antioxidant activity

The 1, 1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging activity was ascertained according to Singh and others [28], and the inhibition of DPPH radical was estimated using the formula:

% Inhibition of DPPH = [($Abs_{control}$ – Abs_{sample}) / Abs_{sample}] x 100

Where:
Abs $_{control}$ = Absorbance of DPPH radical + methanol.
Abs $_{sample}$ = Absorbance of DPPH radical + standard/extract.

Result and Discussion

The therapeutic benefits of bioactive chemicals produced by plants have been reported in several studies. These substances have been utilized in the synthesis of drugs and as medicinal agents [5]. Various pharmacological effects of plant-derived chemicals, including antibacterial, antioxidant [29, 30], anti-inflammatory, anti-cancer [31], antidiabetic, and antiulcerative [32] properties, have been documented. The availability and the classes of phytochemicals found in plants vary from species to species. In this study, *Sansevieria zeylanica* was examined for its phytochemicals, total flavonoid assay, total phenolic concentration, and antioxidant activity. The fresh leaves and roots of *S. zeylanica* were collected in total weights of 1,013.11g and 306.12g, respectively, for this study. The water contents of the fresh leaves and roots were 87.2% and 82.0%, respectively (Figure 1). The yield percents of the leaf and root extracts were 14.81 and 32.64, respectively (Table 1). The high water content reported in this present for *S. zeylanica* is in accordance with a previous study on *S. trifasciata*, another Sansevieria [17]. This high water content is of great importance in the extraction of fiber from the leaves of the plant [17]. The fiber materials from Sansevieria plants have been used in the industrial production of rope [33], paper [34], and polyester composite materials as reinforcing agents in the automotive industry [35].

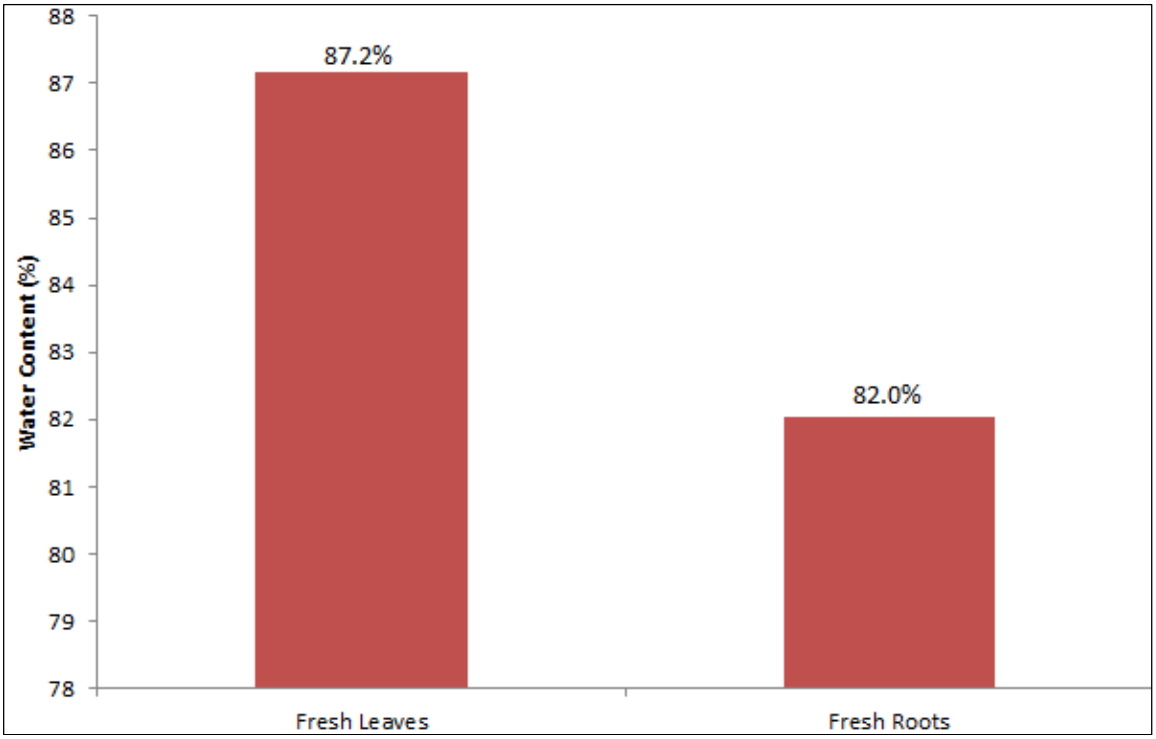

Fig 1: Water content of fresh leaves and roots of *Sansevieria zeylanica*

Table 1: Characteristics, total flavonoid and total phenolic contents of *Sansevieria zeylanica* extracts

Characteristics	Leaf Extract	Root Extract
Yield %	14.81	32.64
Physical Properties		
Colour	Dark green	Dark red
Consistency	Highly viscous (gummy)	Highly viscous (gummy)
Total Flavonoid Content [mg(QE)/g]	ND	3.14
Total Phenolic Concentration [mg(GAE)/g]	2.11	ND

ND –Not Done

The results of the phytochemical analysis showed that the leaf extract of *S. Zeylanica* contained alkaloids, glycosides, flavonoids, betacyanins, steroids, and a trace amount of proteins, while the root extract contained alkaloids, glycosides, flavonoids, betacyanins, steroids, and abundant proteins (Table 2). Plant compounds such as flavonoids, saponins, alkaloids, and tannins have been found to have a variety of antibacterial properties [36, 37]. The presence of alkaloids supports the traditional use of Sansevieria species as antidiarrhoeal agents [38]. Alkaloids' ability to combat human infections has also been documented [39]. The root extract's total flavonoid concentration was 3.14 mg (QE)/g. Flavonoids are used to treat and maintain diabetes because they have strong hypoglycemic activity [40]. These phytochemicals' antibacterial, anti-inflammatory, and antioxidant properties have been thoroughly investigated [29, 30]. Using the Folin-Ciocalteu technique, the leaf extract's total phenolic content was 2.11 mg (GAE)/g. (Table 1). Flavonoids and Phenols were absent in the leaves and root extracts, respectively (Table 2). The findings of the phytochemical analysis in this study are consistent with those of a prior investigation carried out in India [41].

Table 2: Phytochemical screening of *Sansevieria zeylanica* extracts from the leaves and roots

S/N	Phytochemical Compound	Leaf Extract	Root Extracts
1.	Steroids	+	+
2.	Tannins	-	-
3.	Saponins	-	-
4.	Alkaloids	-	+
5.	Glycosides	++	+
6.	Flavonoids	-	+
7.	Anthocyanins	-	-
8.	Betacyanins	+	++
9.	Phytosterols	-	-
10.	Phenols	+	-
11.	Carbohydrates	-	-
12.	Proteins	+	++

- = Not Present, ± = Trace, + = Positive, ++ = Strongly Positive

Antioxidants protect man and animals from diseases by fighting against free radicals. Their mode of action could either be the enhancement of the antioxidant defense systems or the scavenging of reactive oxygen species [42]. Phenolic compounds are bioactive agents found in plants. They possess hydroxyl groups that help in scavenging free radicals [43]. The leaf and root extracts of *S. zeylanica* showed significant suppression of free radicals. The root and leaf extracts, respectively, inhibited 78.2% and 62.0% of the DPPH free radicals at 80µg/ml (Table 3). The flavonoids and phenolic acids found in *S. zeylanica* may be the cause of the antioxidant activity of the extracts used in this study [44]. Additionally, the therapy of several disorders has made substantial use of formulations containing flavonoids [45]. The therapeutic use of Sansevierians is specifically justified by the presence of glycosides, alkaloids, steroids, tannins, terpenoids, and acidic chemicals in these plants [46, 47].

Table 3: Antioxidant activities of Extracts of *Sansevieria zeylanica*

Concentration (µg/ml)	% Inhibition of Free Radicals	
	LE	RE
5	52.5	54.1
10	57.6	60.8
20	58.4	62.8
40	59.9	63.9
80	62.0	78.2

LE = Leaf Extract, RE = Root Extract

According to the findings of the current study, *S. zeylanica* roots are a rich source of protein, which may work against antimicrobial drugs like aminoglycosides, macrolides, and tetracyclines that block protein synthesis. This may be the cause of the antagonistic interaction between Gentamycin and the root extract of *S. zeylanica* reported by Ugbomoiko *et al.* [48].

Conclusion

According to the study's findings, *S. zeylanica*'s leaf and root extracts include a number of phytochemical substances that can be utilized to treat and control a variety of human infections, which makes this plant not only an effective phytomedicine but also a good source of agents for orthodox drugs. In comparison to the leaf extract, the root extract demonstrated higher antioxidant activity. In addition, the roots of *S. zeylanica* can be considered a rich source of protein. Further quantitative studies are needed to verify this point.

Acknowledgment

The laboratory team at the Department of Pharmaceutical Chemistry at Igbinedion University in Okada, Edo State, Nigeria, has provided technical assistance that the authors would like to recognize.

Conflict of Interest: There is no conflict of interest.

References

1. Onyeaka EU, Nwambueke IO. Phytochemical profile of some green leafy vegetables in South East Nigeria. Niger Food J. 2007;25(1):67-76.203
2. Anderson GD. Phytochemicals, dynamic chiropractic. *Trends Food Sci Technol*. 2004;4:168-175.
3. Liu RH. Potential synergy of phytochemicals in cancer prevention: Mechanism of action. J Nutr. 2004;13(4):34795-34855.203
4. Doughari J, Human I, Bennade S, Ndakidemi P. Phytochemicals as chemotherapeutic agents and antioxidants: Possible solution to the control of antibiotic resistant verocytotoxin producing bacteria. J Med Plant Res. 2010;13(11):839-848203
5. Li JW, Vederas JC. Drug discovery and natural products: End of an era or an endless frontier. *Science*. 2009;325:161-165.203
6. El-Readi MZ, Eid SY, Ashour ML, Tahrani A, Wink M. Modulation of multidrug resistance in cancer cells by *chelidonine* and *Chelidonium majus* alkaloids. Phyto Medicine. 2013;20:282–294.
7. Zhao L, Wink M. The beta-carboline alkaloid harmine inhibits telomerase activity of MCF-7 cells by down-regulating TERT mRNA expression accompanied by an accelerated senescent phenotype. Peer J. 2013;1:174.
8. Van Wyk B, Wink M. Phyto medicines, Herbal drugs and Poisons; Briza, Kew Publishing, Cambridge University Press, Cambridge, UK; c2015. p. 13-120.
9. Wink M, Ashour M, El-Readi MZ. Secondary metabolites inhibiting ABC transporters and reversing resistance of cancer cells and fungi to cytotoxic and antimicrobial agents. Front. Microbiol. 2012;3:1-15.
10. Eid SY, El-Readi MZ, Wink M. Synergism of three-drug combinations of sanguinarine and other plant secondary metabolites with digitonin and doxorubicin in multi-drug resistant cancer cells. Phyto medicine. 2012;19:1288-1297.
11. Su S, Cheng X, Wink M. Natural lignans from Arctium lappa modulate P-glycoprotein efflux function in multidrug resistant cancer cells. Phyto medicine. 2015;22:301-307.
12. Efferth T, Herrmann F, Tahrani A, Wink M. Cytotoxic activity of secondary metabolites from *Artemisia annua* L. towards cancer cells in comparison to its designated active constituent artemisinin. Phyto medicine. 2011;18:959-969.
13. Duke JA. Handbook of Medicinal Herbs, 2nd ed.; CRC Press, Boca Raton, FL, USA; c2002. p. 7-24.
14. Chase MW, Christenhusz MJM, Fay MF, Byng JW, Judd WS. An update of the angiosperm phylogeny group classification for the orders and families of flowering plants, APG IV. Bot. J Linn. Soc. 2016;181:1-20.
15. Carlquist S, Schneider EL. Origins and nature of vessels in monocotyledons. Sansevieria. S Afri J Bot. 2007;73:196–203.
16. Staples GW, Herbst DR. A Tropical Garden Flora, Plants cultivated in the Hawaiian Island and other tropical

places. Bishop Museum Press, Honolulu, Hawaii; c2005. p. 204-63.
17. Widyasanti A, Napitupulu LOB, Thoriq A. Physical and mechanical properties of natural fiber from Sansevieria trifasciata and Agave sisalana. IOP Conf. Ser.: Earth Environ. Sci. 2020;462:012032. DOI: 10.1088/1755-1315/462/1/012032
18. Andhare RN, Raut MK, Naik SR. Evaluation of antiallergic and anti-anaphylactic activity of ethanolic extract of *Sanseveiria trifasciata* leaves (EEST) in rodents. J Ethnopharmacol. 2012;142:627-633.
19. Bero J, Ganfon H, Jonville MC, Frédérich M, Gbaguidi, F. In vitro antiplasmodial activity of plants used in Benin in traditional medicine to treat malaria. J Ethno-pharmacol. 2009;122:439–444.
20. Giovannini P, Howes MJR. Medicinal plants used to treat snakebite in Central America, Review and assessment of scientific evidence. J Ethnopharmacol. 2017;199:240–256.
21. Kpodar MS, Karou SD, Katawa G, Anani K, Gbekley HE, *et al.* An ethnobotanical study of plants used to treat liver diseases in the maritime region of Togo. J Ethnopharmacol. 2016;181:263-73.
22. Aliero AA, Jimoh FO, Afolayan AJ. Antioxidant and antibacterial properties of *Sansevieria hyacinthoides*. Int J Pure Appl Sci. 2008;2(3):103-10.
23. Nweze ET, Okafor JI, Njoku O. Antimicrobial Activities of Methanolic extract of Trumeguineesis (Schumm and Thorn) and *Morinda lucinda* Benth used in Nigerian Herb. Medicinal Practice. J Bio. Res. Bio technol. 2004;2(1):34-46.
24. Senthilkumar PK, Reetha D. Screening of antimicrobial properties of certain Indian medicinal plants. J Phytol. 2009;1(3):193-198.
25. Jin X, Shi C, Yu CY, Yamada T, Sacks EJ. Determination of Leaf Water Content by Visible and Near-Infrared Spectrophotometry and Multivariate Calibration in Miscanthus. Front. Plant Sci. 2017;8:721. DOI: 10.3389/fpls.2017.00721
26. Lin JY, Tang CY. Determination of total phenolic contents in selected fruits and vegetables as well as their stimulatory effect on mouse splenocyte proliferation. Food Chem. 2007;101:140-147.
27. Zhishen J, Mengcheng T, Jianming W. The determination of flavonoid contents in mulberry and their scavenging effects on superoxide radicals. Food Chem. 1999;64:555 –559.
28. Singh RP, Chidambara Murthy KN, Jayaprakash GK Studies on Antioxidant polyphenol content of aqueous extract from pomegranate peel and seed extracts using in vitro models. J Agric Food Chem. 2002;50:86-89.
29. Hodek P, Trefil P, Stiborova A. Flavonoids potent and versatile biologically active components interacting with Cytochrome P450. Chem Biol interact. 2002;139:1-21.
30. Harbone JB, Williams CA. Advances in flavonoid research since 1992. Phytochemistry. 2000;55:481-504.
31. Sofowora EA. Medicinal plants and traditional medicine in Africa (1st Ed.). John Wiley and sons, New York; c1974. p. 256.
32. Saida AA, Aboutablc EA, El Awdanb SA, Raslan MA. Proximate analysis, phytochemical screening, and bioactivities evaluation of *Cissus rotundifolia* (Forssk.) Vahl. (Fam. Vitaceae) and Sansevieria cylindrica Bojer ex Hook. (Fam. Dracaenaceae) growing in Egypt. Egypt Pharm. J. 2015;14:180–186.
33. Imani D, Lukman A, Saipul D. Fiber rope made from natural fibers of the mother-in-law's tongue (*Sansevieria trifasciata laurentii*). J Food Agric. Eng. 2015;4(4):579-585.
34. Ornamenti ZI. Manufacture of pulp from common tongue (Sansevieria) fibers using the soda process. Thesis Muhammadiyah University of Surakarta Surakarta; c2017.
35. Mardiyati S, Raden R, Ikhsan P. Mechanical properties of unidirectional Sansevieria fiber reinforced polypropylene composites. Machines. 2016;25(2):73-82.
36. Ibrahim MB, Owonubi MO, Onaolapo JA. Antibacterial Effects of Extracts of leaf, stem and root bark of *Aniogiessus leiocarpus* on *Staphylococcus aureus* NCTC 6571, *Streptococcus pyogenes* NCTC 8198, *Escherichia coli* NCTC 10418 and *Proteus vulgaris* NCTC 4636, J Pharm Res and Dev. 1997;2(1):20-6.
37. Levan M, Vanden Berghe DA, Marten I, Vilientnich A, Lomweas EC. Screening of Higher Plants for Biological activity, Planta Med. 1979;36:311-2.
38. Adeyemi OO, Akindele AJ, Ogunleye EA. Evaluation of the Antidiarrhoeal Effect of *Sansevieria liberica* Ger. and Labr. J. Ethnopharmacol. 2009;123(3):459-463.
39. Prajapati NDA Handbook of Medicinal Plants, A complete source Book-India, Agrobios Publishers; c2007. p. 115-117.
40. Ezigbo VO, Odinma SC, Duruaku IJ, Onyema CT. Preliminary Phytochemical Screening and Antibacterial Activity on Stem Bark Extracts of Ceiba Pentandra. IOSR J Appl Chem. 2013;6(1):42-44.
41. Vysakh G1, Sakthi BRL. Isolation, identification and characterization of the biologically active compound in ethyl acetate extract of Sansevieria zeylanica and evaluation of its antimicrobial effect against Klebsiella pneumonia. Int. J Adv Res. 2015;3(11):1445-1455.
42. Umamaheswari M, Chatterjee TK. In vitro antioxidant activities of the fractions of Coccinnia grandis L. leaf extract. Afr J Trad Compl Altern Med. 2008;5:61-73.
43. Kähkönen MP, Hopia AI, Vuorela HJ, Rauha JP, Pihlaja K, Kujala TS, *et al*. Antioxidant activity of plant extracts containing phenolic compounds. J Agri Food Chem. 1999;(47):3954-3962.
44. Bravo L. Polyphenols: chemistry, dietary sources, metabolism and nutritional significance. Nutr Reviews. 1998;56:317-333
45. Essiett UA, Ukpong UJ. Comparative Phytochemical, Nutrient and Anti-Nutrient of Stems of *Ipomoea involucrata* Beauv, *Ipomoea triloba* L. and *Ipomoea batatas* Lam. American J Food Nutr. 2009;2:71-6.
46. Ikewuchi CC, Ikewuchi JC, Ayalogu OE, Onyeike NE. Proximate and Phytochemical Profile of *S. liberica* Ger. and Labr. J Apply Sci. Environ Manage. 2010;14(2):103-6.
47. Ikewuchi CC, Ayalogu OE, Onyeike NE, Ikewuchi JC. Study on the Alkaloid, Allicin, Glycoside and Saponin Composition of the leaves of *S. liberica* Ger. and Labr by Gas Chromatography. The Pac J Sci. and Tech. 2011;12(1):367-73.
48. Ugbomoiko DO, Egunjobi TO, Omosigho PO, Olley M, Osaiyuwu C, Asemota PA, *et al*. Antibacterial Activity of the Leaf and Root Extracts of Sansevieria zeylanica Against Strains of Methicillin-Sensitive and -Resistant *Staphylococcus aureus.* Int. J Curr. Res. Med. Sci. 2022;8(11):1-1. DOI: http://dx.doi.org/10.22192/ijcrms.2022.08.11.001