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Full Length Research Paper

Hazard analysis and critical control points in palm oil processing in Anambra State, Nigeria

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Palm oil processing with the indigenous technology which is mainly women's occupation at the village level in Akamili, Nnewi, Anambra State, Nigeria was assessed with the hazard analysis and critical control points (HACCP) system for food safety and quality. The analysis showed that the hazards existed at all stages of process. The critical control points were the sorting stage of the palm fruits, clarification to remove moisture and storage which were identified as the important operations in oil processing. These actions taken will promote gender empowerment; reduce hunger and alleviate poverty culminating in achieving food security in agriculture that meets the millennium development goals (MDGs). The actions recommended for eliminating the hazards in production of quality red palm oil are discussed.

Key words: Hazard analysis and critical control points (HACCP), oil palm, fruit, domestic, processing.

INTRODUCTION

Palm tree *Elais guineensis* Jacq. is a versatile plant of cosmopolitan economic importance in Nigeria, Malaysia, Brazil and several West African countries. The palm trunk is sawn into timber and used in constructing fences, roofing houses and reinforcing building and raw material in some paper industries. The palm bunch contains the fruits. The fibrous residue from oil extraction and the shells of the palm kernel serve as fuel for rural homes. The crude palm oil is reddish because it contains a high amount of -carotene. It is used in cooking oil for different cuisines and contains vitamin A essential for good nutrition (Edem, 2002). It is also used in edible oil refining industry. The palm kernel oil is used in confectionary, cosmetics and pharmaceutical industries (Rozman et al., 2001).

Palm oil is one of the few vegetable oils relatively high in saturated fats (such as coconut oil) and thus become semi-solid at room temperature (Opute and Obasola, 1979; Esechie, 1978). The palm kernel cake is a major ingredient in livestock feed manufacture. The bunch spikes/spikelet which are left after the fruits have been removed from the palm bunch are rich in potassium (K) used locally for soap making (Omobuwajo et al., 1997) and in tenderizing local cuisines such as breadfruit and other vegetables (Pers. Com.) . The palm tree may be described as the most useful tree so far in the Sub-Saharan Africa.

Hazard analysis critical control points (HACCP) is important at different stages or levels of process and product quality of crude palm oil. The HACCP system starts from the initial stage of harvesting the fresh fruit bunch through the method of product processing adopted and finally storage of the product. It is necessary to analyze the hazards of each unit of operation and determine ways of controlling or eliminating the hazards.

The objective of the present work is to identify the various hazards in the domestic processing techniques of oil palm fruits at Nnewi Anambra State, Nigeria and steps that should be taken to eliminate the hazards.

MATERIALS AND METHODS

Various stages of operations in crude palm oil production were analyzed for hazards and critical control points identified for reduction or elimination of these hazards by appropriate actions.

Figure 1 shows a flow diagram for domestic operations in crude

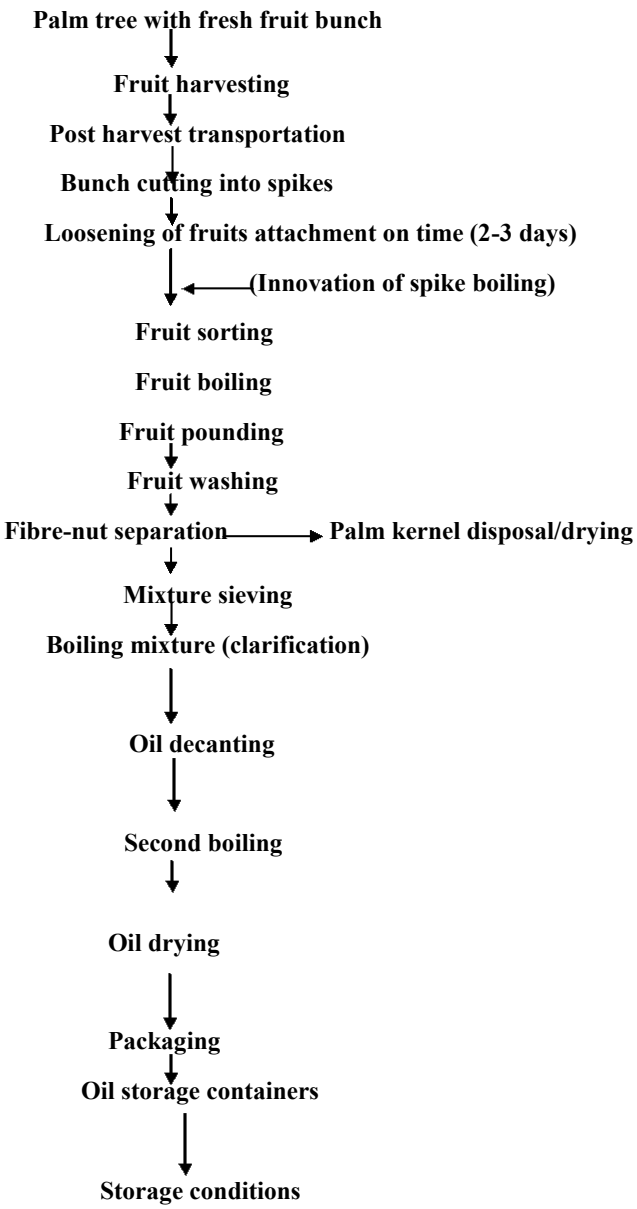

Figure 1. A flow diagram of domestic crude palm oil processing 'wet' method.

palm oil.

RESULTS AND DISCUSSION

The HACCP for processing of crude red palm oil at the domestic level in Nnewi in Anambra state of Nigeria are summarized in Figure 1 and Table 1. Twenty stages of the process were identified with the hazards associated with each stage. Good quality crude red palm oil production starts from the raw materials- palm fruits which must be fresh with minimal signs of damage or contamination from harvest to detachment of fruits from the spikes. Fruit sorting ensures that different grades of fruits are not mixed which ultimately affect oil quality. An innovation to obtain high grade fruits is boiling the fruits in the spikes for easy detachment. Badmus (1987) noted in his study that in mechanized method, the weakening of the attachment bonds of the fruits is achieved by boiling bunches. The critical control points were the boiling mixture stage to reheating stage (clarification) for removal of residual mixture from the crude palm oil. The reheating of the oil must not exceed the limit time to avoid partial bleaching and cooking of oil which will affect -carotene content. Storage conditions included dry and cool environment, storage in opaque containers (plastic,

Table 1. Hazard analysis chart.

Process step	Hazard and source	Control measure
1. Fruit bunch ripening on tree	Birds/Insects eat fruit. Entry point for microbial infection.	Regular inspection and early harvesting.
2. Dropping of ripe fruit	On the soil. Point of microbial infection and contamination with sand particles.	Regular inspection and early harvesting.
3. Fresh Fruit Bunch Harvesting Technique	Damage of fruits in the process of pruning fronds. Insects hidden. Free fall on the ground by gravity, causing bruises on some of the fruits. Increase FFA.	Skilful and careful pruning techniques. Un-bruised fruits. Alternative method to traditional harvesting method to minimize fall (Badmus, 1990).
4. Post harvest Transport	Rust and dirty basket, head pan or wheel barrow. Allows contamination and further deterioration.	Quality standard. Clean materials. Good handling practices.
5. Bunch cutting into spikes	Some fruits broken. Microbial activity.	Skilful cutting for detachment of spikes from bunch.
6. Detachment of fruits from spikes	Dirty materials for covering. Chemical activity – lipolytic enzyme changes at the base.	Personal hygiene. Good handling practices. Innovation: Boil fruits with spikes.
7. Fruit sorting	Mixed fruits of all grades. Unwashed fruits.	Grade fruits for quality control. Use wholesome fruits.
8. Fruit boiling	Contaminants from rusty containers.	Food grade and clean container. Personal hygiene.
9. Fruit pounding	Dirty mortar/pestle and environment.	Clean environment. Personal hygiene with cloak/work dress/apron.
Process step	**Hazard and source**	**Control measure**
10. Fruit washing	Cold mash.	Wash quickly. When cold add hot or warm water to release oil. Personal hygiene.
11. Fibre-nut separation	Thick (viscous) mixture.	Hard squeezing. Add hot water and filter.
12. Mixture sieving	Rusted colander, old raffia basket.	Use clean and rust free materials.
13. Clarification (Boiling mixture)	Rusted containers. Inadequate boiling period.	Rust free /Food grade containers. Boil for maximum time till foam is darker.
14. Decanting oil	Contains moisture, dirt, fibre and slurry.	Second heating.
15. Second boiling	Engrained dirt and residual moisture. Increase FFA.	Careful skimming off the dried oil.
16. Reheating	Over heating.	Heat for appropriate time limit.
17. Fibre-nut disposal	Indiscriminate and improper drying.	Keep fibre near kitchen fire. Sun dry nuts in clean environment or heap near kitchen fire for later cracking.
18. Packaging	Inadequate cooling. Odour development. Rancidity.	Allow proper cooling. Personal hygiene.
19. Storage containers	Tins, transparent bottles and plastic jars on floor. Rancidity.	Opaque or coloured plastic containers and amber glass jars on platform.
20. Storage conditions	Hot environment.	Dry and cool environment.

Product: Domestic crude palm oil: Date: March 26, 2008.

bottles, and tins) to avoid decomposition (lipolysis) from light rays. Storage containers on platform would increase the shelf life. With such good handling practice, the red palm oil produced using indigenous techniques will retain beneficial properties.

Conclusion

The various actions to take for eliminating the hazards are simple and adaptable. The processors of crude palm oil who are mainly women need these skills to ensure food safety and product quality culminating in more income from the value added to their products.

In addition, it will help in achieving food security in agriculture by promoting gender empowerment, reducing poverty and hunger.

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