

Physical and mechanical properties of *Jatropha curcas* L. fruits from different planting densities

Abstract

Jatropha curcas L. is a versatile and rugged crop with enormous unexploited potentials. In order to efficiently take advantage of its full potentials, its physical and mechanical properties need to be well understood. Laboratory tests were conducted to investigate the properties of *Jatropha curcas* L. fruits obtained from trees of three planting densities namely 10880, 5446 and 3630 plants acre⁻¹. The properties included detachment force, rupture force, deformation at rupture point, deformation ratio at rupture point, hardness, energy used for rupture at both vertical and horizontal loading positions. Other properties studied were 1000 unit mass, dimensions, sphericity, bulk density, solid density, porosity, coefficient of static friction on plywood, steel and stainless steel. The solid density value of 0.97 g cm⁻³ was obtained which implies that the fruit could float in water for easy cleaning and separation from foreign materials. It was observed that the fruit had the least coefficient of static friction on stainless steel (0.44). The average values obtained for the detachment force and rupture force at vertical orientation were 16.62 N and 57.17 N, respectively. No clear cut trend was observed in the physical and mechanical properties with respect to planting density. However, the mechanical properties were significantly different with respect to the orientation of the fruits. Both the physical and mechanical properties are essential for the design and development of harvesting and processing machines for *Jatropha curcas* L. fruit.

Keyword: *Jatropha curcas* L.; Detachment force; Harvesting machine