DEVELOPMENT OF GRINDING MACHINE SUITABLE FOR HORTICULTURAL BY-PRODUCTS

By

HEBA MAZEN AHMED MOHAMED

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Name of Gandidate: Heba Mazen Ahmed Mohammed **Degree:** M. Sc.
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ABSTRACT

The grinding process of agricultural wastes is the important operation to produce the pre materials for many wastes uses. Then the importance of the horticultural wastes such as mango kernel, studying its properties and the operating parameter of grinding machine is the aim of this study. To achieve this goal experiments were carried out in Agricultural Engineering Research Institute (AEnRI) in 2009 –2010 seasons. The primary experiments aimed to determine some mango kernel properties (*Mangifera indica) (local variety)* that identify the grinding machine specification. The mango kernel properties were the ratio between seed and kernels, moisture content, the main dimensions (L - W - T), shpericity, the geometric and arithmetic diameters, surface area, coefficient of friction, hardness and shear stress. Based on the study properties the development and evaluation of the grinding machine was performed to suit mango kernels as hard wastes. The results indicated that the average of mango kernel ratio was about 74.5%, the average main dimensions were 53.97±21.50, 20.15±8.57 and 10.95±6.30mm for length, width and thickness, respectively. Average spherisity was(7.51±2.32%), geometric diameter was 4.19±1.76mm, arithmetic diameter was 28.35±3.88 mm and surface area 32.95±4.66 mm^2, coefficient of frictions on galvanized, stan steel and iron sheet were about 0.649, 0.674 and 0.674 respectively. Hardness (360.04±134.54N) and shear stress (230.66±92.86 N/mm^2). The studied factors included drum speeds "S" (1500, 2000, 2500 and 3000 rpm) equivalent to (28.26, 37.68, 47.10 and 56.52 m/s) and knives number "N" (24, 36 and 48 knife). The grinding machine evaluation was based on determining the product quality (frequency distribution of grinding mango kernel size and mean weight diameters "MWD") , the machine performance (machine productivity, required power and specific energy consumption.) and grinding machinery costs. From the obtained results, it can be concluded that their manure grinding machine is suitable grind the local mango kernel at a feeding quantity of 20 kg , drum speed of 2000 rpm and knives number of 36 to obtain the homogeneous size distribution The studied operating Parameters provided MWD , machine productivity, required power, specific energy consumption and operating cost : 1.309 mm, 2.94 Mg/h, 3.60kW and 1.22 kW.h/Mg and grinding one Mg recorded 47.25 LE/Mg,17.4 Mg/day respectively. The developed grinding machine which was manufactured of local materials can be tested to grind many solid wastes to increase economic performance.

Key words: Mango kernels, grinding, hammer mill, particle size, energy, rotor shaft speed, required power,

DEDICATIN

I dedicate this work to my parents, sisters, brothers and my husband for all the support they lovely offered during my post-graduate studies.

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INTRODUCTION

Grinding is one of the first basic operations when dealing with agricultural wastes directive to any of the by-products processes of grinds. Also it is the first pillar to reduce the volume of waste in order to facilitate trading and transportation .Due to the multiplicity of form and properties of these residues conducted on accurate studies should be the nature of each type of agricultural wastes until it is througen put with/without hurting the "size reduction" machine,especially when dealing with solid or large volume waste where often most of grinding machines are not suitable for such wastes.

El-Dorghamy (2010) stated that the amount of agricultural waste in Egypt ranged from 30 to 35 million tons/ year. Some of the agricultural waste are used as fodder, manufactured wood, biogas production and fuel in indoor primitive ovens that causes health problems and damage to the environment. The rest is burned in the field such as rice straw, causing local and regional air pollution problems.

The quantity of crop residues in Egypt was determined as about 40 million tons/year, beside 8 million tons/year of horticultural wastes according to the statistical survey of the (Egyptian Ministry of Agriculture,2012).Egypt produces about 534.434 tons of mangoes annually,discardab out 240 thousand tons of seeds (Central Administration for Orchards and Crops, 2010).

The all uses of mango kernels requare changing it to particles by grindig or crushing machine (Teles Rêgo *et al.*,2010).