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Proximate Composition, Mineral Content and Anti-Nutritional Factors of Cashew (*Anacadium occidentalis*) Apple Waste as Affected by Various Processing Methods

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Abstract

The study was conducted at the Department of Value Addition, Cocoa Research Institute of Nigeria, Ibadan, Oyo State, Nigeria, to evaluate the influence of processing treatments on the proximate composition, mineral profile, and phytochemical properties of Cashew Apple Waste (CAW). Matured, ripe cashew fruits obtained from the cashew plantations of the Cocoa Research Institute of Nigeria were processed after nut detachment; the cashew apple was partitioned into three treatment groups (A, B and C) representing unblanched, blanched, and fermented samples, respectively. Following processing, CAW was sun-dried for 5–7 days until adequately dry. The dried samples were milled to a fine powder, sieved through a 2 mm mesh and analyzed in the laboratory for proximate composition, mineral content, phytochemical screening, and anti-nutritional factors. Proximate analysis indicated that blanched CAW recorded significantly ($P<0.05$) higher values across all measured parameters, except for moisture content, which remained comparable across treatments. Mineral analysis revealed that Ca^{2+}, Fe^{2+}, Mg^{2+}, K^{+} and $PO4^{-}$ were significantly ($P<0.05$) highest in blanched CAW. Phytochemical analysis further confirmed that flavonoids, alkaloids, tannins, phenolics, saponins, phytates, oxalates, and steroids were all significantly ($P<0.05$) higher in blanched CAW. The study concludes that blanching coupled with mechanical juice extraction optimizes the nutritional and phytobiotic quality of CAW, making it the most suitable processing approach for its use as a livestock feed supplement.

Keywords: *Cashew Apple Waste, Proximate Analysis, Mineral Composition, Phytochemical Screening.*

Introduction

The family Anacardiaceae comprises 76 genera divided into five tribes (Anacardiaceae, Dobineae, Rhoeae, Semecarpeae, and Spondiadeae), encompassing about 600 species (Correia et al., 2006). Anacardium occidentale is an abundant tree in the Middle Belt of Nigeria. This species is notable for its antioxidant (Melo-Cavalcante et al., 2003), antigenotoxic, antimutagenic (Melo-Cavalcante et al., 2011), antiulcerogenic (Behravan et al., 2012), anti-inflammatory (Olajide et al., 2004), antibacterial, antifungal, and larvicidal (Behravan et al., 2012) properties. It is also rich in anthocyanins, carotenoids, ascorbic acid (vitamin C), flavonoids, and other polyphenols, as well as mineral components. After juice extraction, the Cashew Apple Waste (CAW) is usually discarded. It is the residue left after the juice has been extracted from the cashew fruit, following the detachment of the cashew nut. The Cocoa Research Institute of Nigeria (CRIN) produces several hectares of cashew as one of its mandate crops and has been extracting and processing the fruit juice, but the CAW, which could be further processed into a feed ingredient for livestock, has always been discarded over the years. There is a dearth of information on its utilization as livestock feed, but research is recently geared toward assessing its chemical composition to ascertain its phytochemical potential and then put it to proper use. Dos Santos Lima et al. (2012) reported that cashew (pulp) biomass has great potential for bioprocessing after pre-hydrolysis and is a promising raw material for bioethanol production, with 12% hexoses and 88% pentoses. Rocha et al. (2011) also reported that CAW could serve as a good source of sugars for ethanol production.

The study, therefore, aimed to determine the phytobiotic potential of cashew apple waste as a candidate livestock feed ingredient through a comprehensive assessment of its proximate composition, mineral profile, and anti-nutritional factor content.

Materials and Methods

Location of the Study

The investigation was carried out at the Department of Value Addition, Cocoa Research Institute of Nigeria, Ibadan, Oyo State, Nigeria.

Sourcing and Processing of Raw Materials

Matured and ripe cashew fruits are harvested from the cashew plantation of the Cocoa Research Institute of Nigeria, Ibadan, in a basket to the production centre. The bad and damaged cashew apples were sorted from the good ones, washed with clean water, and the nuts were detached from the apples. The cashew apple was divided into three samples (A, B, and C) and was processed using different methods as stated below.

> **Sample A: Unblanched Cashew Apple Waste**
> Washed cashew apples were juiced mechanically using a manual mechanical juice extractor fabricated by Cocoa Research Institute of Nigeria (CRIN). The waste was collected and sundried for 5-7 days for proper drying.
>
> **Sample B: Blanched Cashew Apple Waste**
> Cashew apples were placed in a cooking pot with hot water for 10 minutes, with intermittent stirring of the apples. After this, a manual mechanical juice extractor was used to extract the juice, and the waste was collected and sundried for 5-7 days for proper drying.
>
> **Sample C: Fermented Cashew Apple Waste**
> Cashew apples were also juiced with the mechanical extractor, and the waste was packed in an air-tight polythene bag and fermented for 7 days, and were sundried for 5-7 days for proper drying.

All the processed CAW were then milled into a fine powder to pass through a 2mm mesh sieve, and samples were collected, well labelled, and taken to the laboratory for the various analyses.

Proximate Analysis

The moisture content, ash, crude fiber, and crude fat were determined using the method described by AOAC (1990). The crude protein was also determined by the Kjeldahl method. The energy value was determined using an Adiabatic Oxygen Bomb calorimeter (12149 Adiabatic calorimeter, PARR Instrument Co., Illinois, USA.

Mineral Analysis

The mineral content of the samples was analyzed by using an atomic Absorption spectrophotometer (AAS) for the following metals: Ca, K, Fe, Zn, Mg, PO_4^- and Mn. While the Flame Photometer was used in the analyses of K (Ahmed, 2015).

Phytochemical Screening

The samples of cashew apple waste were tested for the specific presence of certain phytochemicals according to the method of Harbone (1998; Tiwari *et al. (*2011). Alkaloids were determined using Wagner's test. Two ml of each of the samples were treated with a few drops of Wagner's reagent (iodine-potassium iodide solution). Flavonoids were determined using the alkaline reagent test, where two mL of the extracts was treated with a few drops of 2mL NaOH. Tannins were obtained with the gelatin test (two ml of the extracts was treated with a few drops of 1% gelatin solution containing NaCl). Phenols were determined using the Ferric chloride test, and triterpenes were determined using Salkowski's test. Two mL of the extracts was treated with a few drops of chloroform and then filtered. The resulting solutions were then treated with a few drops of concentrated H_2SO_4, shaken, and allowed to stand for 5 minutes.

Saponins were obtained using the Froth test, while glycosides were analyzed using Legal's test, where two ml of the samples were treated with a few drops of Sodium nitroprusside in pyridine and NaOH. Cyanogenic glycosides (Picrate paper test): Two ml of the extracts was treated with a few drops of 10mL water and 1mL dilute HCl. Picrate papers (paper strips dipped in saturated aqueous picric acid previously neutralized with NaHCO3) are suspended above a flask containing the solution. The solution was warmed at 45 °C for an hour. Phytases (Liebermann-Burchard's test): Two ml of the extracts were treated with a few drops of chloroform and then filtered. The resulting solutions were treated with a few drops of acetic anhydride, boiled, and then cooled. Concentrated H_2SO_4 was added after cooling. Amino acids (Ninhydrin test): Two ml of the extracts were treated with a few drops of 0.25% w/v ninhydrin and then boiled for 5 minutes. Vitamins such as ascorbic acid, beta-carotene, thiamin, riboflavin, and niacin were also analyzed

Statistical Analysis

The data obtained was subjected to analysis of variance (ANOVA) using Statistical Products for Service Solutions (SPSS) version 21.0. The data obtained were presented as means and standard deviations of the samples. Significant means were separated using the Duncan Multiple Range Test (DMRT) at $P \leq 0.05$.

RESULTS

Proximate Composition of Differently Processed CAW

Table 1 presents the proximate composition of CAW subjected to different processing methods. Moisture content did not differ significantly ($P>0.05$) across the three processing treatments. Crude protein was significantly ($P<0.05$) highest in blanched CAW (19.50%) and least in fermented samples (9.75%). Similarly, crude fat was significantly ($P<0.05$) higher in blanched CAW (2.13%) compared to unblanched samples, which recorded the lowest value (0.35%). Crude fibre showed significantly ($P<0.05$) higher mean value in unblanched CAW (27.70%), while blanched CAW had the least (15.17%). Ash content was also significantly ($P<0.05$) higher in blanched CAW (11.77%) and low in the fermented group (9.90%). NFE was significantly ($P<0.05$) higher in fermented CAW (49.07%), while unblanched CAW had the minimum value (40.67%).

Table 1: Proximate Composition of Cashew Apple Waste Extracted using Different Methods

Parameters	Unblanched CAW	Blanched CAW	Fermented CAW	SEM±
Moisture (%)	8.33	8.80	8.33	0.23
Crude Protein (%)	12.03^{b}	19.50^{a}	9.57^{c}	1.07
Crude Fat (%)	0.37^{c}	2.13^{a}	1.47^{b}	0.14
Crude Fibre (%)	27.70^{a}	15.17^{c}	21.57^{b}	6.28
Crude Ash (%)	10.53^{bc}	11.77^{a}	9.90^{c}	2.75
NFE (%)	40.67^{c}	42.63^{b}	49.07^{a}	8.76

(Source: Analyzed) CAW = Cashew Apple Waste, SEM = Standard Error of Means. Means with the same letters are not significantly different ($P \leq 0.05$) across the rows

Mineral composition of differently processed CAW

The mineral composition of the differently processed CAW is presented in Table 2. Among the treatments, blanched CAW recorded the significantly ($P<0.05$) highest calcium concentration (265.00 mg/100g), while unblanched samples had the least (153.33 mg/100g). A comparable trend was recorded for iron, with blanched CAW yielding the highest mean (10.20 mg/100g) and unblanched recording the lowest (7.33 mg/100g). Zinc values were statistically similar ($P>0.05$) across all treatments. Magnesium was significantly ($P<0.05$) highest in blanched CAW (110.00 mg/100g) and lowest in unblanched CAW (70.00 mg/100g). Manganese content did not differ significantly ($P>0.05$) between treatments, though fermented CAW tended toward a higher value (0.35 mg/100g). Potassium was significantly ($P<0.05$) greatest in blanched CAW (80.00 mg/100g) and lowest in unblanched samples (51.67 mg/100g). Phosphate concentration was likewise significantly ($P<0.05$) highest in blanched CAW (151.67 mg/100g) and lowest in the unblanched group (120.00 mg/100g).

Table 2: Mineral Composition of Cashew Apple Waste Extracted using Different Methods

Parameters	Fermented CAW	Blanched CAW	Unblanched CAW	SEM±
Calcium (mg/100g)	178.33^{b}	265.00^{a}	153.33^{c}	24.06
Iron (mg/100g)	8.97^{c}	10.20^{a}	7.33^{b}	3.27
Zinc (mg/100g)	1.10^{b}	0.53^{a}	0.30^{c}	0.06
Magnesium (mg/100g)	83.33^{b}	110.00^{c}	70.00^{a}	23.46
Manganese (mg/100g)	0.35	0.03	0.02	0.03
Potassium (mg/100g)	35.00^{c}	51.67^{a}	120.00^{bc}	22.26
Phosphate (mg/100g)	65.00^{a}	80.00^{b}	51.67^{c}	8.24

(Source: Analyzed) CAW = Cashew Apple Waste, SEM = Standard Error of Means. Means with the same letters are not significantly different ($P \leq 0.05$) across the rows

Phytochemical Screening of Differently Processed CAW

Table 3 presents the phytochemical profile of the differently processed CAW. Flavonoid concentration was significantly ($P<0.05$) highest (388.33 mg/100g) in blanched CAW and lowest (140.00 mg/100g) in unblanched samples. Alkaloid content was also significantly ($P<0.05$) highest (861.67mg/100g) in blanched CAW and lowest (551.67mg/100g) in those samples from fermented CAW. Tannin values showed ($P<0.05$) variations, with the highest mean value (480.00mg/100g) in blanched CAW and the least mean value (433.33mg/100g) in fermented CAW. Phenolic, terpinoid, and saponin content were significantly ($P<0.05$) highest (49.00, 520.00, and 240.00mg/100g) in blanched CAW, while lowest (30.50, 220.00, and 166.67mg/100g) in those samples from unblanched CAW. Cardiac glycosides and cyanogenic glucosides values showed no significant ($P>0.05$) variation among the three samples. Phytate and oxalate content were significantly ($P<0.05$) highest (75.00 and 20.00mg/100g) in blanched CAW, while lowest (6.66 and 65.66mg/100g) in those samples from unblanched CAW. Steroids and Antioxidant inhibitors values were also significantly ($P<0.05$) highest (94.67and 42.37mg/100g) in blanched CAW, while lowest (65.66 and 23.33mg/100g) in those samples from unblanched CAW.

Table 3 : Phytochemical Screening of Cashew Apple Waste Extracted using Different Methods

Parameters	Fermented CAW	Blanched CAW	Unblanched CAW	SEM±
Steroids (mg/100g)	80.00^{b}	94.67^{a}	65.66^{c}	7.59
Alkaloids (mg/100g)	551.67^{c}	861.67^{a}	583.33^{bc}	43.22
Tannins (mg/100g)	433.33^{c}	480.00^{a}	458.33^{b}	38.66
Oxalates (mg/100g)	1.66^{b}	20.00^{a}	5.66^{c}	4.37

Phytates (mg/100g)	51.67^{b}	75.00^{a}	33.33^{c}	8.76
Saponins (mg/100g)	208.33^{b}	240.00^{a}	166.67^{c}	22.40
Cardiac glycosides (mg/100g)	0.67	2.17	2.17	0.08
Cyanogenic glucos.(mg/100g)	0.67	0.90	0.47	0.26
Terpinoids (mg/100g)	420.00^{b}	520.00^{a}	220.00^{c}	43.24
Phenolics (mg/100g)	37.63^{b}	49.00^{a}	30.50^{c}	10.24
Flavonoids (mg/100g)	238.33^{b}	388.33^{a}	140.00^{c}	32.64
Antioxidants (Inhib.) (%)	29.56^{b}	42.37^{a}	23.33^{c}	6.65

(Source: Analyzed) CAW = Cashew Apple Waste, SEM = Standard Error of Means. Means with same letters are not significantly different ($P \leq 0.05$) across the rows

Discussions

Proximate Composition

Moisture content ranks among the most critical indices in food and feed processing, as it directly governs product shelf life, microbial stability and storage suitability (Oloyede, 2005). The comparable moisture values recorded across all three CAW treatments indicate uniform drying efficiency and suggest that all samples would be equally resistant to microbial proliferation during storage. Chirife and Fontana (2008) established that reduced water activity suppresses microbial growth and enzyme-mediated deterioration, thereby extending product shelf life. The higher ash content of blanched CAW reflects a richer mineral profile relative to the other samples, since ash is a direct indicator of total inorganic mineral content. This is consistent with findings of Okpanachi et al. (2016), who documented high ash values in dried cashew pulp during a laboratory analysis for proximate composition. Lipids provide an excellent source of energy and enhance the transport of fat-soluble vitamins, insulate and protect internal tissues and contribute to vital cell processes (Pamela *et al.,* 2005). The higher fat content recorded in blanched CAW is a pointer to the fact that this product has the potential to supply livestock with needed energy. The low crude fibre content observed for blanched CAW is advantageous to the absorption of glucose and fat. Although crude fibre enhances digestibility, its presence in high levels can cause intestinal irritation, lower digestibility and decreased nutrient utilization (Oladiji and Mih, 2005). The relatively lower crude fibre in blanched CAW is nutritionally advantageous, as excessively high fibre levels impair glucose and fat absorption, provoke intestinal irritation and reduce overall nutrient utilization (Oladiji and Mih, 2005), though the moderate fibre retained may still support glycaemic regulation by slowing gastric emptying (Jones, 1995). The higher crude protein of blanched CAW is likely due to the heat treatment reducing anti-nutritional factors that would otherwise impair protein availability. Odoemena and Ekanem (2006) observed that plant-source proteins, when combined with animal protein, can achieve equivalent nutritional value. The higher NFE in fermented CAW reflects the ability of fermentation to degrade complex organic matter and release soluble carbohydrates (Trease and Evans, 2001).

Mineral Composition

Among the minerals analyzed, calcium was significantly higher in blanched relative to both unblanched and fermented CAW. This macromineral plays a critical role in skeletal development dentition, and neuromuscular function. It is known to be abundant in cereals, nuts and plant-based materials (James, 1996; Thomas, 2006). Iron was also notably higher in blanched CAW. This mineral is indispensable for hemoglobin-mediated oxygen transport and energy metabolism. Iron deficiency is a recognized cause of anemia. This suggest that blanched CAW could serve as a dietary iron supplement for livestock. (Bolt, 1998; Takeri, 2004). Potassium levels were similarly higher in blanched CAW. This element is central nerve signal transmission, osmotic pressure regulation, and acid–base equilibrium in the body. The elevated potassium content in blanched CAW further reinforces its value in supporting metabolic homeostasis (Odoemenam and Ekeyem, 2008). Magnesium acts as a cofactor in carbohydrate-metabolizing enzymes such as α-amylase, maltase, sucrase, and lactase. It is essential in the electrical breakdown of nutrients and other materials within the cells (Bolt, 2008). The higher magnesium content of blanched CAW adds to its nutritional value as a functional feed ingredient. Manganese, which is involved in connective tissue and bone formation, blood clotting, sex hormone synthesis, carbohydrate and fat metabolism, and neurological regulation, showed comparable levels across all three processing treatments. Phosphate was found to be higher among the cashew apples that were blanched and mechanically extracted. This element is a structural component of bone, teeth, nucleoproteins, phospholipids, enzyme systems, and high-energy compounds; its abundance is a desirable attribute in a livestock feed ingredient (Jones, 1995). Zinc is required for the activation of certain enzymes; these include dehydrogenase, alkaline phosphatase, and carboxypeptidase. Zinc-containing organic compounds are employed as astringent and anti- fungal agents. Zinc aids wound healing and metabolism of nucleic acids and insulin (Takeri, 2004). It is, however, found to be higher among the cashew apples that were blanched compared to other samples.

Phytochemical Screening

Flavonoids are recognized for a wide array of pharmacological properties including antioxidant, anti-inflammatory, anticancer and antimicrobial effects. Higher levels in blanched CAW therefore underscores the potential phytobiotic value for livestock applications (Wu *et al*., 2003;Verma *et al*., 2011). Hence the higher flavonoids present in the blanched CAW is nutritionally advantageous to livestock. The antioxidant activity of flavonoids is efficient in trapping superoxide anion (O_2), hydroxyl (OH), peroxyl (ROO) and alcohoxyl (RO) radicals. Alkaloids, though generally toxic to other organisms. They often have pharmacological effects and are used as medications, as antimicrobial, antipyretic, local anesthetic and stimulant, psychedelic, analgesic, antibacterial, anticancer, antihypertension agent, the cholinomimetic, anticholinergic, vasodilator antiarrhythmic, antiasthma and antimalarial. Hence, the presence of alkaloids in the blanched CAW confirms its uses as a potential material in livestock feed. The presence of Tannin in the samples with higher value among blanched CAW comparable to other shows antitumor, hepatoprotective and antioxidant potentials. Alkaloids and tannins may also contribute to the plant's effects as antimalarial, anti- diarrhoea and analgesic agents (Mir, 2013).Phenolic compounds are plant secondary metabolites that are involved in diverse metabolic pathways and are essential for plant growth and reproduction, and as protecting agents against pathogens. Phenolic compounds may play an important role in preventing chronic illnesses such as cardiovascular disease, certain type of cancers, neurodegenerative disease, and diabetes. Blanched cashew apple gave higher phenolic compound which proves the plant to be a viable phytobiotics which could replace the use of antibiotics in poultry production (Asl Marjan and Hossein, 2008). Blanched cashew apple shows higher saponin content comparable to other samples. Saponins are being used commercially as dietary supplements and nutraceuticals. Saponins are expected to lead to hydrolysis of glycoside from terpenoid and hence reduce the toxicity associated with the intact molecules. (Asl Marjan and Hossein, 2008). The anti-nutritional factors detected, including cardiac glycosides, cyanogenic glucosides, phytates and oxalates, were present at concentrations unlikely to pose significant health risks to livestock, as none exceeded the permissible limits recognised by NAFDAC in Nigeria (Blessing et al., 2011). While elevated phytates are known to chelate divalent minerals and cause digestive disturbances (Maynard et al., 2004; Oboh et al., 2003), values observed here are within acceptable limits and can be further reduced by blanching. Higher oxalate and tannin concentration above that reported in this study in blanched CAW could cause great risk of renal absorption and also possess the ability to chelate divalent minerals and prevent their absorption by the body systems However, the levels of oxalate was reduced to this bearable level because the sample was subjected to heat treatment (Blanching) (Lumu *et al.*, 2011). Steroids are known or have been found as an anti-inflammatory agent, anti-tumor, immunosuppressants and, hepatoprotective, antibacterial, plant growth hormone regulator, anthelminthic, cytotoxic and cardiotonic activity. Been higher in blanched CAW shows that the plant has promising phytobiotic potentials in livestock feeding.

Conclusion

Cashew apple waste subjected to blanching and mechanical juice extraction exhibited the highest proximate, mineral, and phytochemical values compared to unblanched and fermented samples. It is therefore concluded that blanching represents the optimal processing strategy for maximizing the nutritional and phytobiotic quality of CAW. Therefore, it can be recommended for the preparation of CAW as a livestock feed ingredient

REFERENCES

1. Asl Marjan N and Hossein H (2008). Review of Pharmacological Effects of *Glycyrrhiza sp*. and its Bioactive Compounds. Phytotherapy Research, 22 (6): 709–24
2. Blessing, A. C., Ifeanyi, U. M. and Chijioke, O. B., (2011). Nutritional Evaluation of Some Nigerian Pumpkins (Cucurbita spp.). Fruit, Vegetable and Cereal Science and Biotechnology. Global Science Books, Vol.5 No. 2, pp. 64-71.
3. Bolt , G. H.(1978) and Bruggenwert, M. G. M. Solid Chemistry, Basic Elements. Elsevier Scientific Publishing Co., New York**,** p. 145
4. Chirife J., Fontana A.J. (2008). Introduction: Historical Highlights of Water Activity Research. In: Barbosa-Cánovas G.V., Fontana A.J., Schmidt S.J., Labuza T.P. Editors. Water Activity in Foods: Fundamentals and Applications. Blackwell Publishing; Iowa, IA, USA. pp. 3–13.
5. Correia SDJ, David JP, and David JM (2006). Metabólitos Secundários De Espécies De Anacardiaceae. Quím. Nova 29:1287-1300.
6. Harborne, J.B (1998). *Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis*. 3rdedition.New York, Chapman and Hall, Pp: 279.
7. James, C.S. (1996) Analytical Chemistry of Foods. Blackie Academic and Professional, New York**,** 219p.
8. James, C.S. (1996) Analytical Chemistry of Foods. Blackie Academic and Professional, New York**,** 219p.
9. Konan NA, and Bacchi EM (2007). Antiulcerogenic Effect and Acute Toxicity of a Hydroethanolic Extract from the Cashew (Anacardium occidentale L.) Leaves. J. Ethnopharmacol. 112:237-242
10. Lima S, Feitosa C, Citó A, Moita Neto J, Lopes J, Leite A, Brito M, Dantas S, and Cavalcante A (2008). Effects of Immature Cashew Nut-Shell Liquid (Anacardium Occidentale) Against Oxidative Damage in Saccharomyces Cerevisiae and Inhibition of Acetylcholinesterase Activity. Genet. Mol. Res. 7:806-818
11. Lumu, R. and Katongole, C. (2011). Comparative Reduction of Oxalates from New Cocoyam (Xanthosoma sagittifolium) Leaves by Four Processing Methods. *Livestock Research for Rural Development*. Vol.23.
12. Melo-Cavalcante AA, Rubensam G, Picada J.N,

Silva EG, Fonseca Moreira JCF, and Henriques JA (2003). Mutagenicity, Antioxidant Potential, and Antimutagenic Activity Against Hydrogen Peroxide of Cashew (Anacardium occidentale) Apple Juice and Cajuina. Environ. Mol. Mutagen. 41:360-369.

13. Mir, AM, Sawhaney, SS and Jassal, M.M.S.(2013) Qualitative and Quantitative Analysis of Phytochemicals of Taraxacum Officinale. *Wadpecker Journal of Pharmacy and Pharmacology*; 2(1):1-2.
14. Oboh, G., Akindahunsi, A. A. and Oshodi, A. A. (2003). Dynamics of Phytate-Zn Balance of Fungi Fermented Cassava Products (Flour and Garri). *Plants Foods for Human Nutrition*, Vol. 58, pp. 1-7
15. Odoemena, C. S. and Ekanem, N. G (2006). *J. Of Sc. And Tech.***,** 5 (2):51-54.
16. Oladiji, A. T. and Mih, F.O (2005) *African J. Biotechnology*, 4 (12): 1439- 1442.
17. Rocha, V. M. P, Rodrigues, H. T. S, Melo, M. M.V, Gonçalves, L. R. B. and Macedo, G. R.(2011) “Cashew Apple Bagasse as a Source of Sugars for Ethanol Production by Klu- yveromyces Marxianus CE025,” Journal of Industrial_Microbiology & Biotechnology, Vol. 38, No. 8, 2011, pp. 1099-1107
18. Takeri, H., Einar, B., Hanffen, H. and Hamffen, H. (2004) Pharmaceutical Analysis. CBS Publishers Distributors, India**,** 854- 859.
19. Thomas, M. D. (2006) Text Book of Biochemistry with Clinical Correlations 6th ed., Willey- Less., John
20. Tiwari, P., Kumar, B., Kaur, M., Gkaur, G., and Kaur, H.(2011). An Evalution of Antimicrobial, Activities of Root Extract of *Calendula Officinalis (Linn). Internationale Pharmaceutica Sciencia*,1(1),98–106.
21. Trease, G.E. and Evans, W.C.(2001) Text Book of Pharmacognosy.14th ed, WB Saunders Company Limited, U.K.**,** 612p.
22. Rocha, M. P., Rodrigues, T. H. S., Melo, V. M. M., Gonçalves, L. R. B., Macedo, G. R. (2011). Cashew Apple Bagasse as a Source of Sugars for Ethanol Production by Kluyveromyces Marxianus CE025. J Ind Microbiol Biotechnol. 2011 Aug;38(8):1099-107.
23. Verma KS, Dixit V, Khare D and Awasthi A (2010): Phytochemical Screening and Antimicrobial Activity of *Buchanania lanzan* Spreng. *Journal of Phytological Research*, 23(2): 339-342.
24. Wu Y, Hao B, Shen E,Zhang X, and Zhao Y.(2003) Regulatory Effect of Laggera Alataextract on Immune Mediated Liver Injury. *Journal of Medicinal Plants Research*; 5(12): 2494-2498
25. Zheng, Y.I ,Pan, Z, Zhang, R and Wang, D(2009) “Enzymatic Saccharization of Dilute Acid Pretreated Saline Crops for Fermentable Sugar Production,” Applied Energy, Vol. 86, No. 11,, pp. 2459 2465