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Full Length Research Paper

A Comparative Study on the Proximate Analysis and Durability of Dried Cubed Locust Beans Condiment using Two Different Binding Agents

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Abstract
Drying of foods is an important means of preservation for agricultural products and dried foodscommand better prices compared to fresh ones and that the seeds commonly fetch two to four times as much as major staples such as maize, sorghum and millet on the market. In this study, research conducted have bring about drying of cubed locust beans condiment bounded by using two agents namely; Cassava starch and Corn Starch. Proximate analysis of the products reveals the nutritional composition of the dried cubed condiment when two different binding agents were used. Drying temperature used varied from 45°C, 50°C and 55°C, air velocity used was 0.5m/s and the source of heat was electricity to operate the dryer. The proximate composition of the cubed condiment was done to determine the effect of the binder on the end products. The results of the proximate composition of the cubes were significantly different ($p<0.05$)ranging from 25.14 - 27.49 % crude protein; 23.34 – 33.56 % crude fat; 5.98 – 7.43 % crude fibre; 2.80 -3.03 % ash; 11.34 – 11.47 % moisture and 16.90 – 27.87 % carbohydrate. Cube made with cassava starch dries faster at reduced time as compared to that of corn starch. The durability indexes are 99.91 % for IruWoro with cassava starch, 99.56 % for Iru Woro with corn starch, 99.81 % for Iru Pete with corn starch and 99.76 % for Iru Pete with cassava starch indicating that both types of locust beans cubed can withstand destructive loads.

Keywords: *Locust beans, Condiments, Binding agents, Cubed, Proximate Analysis*

Introduction

Drying is one of the oldest methods of food preservation. It represents a very important aspect of food processing. It entails subjecting foods to an atmosphere of low vapour pressure and providing the necessary heat to vaporize moisture in raw foods.Longer shelf-life, product diversity and substantial volume reduction are some justifications for the popularity of dried agricultural products. According to Lantin, (2006), a good system for drying transfers moisture from the core of the grain to its surface until such a time that moisture is evenly distributed within the system. Thus, in sun or solar drying, energy from the sun heats the grain evaporating the moisture. The natural air movement on top of the grain removes the evaporated moisture. Also, in heated air drying, the heat from the drying air vaporizes the moisture from the material and the same drying air removes the evaporated moisture away. Hence, drying is the universal method of conditioning food stuff by removing moisture to a predetermined level that is in equilibrium with the normal atmospheric air in order to preserve its quality and nutritive value.

Effective drying of locust beans will enhance its taste, flavour and increase utilization in soups. Also the condiment's availability all year round would contribute to its acceptance to the end users. It would then complement other protein sources like fish, egg and meat in local diets. Locust beans can be converted into a cube form by proper drying and processing methods. This would improve its palatability, appearance, packaging and storage, handling and usage. Hence, leads to excessive dependence on imported condiments.
The mechanism of binding during cubing is made possible by natural adhension between particles and the mechanical load which forces inter-particle contact (Tabil, 1997). According to Pietsch 1984, thin absorption layers are immobile and can contribute to the binding of fine particles under certain circumstance. High binding forces are produced when areas of contact increase during compression of solid particles (Tabil, 1997).Pietsch(1984) further stated that the attraction force between two solids is caused by van der waal's, electrostatic or magnetic forces.

Binding agents are widely used in cubing/pelleting agricultural products. However, there is little scientific documentation as related to their effectiveness.

Starches are extensively used in the food industries as thickeners or binders. Wood, 1987 reported that pre-cooked starch did well as a binder. In this study, Corn starch and Cassava starch with very high starch contents were used. The objective of the study was to determine how cubing of Africa Locust beans condiment could be improved with the use of binders.

Materials and Methods

Sample Preparation

The materials required for this part include; cubing machine, Sensitive Scale to measure the quantity for both binding agent and locust beans, Pure water for mixing the binding agent (Cassava Starch and Corn Starch).

According to the study by Food and Nutrition Department, University of Ilorin, the ratio of the binding agent to the dried milled fermented locust beans seeds is 1:5. The fermented products (dried *IruWoro* and *IruPete*) were then milled into fine particle size.
400 g of dried and milled *IruWoro* and *Iru Pete* were weighed respectively into separate bowls and 80 g of cassava starch and corn starch were used as binding agent in each case and for each fermented locust beans variety. The samples were mixed thoroughly with a stirrer to allow for uniform distribution of the binding agent to produce desired texture. The mixture was converted into cube form using a cubing machine constructed in the Department of Agricultural and

Biosystems Engineering, University of Ilorin. The die size 3 cm by 3 cm and speed 350 rpm were used. The strength characteristic of the product was determined by durability index of the product.

The dryer was pre-heated to the desire temperature using the temperature controller while the samples were prepared accordingly (*IruWoro* and *IruPete*) mixed with binding agent.

Results and Discussion

The results are obtained at different drying temperatures of 45 ^{0}C, 50^{0}C, and 55^{0}C. The factors for proximate analysis were Protein content, Ash content, Crude Fibre, Moisture content, Lipid, Carbohydrate content; these were determined using AOAC 2005 and Durability as determined by Adejumo,2007..

Protein Contents

For the fermented and cubed condiments, the Protein content ranges from 27.31 % - 27.49 % for the cubed *Iru Pete*made from Cassava Starch and Corn Starch as binding agents respectively. For the cubed *IruWoro,* the Protein content ranges from 25.76 % - 27.08 %. This shows that the Protein content varies with the different agent. The values obtained are acceptable for its use as a protein supplement and therefore useful in fighting the problem of protein malnutrition (Omafuvbe*et al*., 2004).

Ash Content

These values were all lower than the 2.95% reported by Edema *et al*., (2005) except the value recorded for cubed *IruWoro* with cassava starch that is 3.03 %. This might be due to the processing methods. Therefore, the ash content obtained in this study is within range and it indicates the mineral content of the food and binding agent have effect on the product.

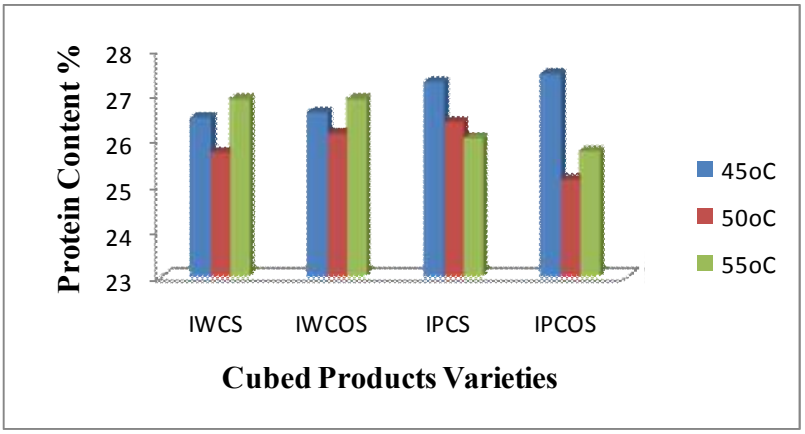

Figure 1: Effect of Drying Temperature and Cubed Product Varieties on the Protein Content

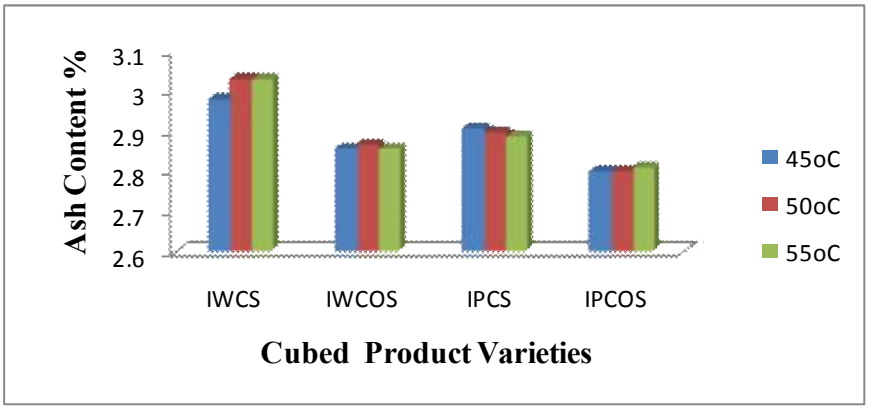

Figure 2: Effect of Drying Temperature and Cubed Product Varieties on the Ash Content

Fats Content

The fermented and cubed condiment has fat content ranges from 23.34 % - 25.89 % for *IruWoro* mixed with cassava starch and corn starch. *Iru Pete* mixed with the different binding agents has fat content ranging from 30.16 % to 33.56 %. The fat content of the condiments suggests they could be good sources of fat-soluble vitamins and could also be useful flavor enhancers (Appiah *et al*., 2012). The increased fat content might be due to some organic constituents of the locust bean becoming soluble due to heat treatment involved in the processing and drying of fermented locust beans (Ogbonnaya, *et al*., 2010).

Crude Fiber Content

The fermented and cubed condiments contain fiber content from 5.98 % - 7.43 % for both varieties. These values were higher than those obtained by Appiah *et al*., 2012 which might be due to processing methods and higher heat treatment. According to Shankar and Lanza, (1991), high fiber intake decreases chances of colon cancer and associated with reducing constipation and the higher the drying temperature, the higher the fiber content. Therefore, higher fiber content observed in the study will be most useful in minimizing colon cancer and constipation.

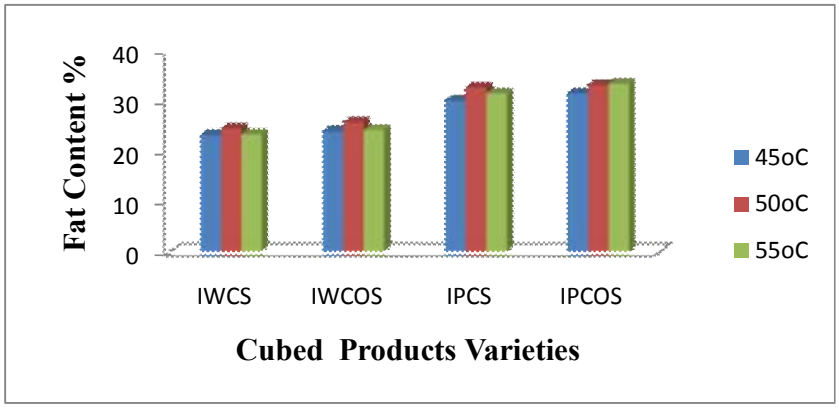

Figure 3: Effect of Drying Temperature and Cubed Product Varieties on the Fat Content

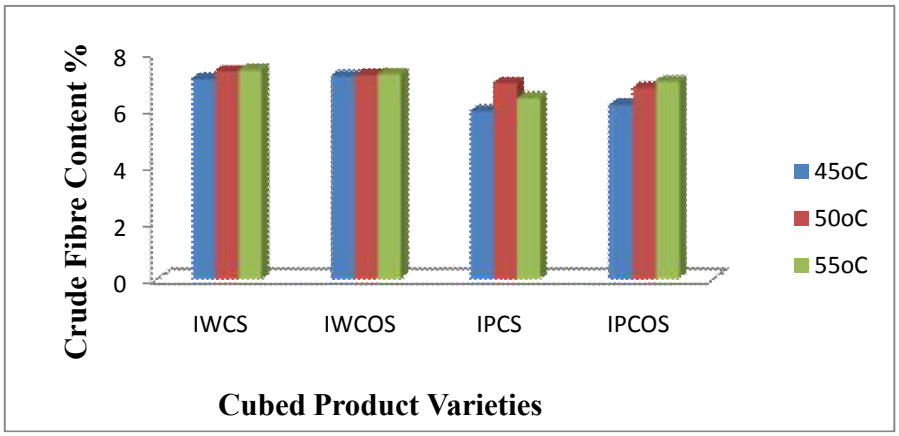

Figure 4: Effect of Drying Temperature and Cubed Product Varieties on the Crude Fiber Content

Carbohydrate Content

Fermented and Cubed Locust Beans condiments from the two varieties have Carbohydrate content ranges from 16.90 % to 27.87 %. This shows that heat source and variety affect the proximate composition. These values were lower than the 46.36% reported by Alabi*et al*., (2005). The results suggest that both *IruWoro*and *Iru Pete*would be better as energy giving condiment and in supplementing the carbohydrate content of meals in which they are used.

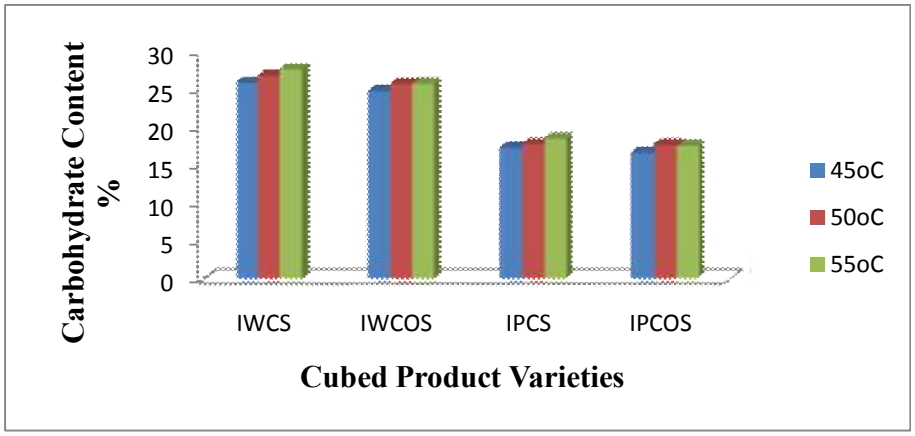

Figure 5: Effect of Drying Temperature and Cubed Product Variety on the Carbohydrate Content

Pellet Durability Index for Locust beans Cube

Durability is the ability of cubes to withstand destructive loads and forces during transportation. Result of the percentage durability is as shown in Table 1 and 2. Cubes made from *Iru Woro*with cassava starch have the highest average durability index of 99.91 % and lowest average volume of fines (particles) of 0.09 %. The second type of binder (Corn Starch),turned out to have an average durability index of 99.81 % and 0.19 % average friability of cubes.This implies that the cubes from both binder typescan withstand destructive loads during handling, transportation and preservation. It is noted that the *Iru Woro* with corn starch have higher moisture content as related to weight has cubes of lower durability index compared with *Iru Pete* combined with corn starch. This is in support of the statement made by Jennifer *et al.,* (2004) that "Increase in moisture content reduces durability. This might be because of weakness in the binding force that occurs as moisture content increases thereby reducing the durability of pellets produced (Adejumo, 2007).

Table 1. Percentage Composition of Durability and Friability From the two Product Varieties Using Cassava Starch.

	IruWoroIru Pete			
S/N	Durability (%)	Friability (%)	Durability (%)	Friability (%)
1	99.91	0.09	99.77	0.23
2	99.92	0.08	99.77	0.23
3	99.91	0.09	99.75	0.25
Mean	99.91	0.09	99.77	0.23

Table 2: Percentage of the Durability and Friability from the two Product Types Using Corn Starch

	IruWoroIru Pete			
S/N	Durability (%)	Friability (%)	Durability (%)	Friability (%)
1	99.56	0.44	99.81	0.19
2	99.56	0.44	99.81	0.19
3	99.55	0.45	99.80	0.20
Mean	99.56	0.44	99.81	0.19

Conclusion

The average drying time for fermented and cubed locust beans condiments with cassava starch was 10 hrs which shows that it dries faster than the one with corn starch of 12 hrs. In terms of durability, the addition of binder improved cubes durability for*IruWoro* cubed with cassava starch. In value addition of food, protein and fat are the target nutritional food properties. Therefore, the drying of fermented locust beans in cubed form resulted in value – added product with increase in the content of protein and fat enrichment in the condiment. It was observed from the study that the fermented cubed condiment produced and dried using *IruWoro* and *Iru Pete* possessed good nutritional properties and can serve as a compliment to sauces and soups in replacement of fish or meat.

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