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Determination of some Engineering Properties of Dika Nut (*Irvingia gabonensis*) at Two Moisture Content Levels as Relevant to Its Processing

Orhevba,* B.A[1], Idah, P.A, Adebayo S. E. and Nwankwo C.C.
[1]Department of Agricultural and Bioresources Engineering, Federal University of Technology, PMB 65, Minna, Niger State, Nigeria

Abstract.
Samples of African bush mango *(Irvingia gabonensis)* were collected from the wild, sun dried for four days to a moisture content of 13.75% (at an average temperature of 38.16^{0}C and relative humidity of 40.60%) and the seeds were carefully split to release the kernels unharmed. The kernels were divided into samples A and B; sample B was sun dried for three days to obtain different moisture content level from sample A. Both samples were then used for the experiments. Some selected physical and mechanical properties of dika nut were determined at two moisture content levels. This study was done under approved standard laboratory conditions using standard engineering methods and instruments. The two moisture content levels of 13.75% and 8.74% were obtained. The result revealed higher values for the physical properties at moisture content level of 13.75% . The following values were obtained for samples A and B respectively: the average length, width, thickness, weight, geometric mean diameter, arithmetic mean diameter, surface area, sphericity, volume and density were 28.97mm, 19.49mm, 11.91mm, 2.23g, 18.77mm, 20.12mm, 1111.81mm^2, 64,95%, 156.17mm^3 and 14.44g/cm^3, and 28.62mm, 18.20mm, 8.24mm, 1.15g, 16.07mm, 18.35mm, 819.02mm^2, 56.46%, 115.61mm^3 and 10.20g/cm^3. The coefficient of static friction was highest on plywood and least on glass for both samples. From the values obtained, it appears the increase in sizes of dika kernel may aid a decrease in coefficient of static friction. The force required to fracture and compress sample A are 25N and 62.5N on axial loading and 12.5N and 45N on longitudinal loading respectively. The force required to fracture and compress sample B was also gotten as 37.5N and 95N on axial loading and 27.5N and 67.5N on longitudinal loading respectively.

Key words: African bush mango, kernel, moisture content, physical properties, mechanical properties

INTRODUCTION

Dika *(Irvingia gabonensis)* is a tree of 15-40m height, with bole slightly buttressed, which occurs in the wild lowland forest with 2 to 3 trees occurring together; in some areas it is found to be gregarious. It is largely distributed in Africa (Leakey, 1999, Leakey and Tchoundjeu, 2001). Dika tree is fully utilized by native African tribes who make use of the bark, leaves, stems, fruits and seed kernels. Also, the wood is a strong and durable material for construction (Festus and Nwala, 2012). Dika tree is a commercially and socially important fruit tree of the West and Central Africa. It is also referred to as African mango, bush mango or wild mango, and the tree has been identified as one of the most important fruit trees for domestication in the region, because of its relative importance to the food industry (Ogunsina *et al.*, 2008; Adebayo-Tayo *et al.*, 2006; Leakey *et al.*, 2005). It ranks highly among non-timber forest products in its use.

Dika fruit is a drupe with a thin epicarp, a soft fleshy thick mesocarp and a hard stony endocarp encasing a soft dicotyledonous kernel. The extracts from *Irvingia gabonensis* seed has a large amount of soluble fibre and it is commonly used in Western cultures as a weight loss supplement (http://www.africanmangotreatment.com). Dika kernels are widely used in West Africa, especially for their food thickening properties. The economic importance of the kernel is further strengthened by its use as a pharmaceutical binder and a base material in the manufacture of soap, cosmetics, confectionary and edible fats (Ogunsina *et al.*, 2007; Agbor, 1994; Okafor, 1978).

Furthermore, due to the ever increasing importance of agricultural products together with the complexity of modern technology for their production, processing and storage, a better knowledge of the engineering properties of these products is necessary. However, it is essential to understand the physical laws guiding the response of these agricultural products so that machines, processes and handling operations can be designed for maximum efficiency and the