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Nutritional Status of Cassava Peels and Root Sieviate Biodegraded With *Aspergillus niger*

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Abstract: The ability of *Aspergillus niger* to improve the nutritional status of Cassava Root Sieviate (CRS) and peels was assessed for ten days through biodegradation. The biodegradation within this time had several effects on the proximate content of the substrates. The protein content of CRS recorded for 0, 5 and 10 days were 2.09, 5.21 and 7.34% while these 5.35, 10.70 and12.64% were values for cassava peels. From the results it was obvious that *Aspergillus niger* was able to enrich the protein content of both sieviate and the peels, i.e. there was significant effect ($p<0.05$) effect of the treatment with best result on the 10th day. The detergent fiber content of both substrates were reduced, for Acid Detergent Fiber (ADF), the following values were recorded for peels 5.81, 4.08 and 2.30% for days 0, 5 and 10. While 16.26, 14.48 and 11.26% were recorded for CRS for the respective days the changes were significantly different ($p<0.05$), Acid Detergent Lignin (ADL) also had same, 6.71, 6.62% trend as ADF, 6.97 were the values for sieviate while 7.41, 6.98 and 6.08% were the values for peels same, 6.71, 6.62% trend as ADF, 6.97 were the values for sieviate while 7.41, 6.98 and 6.08% were the values for peels. There was increase in the value of some mineral content of both substrates as the biodegradation period increased.

Key words: Biodegradatio % cassava peels % root sieviate % *Aspergillus niger*

INTRODUCTION

Nigeria stand as the world's foremost cassava producer with about twenty six million tonnes.

Cassava peels and sieviate which are by products of harvesting and processing constitute 25% of the whole plant. Cassava peels is the skin of the peeled while the chaff that results from processing the root into "foofoo" is called cassava root sieviate. However in harnessing these products as poultry feed ingredients it has been discovered that they are high in fiber hence this limit their utilization.

CRS for instance contains high amount of non-starch polysaccharides mostly of non digestible carbohydrate such as cellulose hemicellulose which have a high water holding capacity. This was observed to be poorly digested and bio utilized by laying birds which resulted in depressed weight gain and reduced egg production [1]. The digestibility of a feed for both ruminant and non-ruminants tend to decrease with crude fiber content. Typically a 1% increase in crude fiber brings a 1% decrease in digestibility for ruminants and a 2% decrease for pigs [2, 3].

Biodegradation can be described as a process in which substrates are decomposed by known mono or mixed cultures of micro organism under controlled environmental conditions with the aim of producing high quality product. The substrate is characterized by relatively low water content [4]. Enzymes from micro organisms especially fungi has been indicated to be promising in degrading structural carbohydrates such as cellulose, hemicellulose and lignin and in degrading or structurally modifying proteins and their anti nutritional properties and to liberate phosphorus complex compounds e.g. phytase [5].

MATERIALS AND METHODS

Inoculation of substrate using micro organism in the solid state fermentation was employed. The cassava peels

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and sieviate were collected from processing centre at barracks Eleyele Ibadan Nigeria. These products were separately dried and about 60 g was put in each of 250 ml Erlenmeyer flasks. The flask with their contents were autoclaved at 120°C for 1 h. After autoclaving, the flask with their content were allowed to cool, then sugar inform of syrup was introduced to adjust the moisture content to about 25%. The sugar syrup was added to provide more carbon for the organism *Aspergillus niger* to feed and grow on. The pure culture of *Aspergillus niger* maintained on potato dextrose was collect from the culture bank of the Department of Botany and microbiology University of Ibadan, Nigeria. The substrates were inoculated aseptically with 5 ml of *A. niger* properly mixed and dully labeled the flask were incubated at 35°C. The samples were prepared in triplicates and arranged based on days of biodegradation. At the end of each experimental period, the respective samples were oven dried at 80°C for 24 h and subjected to further analysis.

Mineral analysis: The wet oxidation procedure of A.O.A.C. [6] was applied in the preparation of the digest for the mineral analysis. Suitable preparations of the digest were read on flame photometer for the respective minerals namely calcium,sodium and potassium.

Chemical analysis: The crude fiber of sieviate and peels was verified determined by the method of A.O.A.C. [6] while protein was estimated by the method of Lowry [7].

Statistical analysis: Data were subjected to analysis of variance and level of significance was indicated.

RESULTS AND DISCUSSION

The appearance of the mycelia of the fungi on the substrate feed stuffs after 48 h was on indication that degradation has commenced. This was in line with Ofoya and Nwajiuba [8] thus confirms suitable environmental condition for the fungi.

The degradation of CRS and peels starts with the breakdown of polysaccharides into oligosaccharide which can be hydrolyzed by glycosidase into their component monomer. The metabolism of these monomers can then give energy and carbon for the growth of the micro organism as reported by Smith *et al.* [9].

From this study it was observed there was increase in protein content (Table 1 and Fig. 1) compared to undegraded CRS from 2.09 to 7.34% also cassava peels had an improvement from 5.35 to 12.64%. This implied that *Aspergillus niger* had significant ($p<0.05$) effect on the protein content. The increase in the crude protein observed was probably due to the additional crude protein produced in the fungal mycelia Onilude [10] or the mycelia protein and this is influenced by carbon to nitrogen ratio, similar results had been reported by Abu [11] using sweet potato in solid state fermentation. Also this result was in line with Iyayi and Losel [12] who reported enriched protein of cassava peel and pulp with different fungi types.

The fiber component decreased over the period of degradation this may be due to the hydrolytic nature of the fungi used for the biodegradation. The result here is in line with Chesson [13] who reviewed the early claim that disruption of cell walls and their degradation by microorganism enzyme could be beneficial to host animal.He reported that available cell wall carbohydrate not attacked by digestive enzymes now seem wildly optimistic after biodegradation. He then stressed that total breakdown requires the action not only of the enzymes responsible for the primary attack on the cell wall polysaccharide and glucan hydrolases but also of a second set of glycosidases able to reduce oligosaccharides to their monomeric components. During biodegradation the enzymes from fungi breakdown polysaccharide into less complex structures. The ease of degrading any fiber component is a function of the enzyme composition of fungi and the physicochemical properties of the substrate. Acid detergent fiber and lignin content also decreased

Table 1: Changes in proximate content of cassava root sieviate and peel following biodegrading with Aspergillus

CRS		Crude protein	ADF	ADL	Cellulose	Hemicellulose
Days	0	2.09+0.63	16.26+2.03	6.97+0.11	9.29+1.33	8.75+1.36
	5	5.21+1.02	14.48+1.07	6.71+0.31	7.77+1.24	6.38+1.11
	10	7.34+1.06	11.26+1.17	6.62+0.21	4.64+1.07	4.09+1.31
Cassava peels		Crude protein	ADF	ADL	Cellulose	Hemicellulose
Days	0	5.35+1.21	9.76+1.21	4.81+0.28	5.40+1.34	21.65+3.15
	5	10.70+2.04	8.23+0.96	6.98+0.14	3.42+2.01	18.38+3.08
	10	12.64+1.08	4.87+1.03	6.08+0.19	1.73+2.23	15.92+3.32

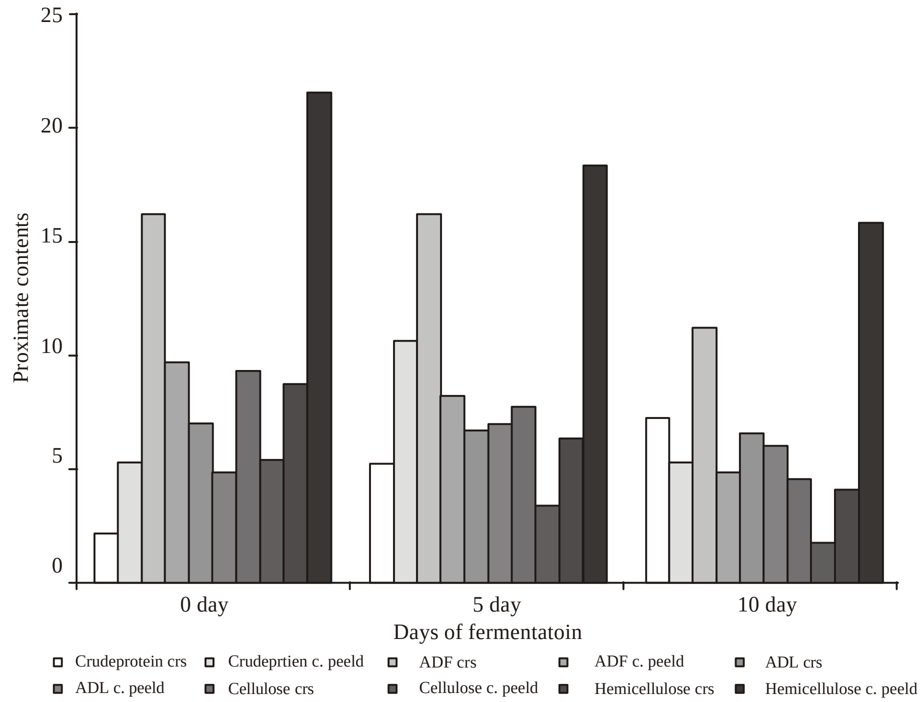

Fig. 1: Effect of *A. niger* on proximate composition of CRS and Cassava peels

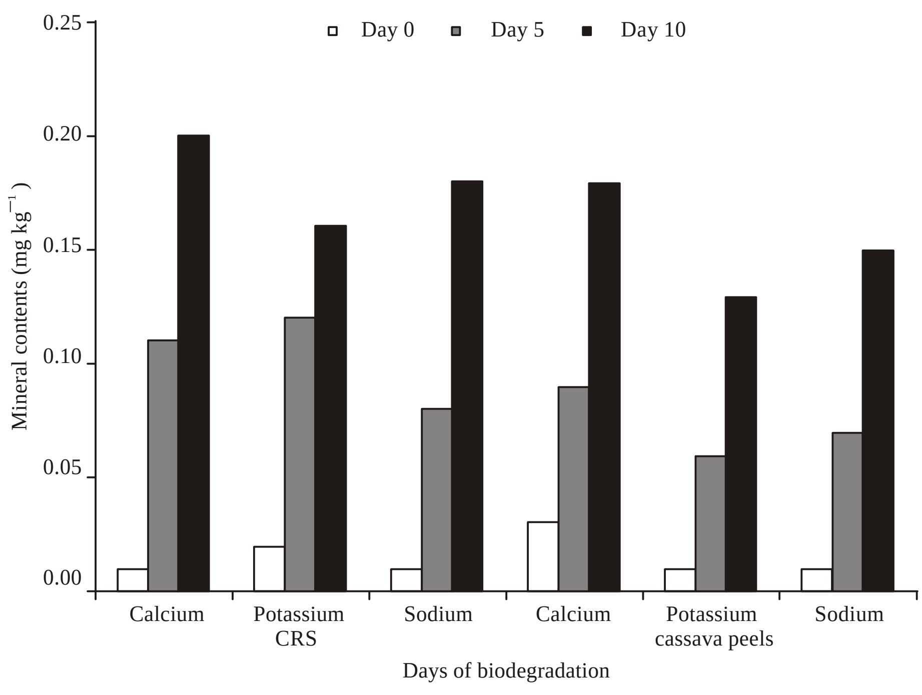

Fig. 2: Effect of *A. niger* on some mineral content of biodegraded CRS and Cassava peels

indicating continuous breakdown activity of the fungi or saccharifytic role of the fungi used. The higher the hydrolyzing or saccharifying ability of the microbes the lower the acid detergent lignin content found in the substrates. Acid detergent fiber is a combination of cellulose and lignin from the result cellulolytic ability of the microbial enzyme was obvious. Biodegradation of cassava peels and CRS also resulted in improvement of some mineral content Fig. 2. It was observed that there was improvement of the calcium, potassium and sodium as biodegradation proceeds with the highest value at the 10th day this is similar with Smith *et al.* [9].

CONCLUSIONS

The use of microbial enzymes to cleave the β (1-4) carbohydrates bond can also be used to improve the nutritional value of animal feeds. This is obvious from the result of proximate and mineral analysis obtained in this study.

Since the nutritional value of CRS and peels were improved then it follows that other non conventional feed ingredients which are readily available can also be improved upon using this method. Consequently inclusion of such into livestock feeding will imply reduced cost of production.

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