

Thermal Characteristics, Phytochemical and Functional Groups Assessment of *Garcinia Kola* as a Tropical Timber

Udeozo¹, I. P., Eboatu², A. N., KELLE³ I. H. and Ejukwa¹, E. E.

¹Department of Industrial Chemistry, Tanisan University Umunya, Anambra State, Nigeria.

²Pure and Industrial Chemistry Department Nnamdi Azikiwe University Awka, Anambra State.

³Department of Industrial Chemistry, National Open University Lagos, Nigeria.

Abstract: The elucidation of *Garcinia Kola*, (family: clusiaceae or guttiferae) timber was carried out in terms of thermal and physico-chemical techniques. Various physical and thermal tests performed on the timber: oven dry density, water imbibitions (at different time intervals: 30 mins, 5hrs & 24 hrs), thermal conductivity, electrical conductivity, afterglow time, flame duration, flame propagation rate, ignition time, moisture content and ash content showed that it's a good timber suitable for various construction purposes. The AAS of the sample showed the absence of As and the presence of some metals such as Pb, Na, K, Zn, Ca, Mg, Cu, Hg, and Cd in the decreasing order of their concentrations. The TLC analysis gave Rf value of 0.53 and 0.55 in the chloroform-methanol and chloroform extracts respectively. Phytochemical screening showed the presence of Saponin, flavonoids, tannins, carbohydrate and resins. It also indicated the absence of steroid / terpenoids, alkaloids and protein. The Fourier Transform Infrared and Ultraviolet spectra suggested that the active compound might be an aromatic compound with OH, C = S and N – H group attached.

Key words: *Garcinia Kola* Thermal Characteristics, Phytochemical, Micro elements and Thin layer chromatography.

I. Introduction

Garcinia Kola is a species of flowering plant that belong to the clusiaceae or guttiferae family. It is a hardwood with bitter kola as its English name. Its natural habitat is subtropical or tropical moist low land forests. It is also a tree that grows in the rain forests of West and Central Africa. The fruit, seeds, nut and bark of the plant have been used for centuries in folk medicine to treat ailments from coughs to fever. According to a report from the centre for international forestry research, *Garcinia Kola* trade is important to the tribes and villages in Nigeria most especially the medicine men who believe in its purgative¹. It resembles *Atlanblackia Floribunda*. It is well branched, evergreen and grown as a medium size tree, reaching 12m height in 12 years and has regular fruiting cycle, that is, the tree produces fruits every year. *Garcinia Kola* is one of the most important trees value in Nigeria for its medicinal seeds and its exploration in the natural forests has been very heavy. The seed of *Garcinia Kola* have pharmacological uses in treating cough, throat infections, bronchitis, hepatitis (inflammation of the liver) liver disorders².

II. Experimental

Sample collection and Identification

Garcinia Kola timber was collected from timber shed at Nnewi in Nnewi North Local Government Area of Anambra State. Timber dealer, forest officer (Mr. Vin Okakpu of Nnewi Forestry) as well as literature³ helped in the timber identification.

Sample preparation

The timber was cut in a saw mill into two different shapes and sizes, dust from the timber was also collected. The timber was cut into splints of dimensions 30 x 1.5 x 0.5cm and cubes of dimensions 2.5 x 2.5 x 2.5cm. The samples were dried in an oven at 105°C for 24 hours before the experiments.

III. Method

The thermal characteristics: Afterglow time, flame duration, flame propagation, ignition time, oven dry density, moisture content, water imbibitions, ash percentage, thermal conductivity and electrical conductivity were variously determined using American Society for testing and material (ASTM) methods^{4,5,6}. The microelement composition was analysed using atomic absorption spectrophotometer model PG 990 manufactured by PG instrument Ltd U.S.A.

The phytochemical compounds: resins, steroids / terpenoids, tamin, alkaloids, carbohydrate and protein were qualitatively determined by the method outlined by Harbone⁷.

The chloroform and chloroform-methanol extracts were monitored using TLC, Fourier Transform Infrared and Ultraviolet Spectroscopic methods.

IV. Result And Discussion

RESULT

The results of the thermal investigation and the analysis of the active constituents present in the timber extract of *Garcinia Kola* are given in tables 1- 6.

Table 1: Results of thermal characteristics of *Garcinia Kola*

Characteristics	Units	Results
Afterglow time	Sec	347.33
Flame duration	Sec	193.33
Flame propagation rate	cm.5 ⁻¹	6.8 x 10 ²
Ignition time	Sec	8
Over dry density	g.cm ⁻³	48.5 x 10 ⁻²
Moisture content	%	18.41
30 mins Water imbibitions	%	19.1
5 hrs Water imbibitions	%	35.8
24 hrs Water imbibitions	%	62.8
Ash Content	%	0.72
Thermal conductivity	Umoh/cm	10.92 x 10 ²
Electrical Conductivity	Sm ⁻¹	2.9 x 10 ³

Table 2: Micro elemental composition %

Zinc	0.2
Lead	1.92
Cadmium	0.008
Copper	0.02
Sodium	0.81
Calcium	0.13
Magnesium	0.08
Potassium	0.66
Arsenic	Nil
Mercury	0.01

Table 3: Phytochemical composition of *Garcinia Kola*

Class of phytochemicals	Inference
Saponin	++
Flavonoids	+++
Resins	+
Steroids / terpenoids	-
Tannin	++
Alkaloids	-
Carbohydrate	++
Protein	-

Key +++ - highly present
 ++ - moderately present
 + - slightly present
 - - absent

Table 4: Results of Thin layer chromatographic characteristics of chloroform- methanol and chloroform extracts.

Sample	Number of spot	Rf value
Chloroform-methanol extract.	1	0.529
Chloroform extract	1	0.546

Wave number (cm ⁻¹)	Suspected chromophores
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Tables 5: Results of Fourier Transformed Infrared and Ultraviolet spectra of Chloroform

3426	O-H stretch for alcohol
2103	C=C stretch for alkynes
2087	N = C = S stretch for Isothiocyanate
1652	C = O stretch for primary
1527	N = O stretch for nitro group
1020	C . O stretch for Isothiocy anate
UV = 204, 217,228, 245 and 280	Indicating highly conjugated isoquinoline amide.

Table 6: Result of Fourier Transformed Infrared and Ultraviolet Spectra of Chloroform - methanol extract.

Wave number (cm ⁻¹)	Suspected chromophores
3436	N - H stretch for secondary amines or primary amides
2091	N = C = S stretch for Isothiocyanate
1643	C = C stretch for alkene
1444	C - H stretch for alkane
1105	C - O stretch for secondary
1023	C - O stretch for vinyl ether
UV _{max} 220, 233, 259, 267, 276, 284, 293, 305, 594 and 648.	Indicating highly conjugated trisubstituted aromatic compound.

V. Discussion

The five characteristics analysis carried out on the wood of *Garcinia Kola* showed that it had low afterglow time (less than five minutes) which made it less hazardous in fire situations because it wouldn't glow long enough for rekindle to take place. Its flame duration value indicated that it can sustain combustion. Water imbibitions at 30 mins, 5 hrs and 24 hrs interval showed the capacity of *Garcinia Kola* wood to absorb water over a period of time. The ash content value is in line with the ascertain of Desch and Dinwoodie (1981) who stated that timbers that possess small ash content are suitable in their use as a source of carbon dioxide for internal combustion engine. One can deduce from the result that *Garcinia Kola* is a hardwood that will be very good for construction and other purposes. The result of the phytochemical analysis showed the presence of saponin, resins, tannin, carbohydrate and flavonoids as the major components. The medicinal values of medicinal plants lies on these phytochemicals and such produce definite physiological actions in human body. Flavonoids exhibit an anti-inflammatory, anti-allergic effects, analgesic and anti-oxidant properties¹⁰. Herbs that contain tannins are astringent in nature and are used for treatment of intestinal disorders such as diarrhea and dysentery¹¹. Also, the presence of tannin in the extract of the plant must have informed its use by many traditional medicine practitioners in the treatment of wounds and bruises which is in line with the finding of some researchers⁹.

The result of the Atomic Absorption Spectrophotometric analysis of the sample is very encouraging. Copper, calcium, potassium and magnesium were present and are involved in body enzymatic activities. Sodium which help in P^H balance of body fluids, mercury, cadmium, lead and zinc were also present while arsenic is absent.

The absorption in the ultraviolet visible spectra and FTR spectra suggested that the active compound might be an aromatic compound with OH, C = S and N - H group attached.

VI. Conclusion

The results of thermal characteristics, phytochemical and AAS analysis of the woods of *Garcinia Kola* had confirmed that it contain some components of medical value and as well as good material for various construction works. The UV and IR spectra show that it contains some bioactive compounds. Phenol represented in IR and UV spectra confirmed the presence of tannins and therefore, the plant can give instant relief when applied on burns or injured skins among other numerous uses. The presence of flavonoids, Ca and Mg from AAS analysis confirmed its anti-inflammatory and anti-oxidant effect.

It is recommended that the anti-microbial properties of the timber extracts be elucidated.

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