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Evaluation of Detergent Residue Concentrated in Food Processed with Detergent

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Abstract: Studies were carried out to evaluate the amount of residue concentrated by cassava paste processed from cassava fermented with detergent and carrot washed with detergent. Due to effects of climate related variables on the production and processing of cassava, rural dwellers have adopted the practice of using detergent to help the process of fermentation of cassava. They also believe that soaking carrots in detergent solution makes it easier to clean. Cassava tubers were harvested in an unpolluted farm, carefully peeled, soaked in detergent water and allowed to ferment. The carrots were also soaked in increasing concentrations of detergent solutions for varying periods of time (20, 40 and 60 minutes). The amount of detergent residue accumulated in the processed cassava and carrot was evaluated using the titrimetric method. The dried cassava paste was found to contain between 0.019 to 0.177 mg/g anionic surfactant residue and between 0.058 to 0.177 mg/g cationic surfactant residue. There was a significant increase ($P < 0.001$) in the amount of residue concentrated in the exposed carrots which was both concentration and time dependent. Care should be taken by rural dwellers and the cassava processors should be educated on the risk associated with the use of chemicals to ferment cassava or process any food stuff.

Key words: Residue · Detergent · Food

INTRODUCTION

Cassava comes second in calories after maize among the most important staple foods in Africa. It accounts for about 7% of the total calorie intake of more than half of Nigerians [1]. The producing households generate a lot of income from cassava processing, coupled with the fact that cassava processing also provides food security with relatively cheap cost of production. The production and processing of cassava in recent times is challenged by many factors of which climate related variables is chief [2]. Such factors including temperature, sunlight, water and relative humidity affect the growth, yield as well as processing of cassava [3]. Cassava pastes (Akpu in Igbo and fufu in Yoruba) is made from whole roots. To make them, whole root is immersed in stream, or in water in a container, with bark peeled or unpeeled for 3 – 5 days to soften and ferment. They are taken out of water, fibers are removed from the pulp by sieving in water using a basket, fiber bag or perforated metal bowl. The mash is squeezed in a bag to remove excess water. The paste so made is steamed before eating.

Climate change has impacted negatively on the softening of fermented cassava. Interaction with indigenous processors has shown that with the unset of climate change, it has become almost difficult for cassava to soften during fermentation. As a result, cassava processors adopted some practices to enhance the softening of fermenting cassava for the production of akpu. Some of these practices include the use of detergents, nails, beans, bitter leaf and jathropa leaves to aid fermentation [2].

Carrot is a nutritional root vegetable that is eaten both raw and in processed form. It belongs to the family Apiaceae. The northern states are the major producers of carrot in Nigeria and then distributed to the other parts of the country. Carrot has been discovered to be rich in â carotene, a precursor of vitamine A [4,5].

Studies has shown that washing carrots with Omo® detergent significantly reduced the moisture, carbohydrate, calcium and sodium contents of the treated carrots [6]. Carrots also contain other nutrients such as iron, pectin, dietary fibres, complex carbohydrates and various essential nutrients [7].

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Before carrots are eaten after harvest, they are handles in different ways in the process of cleaning. One of such processes is soaking in detergent solution before washing to remove dirt and make it appealing to consumers.

This work is therefore aimed at evaluating the detergent residue in carrot and cassava processed with detergent.

MATERIALS AND METHODS

Materials

Test Substances: The test substance DET 1 and DET 2 detergents were procured from a local market in Owerri, southeast Nigeria. Succulent cassava roots (tubers) were procured from an unpolluted farm in Owerri, southeast Nigeria. The carrots were purchased from the carrot dump in Owerri.

Method: Exactly 2 kg of cassava was weighed out into eleven different containers. The cassava tubers were peeled and washed clean with water before adding 2000 ml of water to each of the containers followed by the detergent and the cassava was allowed to soak for 3 days. When the soaked cassava was softened, they were processed into paste by washing off the fiber from the pulp using a sieve and bag. The pastes were dried in the sun and samples were analyzed for residual detergent using the titrimetric method described by IPAN (2005). The containers were labeled A, B, C, D and E representing 0.5, 1.0, 1.5, 2.0 and 2.5 g/L of DET 1. Another setup labeled A1, B1, C1, D1 and E1 representing 0.5, 1.0, 1.5, 2.0 and 2.5 g/L of DET 2 was put in place. In the case of the carrot, same concentrations of detergent solution were used but the carrots were soaked for different time intervals of 20, 40 and 60 minutes in the detergent solution before washing and drying. He dried carrots were grounded and also analyzed for residual detergent using the titrimetric method described by IPAN [8].

Data generated were analyzed using ANOVA.

RESULTS AND DISCUSSIONS

Detergent Residue in Cassava and Carrot Exposed to Detergent: The detergent residue observed were grouped into Anionic Surfactant, cationic surfactant and detergent power/concentration. The result of percentage anionic and cationic surfactant residue in carrots and cassava exposed to DET 1 and DET 2 detergents showed a significant increase ($P < 0.001$) in residue. This increase was both concentration and time dependent. The same trend was also observed in the detergent power/detergent concentration.

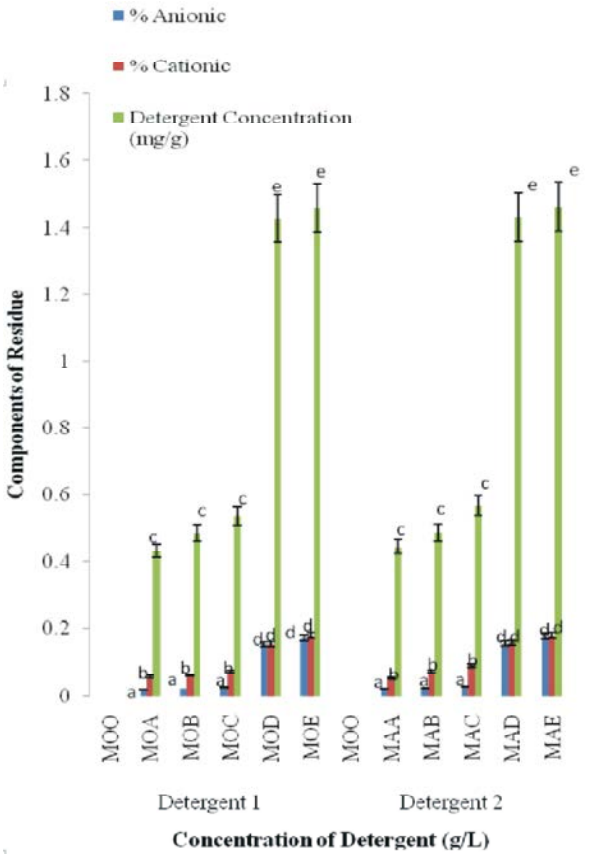

Fig. 1: Different Components of the residue in cassava fermented with DET1 and DET2 detergents.

Bars with different alphabets are significantly different ($P < 0.001$)

There was a significant increase ($P < 0.001$) in the percentage anionic and cationic surfactants residues in the fermented cassava as the concentration of detergent in the water increased.

Bars with different alphabets are significantly different ($P< 0.001$). The percentage anionic surfactant in carrot soaked in detergent at different time intervals before washing increased with concentration of detergent used and time of exposure.

Bars with different letters differ significantly ($P < 0.001$).

There was a significant increase ($P< 0.001$) in the cationic residue in exposed carrot and this increase was dependent on the concentration of detergent used and the time of exposure. DET2 concentrated more cationic surfactant than DET1

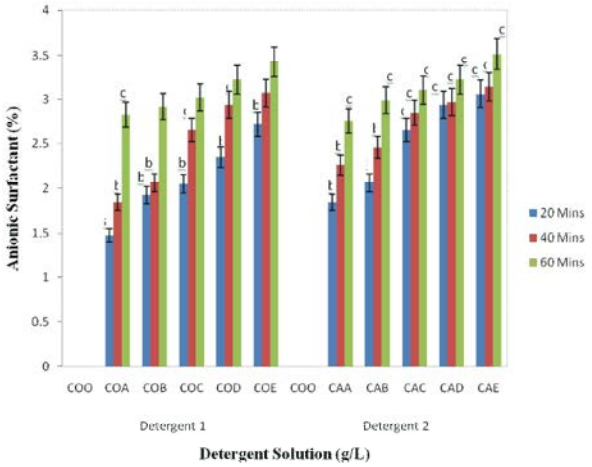

Fig. 2: Anionic Surfactant present as Residue in Carrot Washed with Detergent.

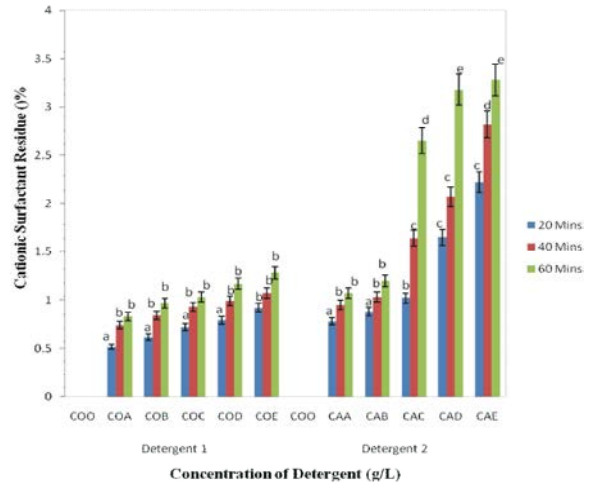

Fig. 3: Percentage Cationic Surfactant Residue in Exposed Carrot.

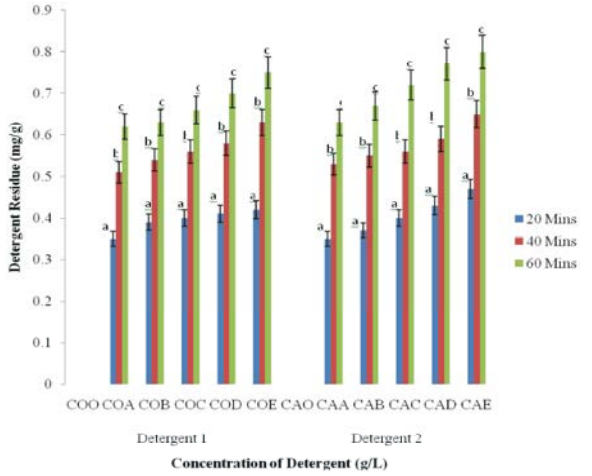

Fig. 4: Concentration of Detergent Residue in Exposed Carrot.

Bars with different alphabets differ significantly ($P < 0.001$)

There was a significant increase ($P < 0.001$) in the concentration of detergent residue in the exposed carrot. The concentration of residue increased with increase in dose of detergent and exposure time.

DISCUSSION

Detergent Residue in Exposed Cassava: It was observed from this study that there was a significant increase ($P < 0.001$) in the amount of residue present in cassava retted with detergent. The amount of residue present increased with increase in the concentration of detergent added to the fermenting cassava. Aisien and Aisien [9] reported that high concentration of detergent inhibited the growth and subsequently killed all the microbial species in cassava fermented with detergent. These microorganisms are responsible for degradation of cyanide and other substances in cassava. Cassava is a living tissue and will naturally accumulate substances including detergents if not degraded by the microbes. Fufu, meal made from cassava paste is a staple food in Nigeria. If 2 kg of cassava concentrated 1.462 mg/g detergent residue with the highest concentration of 2.5 g/L, it implies that the 2 kg cassava will contain 2.924 g detergent residue. The cassava paste realized from 2 kg cassava cannot satisfy an average human per meal. This also implies that an average human will consume at least 2.924 g detergent in their meal on daily basis.

Studies have shown that some of the components of the detergent are toxic. Surfactants interact with proteins, enzymes and membranes. They denature protein in this process which eventually leads to inactivation of enzymes [10]. The denaturation and solubilising potential of surfactants on membranes causes cell lysis [11]. Detergent enzymes also have been shown to disrupt the complex reactions for good health and survival in humans [12].

Detergent Residue in Exposed Carrot: The percentage concentration of residue in the exposed carrot increased significantly ($P < 0.001$) with increase in concentration of detergent and time of exposure. Washing carrot with Omo detergent have been shown by Chuku *et al*., [6] to decrease the moisture content of carrot, which affected the integrity of cell and eventually lead to the disintegration of the cell. When the cells disintegrate, it becomes porous and materials can pass easily into the cell. This may explain the results obtained in this study.

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