EFFECT OF ALUM ON THE FUNCTIONAL AND PHYSICO-CHEMICAL PROPERTIES OF AFRICAN BREADFRUIT SEED (*Treculiaafricana*).

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ABSTRACT
The effect of alum on the physico-chemical properties of African breadfruit (*Treculiaafricana*) was studied. Matured African breadfruit seeds were sorted, washed and steeped with different concentrations of Alum (2%, 4%, 6%, 7% and 9%) for 30minutes. The seeds were parboiled for 5minutes and then dehulled. The functional properties, anti-nutritional and physical characteristics of these samples were each investigated alongside the control (Raw dehulled ABFS). The results obtained showed that the values of the functional properties showed that the WAC, OAC, EC, BD, GC and FC properties ranged from 2.60±0.20%-3.25±0.61%, 3.70±0.32%-4.01±0.71%, 13.84±1.60%-15.32±1.22%, 0.91±0.21%-0.93±0.06%, 2.77±0.52%-2.83±0.81% and 10.06±0.73%-12.46±0.44%. The anti-nutritional analysis showed that the ABFS samples contained hydrogen cyanide (1.09±0.20mg/100g-1.13±0.11mg/100g),oxalate (0.18±0.01mg/100g-1.18±0.1.13mg/100g), phytate (1.75±0.08mg/100g-1.89±0.20mg/100g), tannin(0.49±0.14mg/100g-0.60±0.16mg/100g), trypsin inhibitor (7.90±0.41mg/100g-8.10±0.17mg/100g) and saponin (0.21±0.12mg/100g-0.28±0.00mg'100g). Processing ABFS with alum had significant effect on anti-nutrient reduction which enhanced the nutritional quality as well as its functional and physical characteristics especially sample F.

Key words: ***African breadfruit seed, alum, nutrient, anti-nutrient, functional properties***

INTRODUCTION

African breadfruit (*Treculiaafricana*) is a tropical plant, belonging to the Moracceae family and is related to other exotic fruits like jackfruit, figs, bread-nut and Mulberries. It is a staple food in many tropical regions. The fruit can be roasted, baked, fried and even boiled before consumption. It has immense potential as nutritional sources for man. Like most grain legumes cultivated in Africa, African breadfruit is a source of protein, fat, vitamins, minerals etc. African breadfruit is rich in protein than that for cereals and is similar to most pulses.It is also particularly high in aromatic amino acids which make it a potential source of good quality protein (Agu*et al.,* 2017; Ijeh*et al.,* 2010). It is an important nature resource for the poor contributing significantly to their income and dietary intake (Abiodun*et al*., 2013; Ogbonnia*et al*., 2008) and as animal feed (Onweluzo and Nnamuchi, 2009).

African breadfruit contains some anti-nutrients such as oxalate,tannin, hydrogen cyanide, and phytate which interfere with digestive processes and prevent efficient utilization of their nutrients especially proteins (Fasasi*et al.,* 2013; Ugwu and Oranye, 2006). These toxic substances may interfere with the nutrients of food prepared from breadfruit if processing capability of eliminating them is inadequate. Another anti-nutritional factor associated with African breadfruit is complex carbohydrates example raffinose contained in the breadfruit which is not digestible and may result to flatulence when breadfruit is consumed.

Alum are double sulfate salts, with the general formula $AM(S0_4)_2.12H_20$, where A is a monovalent cation such as potassium or ammonium and M is a trivalent metalion such as aluminum or chromium. When the trivalent ion is aluminum, the alum is named after the monovalent ion. The raw seeds do not store for very longtime due to infections by certain fungi which includes *Aspergillusniger, Botryodiplodiatheobromea and Rhizopusstolonifer* therefore, In food industries, alum is used to parboil African breadfruit in order to improve the keeping quality of the product by extending its shelf life and leaving the cotyledons intact without breaking, thereby enhancing its appeal

A major challenge in the utilization of African breadfruit is the indiscriminate addition of alum by the local processors without knowing its effect on the physical, nutritional and anti-nutritional composition. This research will bring to our knowledge the effect of adding alum on the physico-chemical composition of African breadfruits and extensively on its application in African breadfruit seed.

MATERIALS AND METHODS

SAMPLE COLLECTION AND PREPARATION

Mature African breadfruits and the alum used in this study was procured from Eke-Ukwu market, Owerri, Imo State, Nigeria. A dehulling machine known as dehuller was used to carry out this study. Six kilograms (6kg) of African breadfruit seeds were sorted, divided into six portions, washed, soaked with 2%, 4%, 6%, 7% and 9% of alum concentration respectively for 30minutes and parboiled for 5minutes at 80^0C. After the parboiling of the seeds, the seeds were dehulled using the dehuller. This machine was used to determine the dehulling effectiveness of the

African breadfruit seeds. These seeds after parboiling were put into six different containers and labeled A, B, C, D, E and F. After the labeling, the following analyses were carried out on them.

Determination of Anti-Nutritional Composition

Determination of tannins

Singh *et al.,* (2012) described the Folin-Denis spectrophotometric method for determining tannin concentration. 1 g of each sample was dispersed in 10 ml of distilled water, agitated, and allowed to stand at 28 0C for 30 minutes before centrifugation to get the extract. In a 50 ml volumetric flask, 2.5 ml of the supernatant (extract) was distributed. In a separate 50 mL flask, 2.5 mL of standard tannic acid solution was scattered. Each flask was filled with 1.0 mL Folin-Denis reagent and 2.5 mL saturated Na2CO3 solution. The mixture was diluted to the desired concentration in the flask (50 ml) and incubated at 28 0C for 90 minutes. In a spectrophotometer, the absorbance was measured at 250 nm. The reagent blank was set to zero when the readings were taken. The tannin content was determined using the following formula:

$$\% \text{ Tannin} = \frac{An}{As} \times C \times \frac{100}{W} \times \frac{Vf}{Va}$$

Where:
An = absorbance of test sample
As = absorbance of standard solution
C = concentration of standard solution
W = weight of sample
Vf = total volume of extract
Va = volume of extract analyzed

Determination of Oxalates

The oxalate content of the samples was determined using the titrimetric method published by Day and Underwood (1986). A millilitre (1 ml) of the sample was pipetted into a 100 ml conical flask, 75 ml of 3N H2SO4 was added, and the mixture was agitated intermittently for 1 hour with a magnetic stirrer. After that, it was filtered with filter paper. 25 mL of the filtrate was collected and titrated against potassium permanganate solution (KMO4) for 30 seconds, resulting in a faint pink color. The oxalate content was determined using the following formula:

$$\text{Oxalate content (mg/100ml)} = \frac{T \text{ x } (Vme)(Df) \text{ x } 10^5}{ME \text{ x } MF}$$

Where: T = the titre of KMO_4 (ml)
Vme = the volume-mass equivalent (i.e. $1cm^3$ of 0.05m KMO_4 solution is equivalent to 0.00225 g anhydrous oxalic acid).
Df = the dilution factor of titrate (300ml)
A = the aliquot used (125ml)ME = the molar equivalent of KMO_4 in oxalate
Mf = the mass of sample used

Determination of hydrogen cyanide (HCN)

The method of A.O.A.C (2010) was employed for this determination. One gram (1g) of each sample was dissolved in a 250ml of distilled water in a round bottom flask and allowed to stand for 2hours (for autolysis to occur). Full distillation was carried out and 150ml of distillate was collected in a 250ml conical flask containing 20ml of 2.5% NaOH. An antifoaming agent (silicon) was added before distillation. Eight milliliters (8ml) of NH_40H and 2ml of 5% Kl was added to 100ml of the distillate containing hydrogen cyanide. It was mixed and titrated with 0.02N silver titrate ($AgN0_3$) using a micro burette against a black background. Permanent turbidity indicated the end point. Hydrogen cyanide content of the sample was calculated thus:

$$\text{Hydrogen cyanide (mg /100kg)} = \frac{\text{Titre value (ml) x 1.08(g) extracted volume(ml) x 100}}{\text{Aliquot vol. (ml) x sample (g)}}$$

Determination of trypsin inhibitor

This was done using the spectrophotometer method described by (Arntfield*et al.,* 1985). Ten grams (10g) of sample was dispersed in 50ml of 0.5 NaClsolution and stirred for 30min at room temperature. It was centrifuged and the supernatant filtered through Whatman N0.41 filter paper. The filtrate was used for the assay. Standard trypsin was prepared to treat the substrate solution of the N.Bensoyl-DL arginine P-nitroanilide (BAPA). The extent of inhibition was used as a standard for measuring trypsin inhibition activities of the test sample extract.

In a test tube containing 2ml of extract of 10ml of the substrate (BAPA) was added 2ml of the standard trypsin solution. Also, 2ml of the standard solution was added in another test tube containing only 10ml of the substrate. Then it was later allowed to stand for 5min and then the absorbance of the solution measured spectrophotometrically at 410nm. One trypsin activity until inhibited was given an increase of0.01 absorbance until 410nm. TIA was expressed as number of trypsin units inhibited (TUI) per unit (g) of the sample analyzed. Thus,

TUI/g =Absorbance of test sample solutionx absorbance of the blank (control)

Determination of Saponin

The approach of Hiai et al., (1976) was applied, using Onwuka, (2018) method. Vanillin (8 percent w/v, 0.1 ml) and sulfuric acid (72 percent w/v, 1 ml) were combined with 0.1 ml of each sample's aqueous extract. The combination was incubated for 10 minutes at 60°C and then cooled in an ice bath for 15 minutes before being measured at 560 nm. The total saponin content was reported as aescin equivalents (AE, mg/mg extract), with aescin as the reference standard.

$$\% \text{ Saponin} = \frac{\text{Weight of saponin}}{\text{Weight of sample}} \text{x } \frac{100}{1}$$

Determination of phytate

The oberlease spectrophotometer method described by (Onwuka 2018) was used. A weighed

processed sample (2g) was extracted by mixing it with 50mls of 0.200 HCl solution and shook for 30 minutes. It was filtered through whatman No. 42 filter paper to obtain the extract. Meanwhile standard phytate solution (sodium phytate) was prepared and diluted to the chosen concentration, Ferric solution (ferric ammonium sulphate). The tubes were corked with stoppers and boiled in water bath for 30minutes. Then it was cooled in ice for 15minutes and allowed to attain their respective absorbance to read in a spectrophotometer at 519 nanometer wavelength. The phytate content of the sample was calculated thus:

$$\% \text{ Phytate} = \frac{100}{W} \times \frac{Au \times C \times V.T}{As \times 1000 \times Va}$$

Where,
W = Weight of sample
Au = Absorbance of sample
As - Absorbance of standard phytate solution
C - Concentration of standard phytate
VT = total extract volume
Va = volume of extract used.

FUNCTIONAL PROPERTIES

Determination of water absorption capacity (WAC)

The procedure describe by Beuchat (1977) was used to determine the water absorption capacity.Thirty milliliter (30ml) centrifuge tubes were thoroughly washed and dried in an oven at low temperature (2-4^{0}C). One gram (1g) of the sample was weighed into the tube (of known weight) and 10ml of distilled water was added and then thoroughly mixed. The tubes with the mixture (sample and water) were centrifuged for 15mins at a speed of 3000rev/min and were carefully decanted. The tubes were later inverted to let the unabsorbed water drip off after which the content and tubes were weighed and recorded.

The result was calculated as follows;

$$WAC = ax_2 - ax_1$$

Where;
a = weight of centrifuge.
ax_1 = weight of centrifuge tube + dry sample.
ax_2 = weight of centrifuge tube + wet sample.

Determination of foaming capacity (FC)

The procedure described by Coffman and Garcia (1977) was used. Eight grams (8g) of the sample was weighed into mixing bowel containing 100ml of distilled water. The mixture was whipped at high speed for 10min using moulinex 518 blender. The foam and slurry was quickly poured into 250ml graduated cylinder and the volume carefully recorded.

$$\text{Foaming capacity (FC)}\% = \frac{V_f - V_1}{V_1} \times \frac{100}{1}$$

Where,
Vf = volume after whipping
V_1 = volume before whipping

Determination of oil absorption capacity (OAC)

The procedure described by Beuchat (1977) was used but with slight modifications. Samples weighing 2g was mixed with 10ml of soybean oil of density 0.9glcm^3. The mixture was shook continuously for about 1 minute and later allowed to stand in a graduated cylinder. The volume of the supernatant was noted and converted to % of oil absorbed per 100g of sample (glg basis).

Determination of bulk density (BD)

Bulk density of each sample was determined by the method of Nwanekezi*et al.,* (2013). 2g of the sample was filled into 5ml graduated cylinder. The bottom of the cylinder was gently tapped ten times and then final volume was taken. The bulk density was estimated as mass per unit volume of the sample.

$$\text{Bulk density \%} = \frac{\text{Mass of material}}{\text{Volume of material after tapping}}$$

Determination of emulsion capacity (EC)

Emulsion capacity was determined by the method of Beuchat (1977) at room temperature. About 2g of flour sample and 700ml of distilled water or NaCl (0.10ml) solution was blended for 30seconds in a magnetic dispersion. Bleached decolorized vegetable oil was added continually from burette and blending continued until the emulsion break point was reached i.e. then, there was a separation into 2 layers. Emulsion capacity was expressed as gram oil emulsified per gram of flour.

TABLE 1: FUNCTIONAL PROPERTIES OF RAW AND PROCESSED ABFS

ABFS samples	WAC (%)	OAC (%)	EC (%)	BD (%)	GC (%)	FC (%)
A	a 3.25± 0.16	a 4.01±0.71	a 15.32±1.05	a 0.92±0.24	a 2.82±0.03	a 12.46±0.44
B	a 3.25±0.08	ab 3.98±0.13	a 14.32±1.22	a 0.92±0.19	a 2.83±0.18	ab 12.39±0.43
C	a 3.19±0.11	ab 3.91±1.00	a 15.23±0.16	a 0.91±0.21	a 2.82±0.93	ab 12.3±0.26
D	a 3.0±0.16	ab 3.82±0.42	a 15.00±1.08	a 0.92±0.31	a 2.80±0.22	bc 12.08±0.26
E	a 2.88±0.16	c 3.75±0.17	a 14.59±0.47	a 0.93±0.06	a 2.80±0.34	c 11.87±1.18
F	a 2.60±0.20	c 3.70±0.32	a 13.84±1.60	a 0.93±0.05	a 2.77±0.52	d 10.06±0.73
LSD	1.007	0.234	1.723	0.002	0.140	0.323

Values are means of triplicate analysis and standard deviation. Means on the same column with the same superscript are not significantly different(P>0.05).

KEY:WAC: Water absorption capacity A = 0% alum OAC: Oil absorption capacity B = 2% alumEC: Emulsion capacity C = 4% alum GC: Gelation capacity D = 5% alum BD: Bulk density E = 7% alumFC:Foaming capacity F = 9% alum

FUNCTIONAL PROPERTIES OF RAW AND PROCESSED ABFS

Water absorption capacity (WAC)

Water absorption capacity of the breadfruit samples was observed to be in the range of 2.60%-3.25%. Samples A and B had the highest WAC followed by sample C(3.19%), D(3.0%), E(2.88%) and F (2.60). The results revealed that flour samples with higher percent of alum had lower WAC. Water absorption capacity is the ability of a substance to combine with water under restricted conditions (Singh, 2012). It also indicates the extent to which protein can be incorporated into aqueous food formulations.

Oil absorption capacity (OAC)

Oil absorption capacity of the ABFS samples from Table (3) was observed to be in the range of 3.70%-4.01%. Samples A and B had the highest OAC as sample F had the least. This showed a decreasing trend from sample A to F as the concentration of alum increased. High OAC indicates the lipophilic character of the components of the flours (Ubbor and Akobundu, 2009). It is a vital quality of a raw material that reflects on the mouthfeelof the final product. The oil absorption capacity of the ABFS sample flours could therefore be of advantage in food formulations because it helps in increasing the palatability and shelf life of the product produced with the flours especially baked products like cookies and cakes (Seena and Sridhar, 2015).

Emulsion capacity (EC)

From table (3) above, the values of the emulsion capacity of the ABFS samples ranged from 13.84% in sample F which had the least value to 15.32% in sample B which had the highest value. The results showed that flour samples with higher concentration of alum had lower emulsion capacity. This is the capacity of protein to aid the formation and stabilization of emulsion in application of cakes butter and mayonnaise. Emulsion properties are pH dependent. At alkaline pH region, more storage proteins are soluble and the stability of proteins is enhanced. The higher values of the of the ABFS flour samples emulsion capacity indicates that they can withstand high emulsion.

Bulk density (BD)

The bulk density of the ABFS samples ranged from 0.91% in sample C to 0.93% in sample E which had the least value and highest value respectively. The results obtained showed that ABFS flour samples with higher percent of alum had higher bulk density. Bulk density is a measure of the heaviness of a flour sample (Oladele and Aina,2009). Among all the functional properties of the ABFS samples, bulk density was the lowest. Bulk density influences the packaging and transportation of material. Therefore, the low bulk density of the samples implied that they can be packaged and transported with ease comparable to other flours.

Gelation capacity (GC)

The analysis showed that the gelation capacity of the ABFS samples from Table (3) ranged from 2.77%-2.83%. Samples B and C had the highest values followed by sample A(2.82), D(2.80), E(2.80) and F(2.77). The results showed that the higher the concentration of alum, the lower the gelation capacity in ABFS flour samples. The result was not statistically different (P>0.05) at level of probability across all the samples. The gelling ability of a sample is due to the nature of the starch and protein and their interaction during processing. Variations in the gelling properties of flours have been attributed to the relative ratio of protein, carbohydrates and lipids that make up the flours and interaction between such components (Sathe*et al*., 1982). Gel enhances the body and texture ofproduct and their primary function in foods is to bind or solidify the free water in the food.

Foaming capacity (FC)

The values of the foaming capacity of the ABFS samples ranged from 10.06% in sample F to 12.46% in sample A which had the least and highest values respectively. There was a decreasing trend from sample A(raw) to sample F as the quantity of the alum added increased from 2.0% to 9.0%. Foaming capacity could be a reflection of the protein contents of the samples. There was a significant difference (P<0.05) in the values of the foaming capacity content of the ABFS samples flour. Foaming capacity refers to the amount of interfacial area that can be created by the protein in the flour (Fennama, 1996).

TABLE 2: ANTI-NUTRIENTS OF DEHULLED BREADFRUIT SAMPLES

ABFS Sample	Hydrogen Cyanide (mg/100g)	Oxalate (mg/100g)	Phytate (mg/100g)	Tannin (mg/100g)	Trypsin Inhibitor (mg/100g)	Saponin (mg/100g)
A	1.13 ± 0.00^{a}	0.18 ±0.10^{d}	1.89±0.20^{a}	0.60 ±0.16^{a}	8.09 ±0.51^{a}	0.27 ±0.01^{a}
B	1.13±0.01^{a}	1.18 ±0.13^{a}	1.88 ±0.35^{a}	0.58 ±0.09^{b}	8.10±0.17^{c}	0.28 ±0.00^{a}
C	1.13 ±0.11^{a}	1.16 ±0.14^{ab}	1.88 ±0.12^{c}	0.58 ±0.01^{b}	8.08±0.25^{a}	0.27±0.10^{a}
D	1.12 ±0.03^{a}	1.12±0.00^{abc}	1.80±0.06^{ab}	0.54±0.17^{c}	7.99±0.01^{ab}	0.26±0.04^{a}
E	1.11±0.09^{a}	1.08±0.02^{bcd}	1.75±0.08^{b}	0.49±0.14^{d}	7.94±0.36^{b}	0.22 ±0.01^{a}
F	1.09±0.20^{b}	1.07±0.04^{cd}	1.75±0.13^{b}	0.49±0.15^{d}	7.90±0.41^{b}	0.21±0.12^{a}
LSD	0.04	0.09	0.11	0.02	0.12	0.08

Values are means of triplicate analysis and standard deviation. Means on the same column with the same superscript are not significantly different(P>0.05).
KEY:A = 0% alum B = 2% alumC = 4% alum D = 5% alumE = 7% alum F = 9% alum

ANTI-NUTRIENT OF DEHULLED AFBS SAMPLES

Hydrogen cyanide

From table (5) above, it was observed that the ABFS samples contain Hydrogen cyanide whose values ranged from 1.09±0.20mg/100g in sample F and 1.13±0.11mg/100g in sample C. sample A,B and C had the highest values (1.13) followed by D(1.12), E(1.11) and F(1.09). The value of the hydrogen cyanide content of the raw ABFS samples (1.13±0.00mg/100g) obtained fsrom this study was lower to the value of hydrogen cyanide for raw *Treculiaafricana* seeds (26.45mg/kg) by Ugwu and Oranye,(2006). There was a reduction in the values of the ABFS samples which could be due to leaching of the anti-nutrients into the soaking water and the heat treatment.

Oxalate

The result of the anti-nutritional factor analysis carried out on the ABFS samples showed that they contain oxalate whose value ranged from 0.18±0.10mg/100g – 1.18±0.13mg/100g. Sample B had the highest value while sample A (raw) had the least value. The value of the oxalate content of the raw ABFS sample (90.18±0.10mg/100g) was higher than the value (0.03±0.11%) reported for *Treculiaafricana* seeds as reported by Osabor*et al.*,(2009). There was significant difference (P<0.05) in the values of the oxalate content though there was a decreasing trend from sample B to F as the concentration of alum increased from 2% to 9%.). The amount of oxalate ingested may be an important risk factor in the development of idiopathic calcium oxalate nephrolithiasis (Holmes and Kennedy, 2003).

Phytate

Phytate was among the anti-nutritional factor analysis carried out on the ABFS samples with its values ranging from 1.75±0.08mg/100g-1.89±0.29mg/100g. The value of the raw ABFS sample was slightly lower than the values reported for the phytate content of raw *Treculia Africana* seeds (2.16mg/100g) by Ugwu and Oranye, (2006) but higher than the value (90.76±0.01mg/100g) reported by Osabor*et al.,* (2009). The low level of phytic acid in the raw ABFS suggests that the nutritive value of the raw seed will be less impaired. There was significant difference (P<0.05) between the values of the phytate content of the ABFS samples.

Tannin

The values of the tannin content of the ABFS samples ranged from 0.49±0.14mg/100g–0.60±0.16mg/100g. Sample A (raw) had the highest value while samples E and F had the least values. The tannin content (0.60±0.16mg/100g) of the raw ABFS sample reported in the present study was lower when compared with the value (0.14±0.00%) reported by Ijeh*et al.*,(2010) and (26.45mg/100g) reported by Ugwu and Oranye, (2006). The differences observed in the tannin contents of these raw ABFS samples could be attributable to the species of variety of African breadfruit seed used. There was a reduction in the values of the tannin content which could be as a result of leaching and effect of thermal processing on the heat labile tannins contained in the ABFS samples. This agrees with the fact that tannins are polyphenols and polyphenolic compounds which are soluble in water (Ugwu and Oranye, 2006) are mostly located in the seed coat and therefore their reduction during steeping. Ikemefuna*et al*., (2014) also reported that soaking and fermentation decreases the tannins content in legumes.

Trypsin inhibitor

The trypsin inhibitor content of the ABFS samples from table (5) above ranged from 7.90±0.41mg/100g in sample F and 8.10±0.17mg/100g in sample B which had the least value and highest value respectively. There was significant difference (P < 0.05) in the values of the trypsin inhibitor content of the ABFS as there was also a reduction which could be due to leaching out of the trypsin inhibitor into the soaking water during soaking and the heat treatment (parboiling) applied.

Saponin content

Saponin content was highest (0.28±0.00mg/100g)in sample B and least (0.21±0.12mg/100g) in sample F. The value of the saponin content of the raw ABFS samples (0.28±0.00mg/100g) obtained from this study was closer to the value reported for the saponin content of raw*Treculia Africana* seeds (0.37±0.03%) by Ijeh*et al.,* (2010). It was observed that saponin present in the raw ABFS sample was reduced to minimal level when steeped with different concentrations (2%, 4%, 6%, 7% and 9%) of alum. This result confirms with the report of (Onimawo and Akubor, 2015), that alkaline washing or dry scouring and abrasive dehulling have been suggested as techniques for saponin reductions in legumes. Saponins are not destroyed during cooking. However, Onimawo and Akubor (2015) reported that trace elements of saponins are nutritionally beneficial because of their hypocholestorolemic activity (cholesterol lowering). Saponin is another anti-nutritional factor whose toxicological effects should be balanced with its benefits.Saponin causes reduction in the absorption of nutrients such as glucose and cholesterol (Price *et al*., 1987).

PHYSICAL CHARACTERISTICS OF THE DEHULLED ABFS

Colour (appearance)

Colour is an index of quality. The colour of the dehulled African breadfruit seed samples was

more enhanced from brown to white as the alum addition increased from 2% - 9%. Sample F (9% alum addition) had the best colour(white). The higher the alum content, the brighter the ABFS.

Stickiness

The stickiness or gumminess of the dehulled African breadfruit seed samples reduced as the concentration of alum increased (2%, 4%, 6%, 7% and 9%). After the dehulling, sample F (9%) was not sticky or gummy to the hand. The higher the alum addition, the lesser the stickiness.

CONCLUSION

The result of this research proved that the current setback in the processing of African breadfruit (dehulling) could be mitigated by the addition of alum since it had positive influence on anti-nutritional composition of parboiled African breadfruit seeds but, the quantity of alum should be mild or calculated (%) . The reduction in functional properties (WAC, OAC, EC, BD, GC and foaming capacity) of the breadfruit flours are very minimal especially at 2% level. Also, addition of alum shows desirable physical characteristics (colour and texture) above that of the raw parboiled and dehulled African breadfruit seeds.

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