Available online www.jsaer.com

***Journal of Scientific and Engineering Research*, 2019, 6(5):34-39**

Research Article

ISSN: 2394-2630
CODEN(USA): JSERBR

Phytochemical and Some Heavy Metals Analysis of Stembark Extract of Sacoglottis Gabonensis

Dibofori-Orji Amalo Ndu, Ali Sunday Timothy

Department of Chemistry, Faculty of Natural and Applied SciencesIgnatius Ajuru University of Education, Rumuolumei, Port Harcourt, Nigeria
Corresponding Author: email: jc_orji@yahoo.com GSM: +2348039572370

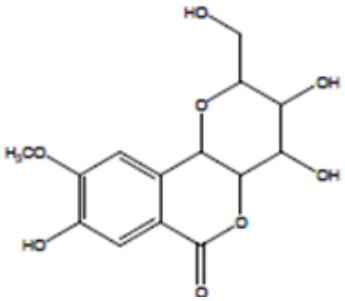
Abstract The results of the phytochemical analysis of Sacoglottis gabonensis both in water and dichloromethane extract showed the presence of steroids, saponins, glycocides, alkaloids and tannins. The concentration of heavy metals (Cr, Cd, Cu, Ni and Pb) in Sacoglottis gabonensis from Iwofe in Etche LGA of Rivers State was done through Solar Thermo Atomic Absorption Spectrophotometer model SE 71906. Results obtained showed high levels of Cadmium, Chromium and Lead with values: 0.741, 7.562 and 10.310 mg/kg respectively compared to the World Health Organization's permissible limits of: 0.003, 0.5 and 0.01 mg/kg respectively. Following the health implications of these heavy metals, their presence in Sacoglottis gabonensis does not tell well for its use as good preservative for palm wine.

Keywords higher education institution, vocabulary, motivational intent, weighting factor, importance of content

1. Introduction

Sacoglottis gabonensis is a large evergreen tree found in South America and Africa. It occurs in evergreen forest, savanna edges and on river banks. *History traces the origin of the plant seed from* South America from where it dispersed to Africa by water movement. The seeds float in water and can remain good even after four years. The wood is widely used for timber domestically and of export values. The log produces heavy, hard and durable wood which is resistant to termites and insect attacks. The stem extract is used in hipbaths in women after child delivery [1]. Lasekan *et al*, [2], identified that *Sacoglottis gabonensis* stem bark when added to palm-wine or gin prevents fever and eradicates body pains. It has also been extensively used in Africa for the preservation of palm wine in Nigeria but much attention has not been paid to the health effect of this practice.

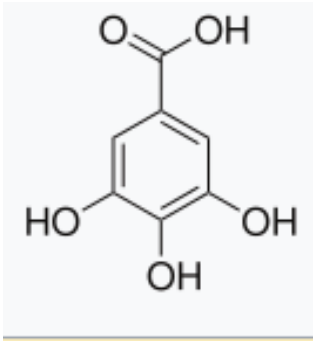
Phytochemicals is a name coined from a Greek word "phyto" (meaning plant) which stands for chemicals produced by plants through primary or secondary metabolism. These are chemicals that have biological activities in plants and play roles in plant growth or defense against competitors, predators or pathogens [3]. Even as some phytochemicals are used as poisons, many of them are of medicinal values. According to Chigozie, *et al*., [4], phytochemical analysis of the wood of *Sacoglottis gabonensis* showed the presence of sterols, glycoside, terpenoids, flavonoids, tannins, saponins and alkaloid. Research report by Guy, *et al*., [5] shows Bergenin and Gallic acid as the most active compounds in the bark extracts of *Sacoglottis gabonensis*. (C-glucoside) is found in the form of colourless crystalline compound. It is also known as cuscutin glycoside (trihydroxybenzoic acid). It is the C-glycoside of 4-O-methyl gallic acid. It possesses an O-demethylated derivative called norbergenin [6]. The structure of Bergenin is shown below:



Bergenin ($C_{14}H_{16}O_8$) has been reported having anti hepatotoxic, anti ulcerogenic, anti-HIV, antifungal, hepatoprotective, antiarrhythmic, neuroprotective, anti-inflammatory, immunomodulatory and burn wound healing properties.

A high sugar concentration was observed when palm wine was preserved with Sacoglottis gabonensis and this indicated a lower rate of yeast fermentation. This was attributed to the fact that it contains bergenin, which has been found to significantly inhibit the actions of fermentation of yeasts.

Gallic acid (3,4,5-trihydroxybenzoic acid) is a type of phenolic acid. The chemical formula of gallic acid is $C_6H_2(OH)_3COOH$. It is found both free and as part of hydrolysable tannins. The structure of gallic acid is shown below



3,4,5-trihydroxybenzoic acid ($C_6H_2(OH)_3COOH$)

The compound gallic acid was isolated from *Sacoglottis gabonensis* by using Column chromatography for the first time. Bergenin and gallic acid can be considered as antimicrobial active principles of *Sacoglottis gabonensis* [5]. Benzene was suspected in palm wine preserved with *Sacoglottis gabonensis* and this was informed as a result of the reaction between benzoic acid (from gallic acid in the bark extract of the plant) and the ascorbic acid (Vitamin C) found in palm wine [7].

The bark of *Sacoglottis gabonensis* is predomonently used in Etche LGA of Rivers State for the preservation of palm wine. The big question is "Is this practice healthy?" This is what this work seeks to confirm through analysis.

Heavy Metals

Heavy metals are generally defined as metals with relatively high densities, atomic weights, or atomic numbers. The criteria used, and whether metalloids are included, vary depending on the author and context. In Chemistry, we are likely concerned with chemical behavior [8]. The heavy metals of interest in this work are: Cadmium (Cd), Chromium (Cr), Lead (Pb), Copper (Cu) and Nickel (Ni).

Cadmium (Cd): Cadmium is a chemical element with symbol Cd and atomic number 48. It is a soft, bluish-white metal. It was discovered in 1817 by Stromeyer and Hermann, both in Germany. Cadmium was used for a long time as a corrosion-resistant plating on steel, and cadmium compounds are used as red, orange and yellow pigments, to colourglass, and to stabilize plastic [9].

Cadmium is a toxic pollutant classified as a human carcinogen (International Agency for Research on Cancer, 1993).Acute exposure to cadmium fumes may cause flu-like symptoms including chills and fever. Symptoms may resolve after a week if there is no respiratory damage.

Chromium (Cr): *Chromium* is a chemical *element* with symbol Cr and atomic number 24. It is the first *element* in group 6. Chromium was discovered by the French chemist Nicholas Louis Vauquelin at Paris in1798. The carcinogenity of chromate dust has been known for a long time, and in 1890 the first publication described the elevated cancer risk of workers in a chromate dye company. Three mechanisms have been proposed to describe the genotoxicity of chromium(VI). The first mechanism includes highly reactive hydroxyl radicals and other reactive radicals which are byproducts of the reduction of chromium(VI) to chromium(III). The second process includes the direct binding of chromium(V), produced by reduction in the cell, and chromium(IV) compounds, to the DNA. The last mechanism attributes the genotoxicity to the binding to the DNA of the end product of the chromium(III) reduction [10].

Lead (Pb): *Lead* is a chemical element with symbol Pb (from the Latin word, plumbum). It has atomic number 82. It is a heavy metal that is denser than most common materials. *Lead* is soft and malleable, and has a relatively low melting point.

Lead poisoning is a type of metal poisoning caused by lead in the body. The brain is the most sensitive. Symptoms may include abdominal pain, constipation, headaches, irritability, memory problems, inability to have children, and tingling in the hands and feet.

Copper (Cu): Copper is a chemical element with symbol **Cu** (from Latin: *cuprum*) and atomic number 29. It is a soft, malleable, and ductile metal with very high thermal and electrical conductivity. Gram quantities of various copper salts have been taken in suicide attempts and produced acute copper toxicity in humans, possibly due to redox cycling and the generation of reactive oxygen species that damage DNA. Corresponding amounts of copper salts (30 mg/kg) are toxic in animals. A minimum dietary value for healthy growth in rabbits has been reported to be at least 3 ppm in the diet. Higher concentrations of copper (100 ppm, 200 ppm, or 500 ppm) in the diet of rabbits may favorably influence feed conversion efficiency, growth rates, and carcass dressing percentages.

Chronic copper toxicity does not normally occur in humans because of transport systems that regulate absorption and excretion. Autosomal recessive mutations in copper transport proteins can disable these systems, leading to Wilson's disease with copper accumulation and cirrhosis of the liver in persons who have inherited two defective genes.

Nickel (Ni): Nickel is a chemical element with symbol **Ni** and atomic number 28. It is a silvery-white lustrous metal with a slight golden tinge. Nickel belongs to the transition metals and is hard and ductile. Nickel compounds are classified as human carcinogens based on increased respiratory cancer risks observed in epidemiological studies of sulfidic ore refinery workers. The human and animal data consistently indicate a lack of carcinogenicity via the oral route of exposure and limit the carcinogenicity of nickel compounds to respiratory tumours after inhalation. Nickel metal is classified as a suspect carcinogen; there is consistency between the absence of increased respiratory cancer risks in workers predominantly exposed to metallic nickel and the lack of respiratory tumours in a rat lifetime inhalation carcinogenicity study with nickel metal powder. In the rodent inhalation studies with various nickel compounds and nickel metal, increased lung inflammations with and without bronchial lymph node hyperplasia or fibrosis were observed. In rat studies, oral ingestion of water-soluble nickel salts can trigger prenatal mortality effects in pregnant animals. Whether these effects are relevant to humans is unclear as epidemiological studies of highly exposed female workers have not shown adverse developmental toxicity effects [11].

Materials and Methods

The stem bark of *Sacoglottis gabonensis* was collected from Etche Local Government Area of Rivers State of Nigeria and identified. It was dried and ground to fine particles .5g of the powder was boiled in 50ml of distilled water for 15-20 minutes. This was kept at room temperature overnight and filtered. The filtrate was evaporated to dryness in hot air oven and stored in refrigerator. The condensed extract was used for phytochemicals tests. For the dichloromethane extract, 50g of the powdered bark extract of *Sacoglottis gabonensis* was dissolved in 250cm^3 of dichloromethane and kept for24hrs.It was filtered and the filtrate was used for phytochemical analysis. The Phytochemical analysis method was according to Raman [12].

Test for Heavy Metals in *Sacoglottis Gabonensis*

Sacoglottis gabonensis was digested (as described below) and tested for the presence of cadmium (Cd), chromium (Cr), lead (Pb), copper (Cu) and Nickel (Ni) using Solar Thermo Atomic Absorption Spectrophotometer model SE 71906.

Acid Digestion of *Sacoglottis Gabonensis* Bark

2g of *Sacoglottis gabonensis* powder was weighed into a beaker. A mixture of 6ml of trioxonitrate (IV) Acid and 2ml of tetraoxochlorate (VII) Acid was added. The solution was stirred while 20ml of distilled water was added. This was allowed to stay for 30minutes. This was heated on the hop plate until clear solution was obtained. At this point the initial volume had reduced to one-third. It was removed and allowed to cool. It was filtered with filter paper. The filtrate was made up to 50ml with distilled water. This solution was aspirated to Atomic Absorption Spectrophotometer (AAS) for metal analysis.

Results

Table 1: Phytochemical Analysis of *Sacoglottis gabonensis*

Phytochemicals	Water Extract of Nche	Dichloroethane Extract of Nche
Steroids	+	+
Saponins	-	+
Glycosides	+	+
Alkaloids	+	+
Flavonoids	-	-
Tannins	+	+

Table 2: Mean Concentration of Heavy Metals in *Sacoglottis gabonensis* (mg/l) n=4

Sample Identity	Copper (Cu)	Cadmium (Cd)	Nickel (Ni)	Chromium (Cr)	Lead (Pb)
Sacoglottis gabonensis (Nche)	2.571	0.741	<0.001	7.562	10.310
WHO Permissible limits	2.000	0.003	0.02	0.05	0.01

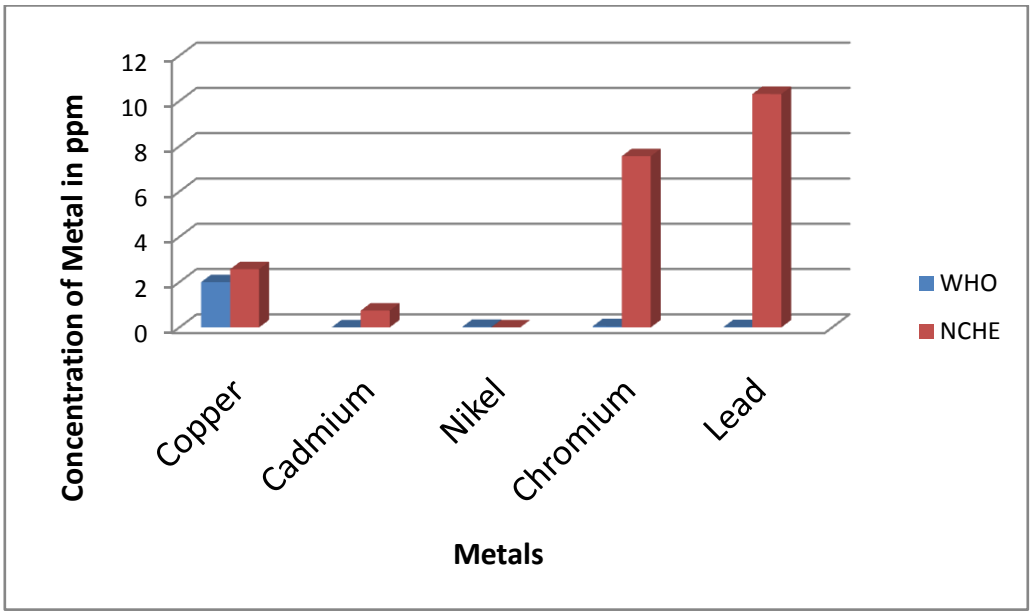


Figure 1: Heavy Metals in Sacoglottis gabonensis compared to WHO permissible Limit

Discussion

Extractionof phytochemicals from *Sacoglottis gabonensis* using water showed the presence of steroids, glycocides, alkaloids and tannins whereas using dichloromethane showed the presence of steroids, saponins, glycocides, alkaloids and tannins. This analysis confirms the presence of these phytochemicals in *Sacoglottis gabonensis* and also proves dichloromethane a better extraction solvent than water in this case. The concentration of heavy metals (Cr, Cd, Cu, Ni and Pb) in *Sacoglottis gabonensis* from Etche LGA of Rivers State was confirmed through Solar Thermo Atomic Absorption Spectrophotometer model SE 71906. Results obtained showed high levels of Cadmium, Chromium and Lead with values: 0.741, 7.562 and 10.310 respectively in ppm compared to the World Health Organization's permissible limits of: 0.003, 0.5 and 0.01 respectively [13]. Copper has a value of 2.571 which is a bit above the WHO permissible level of 2.0. Nickel with <0.001 is below the WHO level of 0.02. These extreme high levels of cadmium, chromium and lead prove the *Sacoglottis gabonensis* unhealthy for the preservation of palm wine due to the health hazards these heavy metals impose to the consumers of such palm wines.

Conclusion

Sacoglottis gabonensis from Etche LGA of Rivers State contains extremely high levels of cadmium, chromium and lead and therefore not good for the preservation of palm wine. These high levels of toxic metals might either be attributable to a point source of waste discharge or any other anthropogenic source. This would therefore require an opening for further investigation. The presence of tannins in the water extracts of *Sacoglottis gabonensis* also poses a health challenge since tannins could also react with the Vitamin C in palm wine to give benzene.

References

[1]. Burkill, H.M. (1994). The useful plants of West Tropical Africa 2nd Edition. Royal Botanic Gardens, Kew, United Kingdom. 648.

[2]. Lasekan, O., Buettner, M. & Christlbauer, M., (2009). Investigation of the Retronasal Perception of Palm Wine (Elaeis guineensis) Aroma by Application of Sensory Analysis and Exhaled Odorant Measurement (Exom). African Journal for Food and Agricultural Nutrients Development 9, 793–813.

[3]. Breslin, A. (2017). The Chemical Composition of Green Plants. Sciencing, Leaf Group ltd. London, 33-36.

[4]. Chigozie, M., Ejike, Chukwuma, S., Ezeonu & Augustine, N. E., (2014). Determination of the Physical and the Phytochemical Constituents of Some Tropical Timbers Indigenous to Niger Delta Area of Nigeria, European Scientific Journal, 10(18).

[5]. Guy R. F. T., Giresse D. N. O., Jean-bernard B. and Jacques L. (2015). Phytochemical Study of Sacoglottis gabonensis (Baill.) Urb. Isolation of Bioactive Compounds from the Stem Bark. American Chemical Science Journal, 11(4).

[6]. Nazir, N., Koul, S., Qurishi, M. A, Taneja, S. C., Ahmad, S. F., Bani, S. & Qazi, G. N., (2007) Immunomodulatory Effect of Bergenin and Norbergenin Against Adjuvant-Induced Arthritis—A Flow Cytometric Study. Journal of Ethnopharmacology. 112 (2): 401–405.

[7]. Okwu, D.E. & Nnamdi, F.U. (2008). Evaluation of the Chemical Composition of Dacryodes Edulis and Raphia Hookeri Mann and Wendl Exudates Used in Herbal Medicine in South Eastern Nigeria. African Journal of Traditional Complementary Alternative Medicine, 5 (2), 194–200.

[8]. Baldwin, D. R. and Marshall, W. J. (1999). Heavy Metal Poisoning and its Laboratory Investigation. Annals of Clinical Biochemistry, (36) 3, 267-300.

[9]. Meija, J. (2016). Atomic Weights of the Elements. Journal of Pure and Applied Chemistry. 88(3): 265–291.

[10]. López-Luna L., González-Chávez M.C., Esparza-García F.J., Rodríguez-Vázquez R. (2016). Toxicity Assessment Of Soil Amended With Tannery Sludge, Trivalent Chromium and Hexavalent Chromium, Using Wheat, Oat and Sorghum Plants. Journal of Hazardous Materials.163(2–3) 829-834.

[11]. Kamerud, K. L., Hobbie K.A. & Anderson K. A. (2013). Stainless Steel Leaches Nickel and Chromium into Foods during Cooking. Journal of Agricultural and Food Chemistry.61 (39): 9495–9501.
[12]. Raman, N. (2005). Phytochemical Technique, New Indian Publishing Agencies: New Delhi.19.
[13]. World Health Organization, (1993). Guidelines for Drinking Water Quality (2nd edn.) (Vol. 1-2) Recommendations, Geneva, 24.