

**CONTROLLING OF SHELL IN COCOA NIBS USING MECHANICAL  
METHODS**

**BY**

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## **ABSTRACT**

Cocoa was an important cash crop before the era of the oil boom. It was one of the major cash crops fetching Nigeria reasonable amount of foreign exchange. It was mostly exported in beans form. A few years back, Nigeria government decided to establish some cocoa processing plants so as to process the cocoa beans into semi-finished products like cocoa butter, cocoa cake, cocoa liquor and cocoa powder. One of the major aims of the government was to create employment opportunities through these plants. Presently, there are ten cocoa processing plants in Nigeria although some of them are not in operation. The few ones in operation still have, atimes, their products rejected in the world market due to low quality of their products. To keep the few cocoa processing plants alive and arrest unemployment it may cause which can defeat the vision of the Nigerian governments, the causes of the low quality products must be looked into and proffer solution to the causes in order to make the objectives of setting up these cocoa processing plants a reality. To get quality products, quality cocoa beans must be produced.

Some factors that make cocoa products of low quality and unacceptable in the world market are: percentage moisture content before crushing, improper fermentation (slattiness), insect attack, germinated seeds, development of mould, shells in nibs, and nibs in shells. The quality control units or department of all cocoa processing companies tried enough to control these factors except the shells in nibs and nibs in shell which are caused mechanically and needs mechanical approach for solution. Hence, the need to ensure that the shell in nibs during cocoa nibs' production is within accepted specification of 1.75% as recommended by US Food and Drug Administration (2011) to ensure high quality products (butter, cake and powder). In this work, two mechanical factors were considered in controlling shells in nibs during cocoa nibs' production; centrifugal force of the beans' crusher's hammers and their wearing rate. Impact test was conducted on dry cocoa beans

by free-fall of mass 0.2202 Kg and the wear rate of hammer calculated using results obtained from a hammer mill used in cocoa processing industry. The results show that the optimum required centrifugal force for cocoa nibs' production is 8.35 N. The wearing rate of mild steel hammers used in the beans crusher is 1.588 g/day at the optimum crushing of cocoa beans of 12.85 metric tonnes per day. This study determined the replacement days of these hammers to be every 42 days to obtain good quality nibs. It was shown in this research that as the centrifugal force increases beyond optimum, nibs in shell increases and vice versa. This research also confirmed that as the wearing rate of the hammer increases beyond 1.588 g/day, the shell in nibs increases.

When centrifugal force value of 8.35 N was used and the crusher's hammers were replaced every 42 days, the shells in nibs was brought to 1.15% which is acceptable and far below the recommended shell in nibs of 1.75% by US Food and Drug Administration (2011).

## **CHAPTER ONE**

### **1.0 INTRODUCTION**

The introduction to this research covered: background, the research objectives, justification, and contribution to knowledge.

### **1.1 Background**

Cocoa is an important crop that constitutes the bedrock of some countries economy. Its importance varies with individuals or organization. To the farmer, it is an important tropical perennial tree crop which generates his income for the upkeep of his family and himself. It has helped him raise his standard of living over the years. To the governments of many developing countries, cocoa is a premier cash crop whose export provides much-needed foreign exchange for financing capital projects. To the cocoa products manufacturers, it is the raw material which produces numerous consumer products. To the consumer, it is a food taken for pleasure, but which has a high nutritive value, making it a supplement to a balanced diet. To the researchers, whose primary concern is to ensure its continued existence with better performance, it is a fascinating tree crop with numerous challenges for each category of specialists (Olubusoye, 1994).

The relative ease and cheapness with which cocoa is processed, even by unskilled personnel, together with the fact that elaborate and sophisticated devices are not needed at the primary stage for the crop to be turned into marketable produce, has made cocoa and its culture popular among millions of peasant farmers and plantation owners (Are and Gmynne-Jones, 1973). Concentration of resources has been on the production of good cocoa beans for processing into cocoa butter, cocoa cake, and cocoa-powder for the manufacture of chocolate, cacao drinks and other cocoa-based products - pastries and cosmetics (Opeke, 1984).

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