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PROXIMATE AND THE ELEMENTAL COMPOSITIONS OF *FICUS POLITA* SEEDS POWDER FUNCTIONALIZED FILLER AS ALTERNATIVE TO CALCIUM TRIOXOCARBONATE IN POLYMER TER-BLEND

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ABSTRACT

The production and search for alternative inexpensive fillers to the conventional ones used in the manufacture of polymer blends has increased. Thus information about *Ficus polita* seeds powder are needed and are very important. This study examined the proximate and elemental compositions of *Ficus polita* seeds powder and its possibility to serve as alternative filler. The *Ficus polita* seeds powder were prepared by drying the seeds at temperatures between 25 -30 °C and was sieved with 75 µm sieve. The phytochemical and elemental compositions of the *Ficus polita* seeds powder were evaluated using standard methods. The results revealed that the percentage of the phytochemical compositions of the crude fat, crude fiber, crude protein, carbohydrate, phytate, oxalate, saponin, tannin, flavonoids, alkaloids and cyanide, were 7.92, 20.14, 8.38, 46.66, 0.08, 0.26, 2.40, 0.88,1.40,3.40 and 0.04 % respectively. The inorganic minerals and their amount in mg/g were phosphorus, potassium, sodium, iron, magnesium and calcium, obtained in the F*icus polita* seeds powder were 6 ± 0.030 mg, 74 ± 0.010 mg, 89 ± 0.145 mg, 33 ± 0.20 mg, 40 ± 0.28 mg and 20 ± 0.011 mg/100 g respectively.

Keywords: Calcium trioxocarbonate, elemental composition, *Ficus polita* seeds and proximate analysis

INRODUCTION

The studies on alternative fillers to the conventional calcium carbonate and other inorganic sources are very significant. The high cost and sometimes unavailability of the conventional fillers coupled with the shortages of foreign exchange and poor quality of composites for outdoor

applications have rendered blends and composites production an expensive venture in Nigeria [1]. The prices of the locally available polymer products are high most especially as the concentrates containing calcium carbonate filler are usually imported.

Ficus is a genus of about 800 species of woody trees, shrubs, climbers and vines in the family Moraceae, native throughout the tropics with a few species extending into the warm temperate zone [1]. The genus includes the common Fig *Ficus carica* that produces a commercial fruit called a fig. The fruit of many other species are edible though not widely consumed. Most species are evergreen, while those from temperate areas, and areas with a long dry season, are deciduous [2]. It is believed that the aroma volatiles of figs are insect and pollinator attractants [3,4]. *Ficus lutea* Vahl West African rubber is a showy and fast-growing fig with reddish bark and leaves. *Ficus lutea* of West Africa yields rubber of variable quality. The production of rubber by this tree merits further investigation, as it grows readily in nearly every district of West Africa and the Sudan [2]. *Ficus Polita Vahl or* Wild rubber fig is a large tree, 10–16 m tall, occurring in evergreen, coastal and dune forests [2]. The trunk is often buttressed and the bark is grey-brown to creamy-green. It is known by the Hausas as *'Durumi'* and by the Kanuris as *'Rita'*. The plant is used as a forage for animals because of its rich protein content [5,6]. It has been reported to possess the potential for the amelioration of HIV infections [5], anti-inflammatory (7) and anti-malarial (8). *Ficus thonningii* Blume or common strangler fig is widely distributed in upland forest, open grassland, riverine, and rocky areas. It is planted as a live fence with the intention of using the leaves as mulch or green manure, for producing shade or for fodder. It is also highly regarded for its ability to storewater and conserve soil. *Ficus thonningii* is an evergreen tree 6–21 m, with a rounded to spreading and dense crown. The bark is important in local medicine, and it is used in treating colds, sore throat, dysentery, diarrhea, wounds, constipation, nose bleed and to stimulate lactation [9]. The latex is used for wound fever, while an infusion of the root and fiber is taken orally to help prevent abortion. Powdered root is taken in porridge to stop nosebleed; the milky latex is dropped into the eye to treat cataracts [9]. The *Ficus thonningii* is used for ceremonial and sacred purposes [10]. A good jam can be made from the ripe fruits. Livestock and wide animals eat the dry leaves, twigs and fruits. The fruits are a rich source of carbohydrates and essential nutrients [10]. The extract of the plant

has been reported to be useful as an anti-inflammatory [11], astringent and purgative [12], anti-diabetic [13,14] and antibacterial [15].

The proximate composition of *Ficus carpensis* leaf and seeds which is one of the species of the *ficus* plants used in the work carried out by Micheal et al.,[2], showed that the leaf moisture content and seeds moisture content varied between 5.77% in the leaf to 10.60% in the seeds. The low values in the leaf could be the result of the role played as a food producing and respiratory part of the tree while the seeds are the storage part.

Over the past 30 years greater attention has been focused on the development of biodegradable blends and composites for the sustained of friendly and healthy environment. In recent times, biodegradable materials have gained importance particularly for the protection of the environment from ever increasing plastic waste [3].

Ficus species are evergreen browse plants that grow in the various ecological zones of Nigeria and are available all the year round. The fig tree which is also referred to as *Ficus polita* commonly known as wild rubber tree [4] and called Durumi in Hausa, Jammeiz alazrak in Shuwa Arabic all in northern Nigeria, belongs to the family Moraceae [3]. It grows to about 18m high and is much branched with dense rounded crown upon which abscission can occur during wind or storm [4]. This perennial plant is found grown in villages primarily shade around the houses [5] The leaves of *Ficus polita* tree are harvested to feed ruminant animals by peasant farmers in most rural settings in Nigeria and they have been reported to contain anti nutritional factors such as tannin, phytate, saponin, oxalate and hydrogen cyanide [6, 7]. Thus, studies on alternative fillers to the conventional ones are very important.

In recent years, studies have been conducted on the use of other nonconventional fillers especially the nonconventional fillers containing the phytochemicals and inorganic minerals, in order to replace the relatively more expensive conventional fillers [1]. However, not much literature information on the seeds quality of this plant was found. The current study was to identify the proximate and the elemental composition of *Ficus polita* seeds powder to serve as ameliorating agent on the mechanical properties of polymer ter-blends.

MATERIALS AND METHODS

The *Ficus polita* seeds of the *Ficus polita* plant used in this research were obtained from Samaru, Zaria, Kaduna State, Nigeria. The dried sample of this proposed filler was mechanically ground using porcelain mortar and pestle and sieved with 75 μm mesh sieve obtained from the Department of Geology Ahmadu Bello University, Zaria. The sieved *Ficus polita* seeds powder were subsequently stored in polyethylene bags for further laboratory analysis.

The chemical parameters investigated were: moisture content (MC), ash content (AC), crude fat (CFR), crude fibre (CF), crude protein (CP), free nitrogen extract (FNE), carbohydrate, phytate , oxalate (OXT), saponin (SP), tannin (TN), flavonoids (FV), alkaloid (AK) and cyanide (HCN) all of which constituted the proximate analysis of the sample, while the elemental determination were made for the mineral composition.

Determination of proximate parameters

The moisture content (MC) and ash content were determined by the method described by Ndamitso *et al.*, [1]. The crude protein (CP) and Total carbohydrates of the *Ficus polita* seed powder was determined using the method described by Ndamitso, *et al.*, [1].

DETERMINATION OF PHYTATE

The phytate was determined according to the standard method used by Ndamitso *et al.*, [1]. Exactly 0.5 g of the powdered sample was soaked in 100 cm^3 of 2% HCl for 24 hours and filtered. 25 cm^3 of the filtrate was pipetted and 5 cm^3 of 0.5% ammonium thiocynates solution was added and mixture was titrated three times with 0.01 $moldm^{-3}$ iron (III) chloride solution until a brownish yellow colour was obtained which remained for 3 minutes.

DETERMINATION OF OXALATE

The amount of the oxalate was estimated using the method reported by Ndamitso *et al.* [1]. The total oxalate obtain was analyzed by weighing 0.5 g of the grounded sample of powdered *Ficus polita* seeds was taken and extracted three times by warming and stirring with magnetic stirrer for 1 hour in 20 cm^3 of 0.3M HCl each time. Total extract was made up to 100 cm^3 in a volumetric flask with distilled water. 5 cm^3 of this solution was taken and made alkaline with few drops of 5M of ammonium hydroxide. Three drops of glacial ethanoic acid was added followed

by three drops of phenolphthalein indicator until a colourless solution was obtained. One centimeter cube of 5% calcium chloride was then added and the mixture was allowed to stand for 3 hours and was centrifuged at 300 rpm for 15 minutes. The supernatant was discarded and precipitate was dissolved in 2 cm^3 of 1.5 M H_2SO_4 and warmed in a water bath. The warmed mixture was then titrated with freshly prepared 0.0l M $KMnO_4$ which was initially at 25 ℃ until the first permanent faint pink colour was achieved. This was allowed to stand until it become colourless. This colourless solution was further titrated until a pink colour which persisted for about 30 seconds. The oxalate was calculated from data obtained as the oxalate content.

DETERMINATION OF SAPONINS

The saponin of the F*icus polita* seeds powder was determined gravimetrically using AOAC method as reported by Ndamitso *et al.* [1]. About 5 g of dried powdered sample was placed in abottle and transferred into a soxhlet apparatus. About 300 cm^3 of acetone was added in order to extensively extract the lipids and interfering pigments present in the sample, this sample was heat for 3 hours. After wards, pre-weigh and bottom flask containing 300 cm^3 of method was used to exhaustively extract the saponin for 3 hours. The methanol was distilled off and collected for subsequence use the difference between find and initial weigh of the flak was taken calculated and recorded as the weight of the extracted and recorded as the weight of the extracted saponin and subsequently the percentage weight of the saponin was obtained.

DETERMINATION OF TANNINS

The quantity of the tannin present in dried sample of the *Ficus polita* seeds powder was determined and estimated by AOAC method as reported by Ndamitso *et al.*, [1]. About 1 g of the dried powdered sample was weighed into a conical flask. Exactly100 $cm^3$of distilled water was added and the mixture was weighed in gently for 1 hour on a hot plate. It was then left for 1 hour and filtered by bulkner funnel in 100 cm^3 volumetric flask and made to mark with distilled water and mixture was heated gently for 1 hour on a hot plate. The resulting solution was filtered into 100 cm^3 volumetric flask and made up to mark. In order to develop colour 20 cm^3 of this resulting filtrate was pipetted in to 100 cm^3 volumetric flask having in it 50 cm^3 of distilled water. About 10 cm^3 Folin-Denis reagent and 20 cm^3 saturated sodium trioxocarbonate solution

was shaken thoroughly and allowed stand for 30 minutes at 25 °C optical density was measured at 700 nm using spectrophotometric method adopted by Okoronkwo *et al.*, [9].

DETERMINATION OF THE CYANIDE GROUP (CN^-)

The amount of cyanide in the *Ficus polita* seed powder was determined the method described by Cropal and Rayhan [13]. Exactly 8 g of powdered sample was placed in 800 cm^3 kjeldahl flask, 200 cm^3 of distilled water and 5cm^3 chloroform were added and steam-distilled into 100 cm^3 test tube containing 5 cm^3 and 2% potassium hydroxide. About 70 $cm^3$of distilled was placed into a beaker and was made to 300cm^3. Small amount of potassium Iodide (Y O 1G) was titrated against nitrate (V) solution until a faint pink colour was obtained and the cyanide was calculated from average titre values.

RESULTS AND DISCUSSION

Table 1: Elemental composition (mg) of *Ficus polita* seed powder

S/N	Elements	Phosphorus	Potassium	Sodium	Magnesium	Calcium	Iron
1.	Quantity (mg)	6 ± 0.030	74 ± 0.010	89 ± 0.145	40 ± 0.28	20 ± 0.011	33 ± 0.20

Table 2: Phytochemical Composition (%) of *Ficus polita* Seed powder

	CFT	CF	CP	CH	PT	OX	SP	TN	FV	AK	CN
Quantity (%)	7.92	20.14	8.38	46.66	0.08	0.26	2.40	0.88	1.40	3.40	0.04

Where CFT means Crude fat, CF;, crude fiber, CP; crude protein OX; oxalate, SP; saponnin, TN; tannin,FV; flavonoids, AK; alkanoids and CN; cyanide

The total ash content of the *Ficus polita* seeds powder in this research was 6.27% higher than that obtained by other authors in their research using other forms of the *ficus* species [1,7 and 8].

This higher ash contents obtained in this research was indication of having minerals elements contents. Adebisi and Oyeleke [4] further revealed that the ash content varied between 3.65% in the leaf to 3.50% in the seeds. The low level of the ash in the samples is an indication of low level of inorganic in the sample. Achi *et al.*, [7] carried out a comparative studies of the total ash content between the leaves and bark they reported that the ash content obtained in leaves is higher with value 12.88± 0.28% and bark 9.00 ± 0.06%. Adebisi and Oyeleke [4] further explained that, the higher total ash content of leaves compared to that of the bark is accompanied with the indication of higher elemental composition in the leaves compared to the other part of the plant. This is because it is an active growing part of the *Ficus polita* tree. However, similar results were obtained in pulp rice by Otu *et al.*, [5]. The results of other research of this plant on its seeds established the ash content in the raw as 11.8% and boiled as 9.12% [5]. Ash content is generally taken to be a measure of the mineral content of the original food as reported by Otu *et al* [5]. This result may indicate that *Ficus* seeds would likely contain very high qualities essential minerals. Ash content is an index to evaluate and grade the nutritive quality of foods [5].

The moisture content obtained in this research was 10.63±0.43%. This is an indication of getting more organic matter because, the values obtained for leaves and bark of the *Ficus polita* plant as reported by Ndamitso *et al.*, [1], for the leaves having values of 4.48±0.43% and the stem-bark ,2.80±0.18%.. Odusami *et al* [6] reported similar results in the qualitative phytochemical screening and nutritional composition of the leaves and bark of *Ficus polita* (moraceae) with the leaves having value of the moisture content 4.03±0.35% and that bark 4.93±0.35%. Okoronkwo *et al.* [8] revealed that moisture content of *Ficussy comorus* seeds analyzed by standard analytical technique was 99.63±0.1%) lower than that of *Ficus* Vahl seeds 12.89± 0.26%.

The fat obtained in this research was 7.92± 0.10%. The value of crude fiber showed that the *Ficus polita* seeds have 20.14% crude fiber content, similar to that of the work carried out by Ndamitso *et al.*, [1] which revealed value for the steam bark was 35.49±0.29% and that of the leaves was 27.46±0.28% which were higher than the value for maize silage and the palm kernel meal (30.50%) but higher than that of the copra meal (15.40%) as reported by Achi *et al.*, [7]. However higher crude fiber content value was also obtained for the steam bark of this plant (35-

49± 0.29%) as reported by Achi *et al.*, [] which was higher than the value obtained of the copra and palm kernel meals as earlier stated.

This higher fiber content makes it less important for bark as feed than the leaves but which may serve as reinforcing filler in polyblends when properly dried, sieved and using controlled moulding conditions. Recent advancement in polymer science and technology make use of fiber as reinforcing filler in polymer blend formulation. Thus, the seeds of the *Ficus polita* plant may be used as reinforcing filler in polymer blend for engineering applications. Since the phytochemical, proximate and the elemental composition analyses revealed the phytate, oxalate and some metals that can reinforce polymer as previous authors established [10]

The crude protein value obtained in this research was 8.38± 0.29% lower than 11.40± 0.65% for leaves and higher than 6.16± 0.28% for stem-bark as reported by Ndamitso *et al.*, [1]. The crude protein values of the leaves [1,7 and 8], was about thrice of that bark reported in this research. Moderate amount of crude protein was obtained in extract of *Ficus capensis* leaves carried out by Achi *et al.*, [7].

Phytochemical studies in this research carried out on aqueous extract of *Ficus polita* seeds powder showed that flavonoid content as 14000 ± 0.006 mg/ 100 g.

The amount of phosphorus, potassium, sodium, iron, magnesium and calcium, obtained in the *Ficus polita* seeds powder are 6 ± 0.030 mg, 74 ± 0.010 mg, 89 ± 0.145 mg, 33 ± 0.20 mg, 40 ± 0.28 mg and 20 ± 0.011 mg/100 g respectively.

The elemental composition of this part of the tree is associated with most growing parts of the tree with more mineral elements other than the rest segments of the tree [1]..

The level of phosphorus, sodium, Iron, Magnesium and Calcium values obtained were similar to those reported by Ndamitso *et al* [1].

The percentage composition of Crude fat, crude fiber, Crude protein, Carbohydrate, Phytate, Oxalate, , Saponin, Tannin, Flavonoids, Alkaloids and cyanide, are 7.92, 20.14, 8.38, 46.66, 0.08, 0,26, 2.40, 0.88,1.40,3.40 and 0.04, respectively.

This is a preliminary study to find out the phytochemicals components, proximate and the minerals contents of the *Ficus Polita* seeds powder. Based on the findings and literatures surveyed it can be postulated that *Ficus polita* seeds powder can serve as an alternative

functionalized filler to the available calcium trioxocarbonate (IV) filler in the industrial preparation of ter-polymer blends for engineering application.

CONCLUSION

The percentage composition of crude fats, crude fibers, crude proteins, carbohydrates, phytates, oxalates, saponins, tannins, flavonoids, alkaloids and cyanide, and the minerals composition of the *Ficus polita* seeds powder were determined. It is postulated to be alternative potential functionalized filler to the available calcium trioxocarbonate(IV) filler in the industrial preparation of ter-polymer blends for engineering application, most especially if properly and carefully prepared.

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