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Design and Development of Cassava Physical Properties Apparatus

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***Abstract:* -- To develop the cassava sett planter measurement of cassava physical properties were needed. However, there is no instrument has been developed to analyse the physical properties of cassava. Cassava physical properties apparatus were designed by using of solid works software 2016. Construction of the test rig work was fabricated in the laboratory. It consists of trapezoidal frame, feed trough, angle indicator and screw shaft. The angle of feed trough can be adjusted manually by screw conveyor shaft. Cassava setts were placed on a feed trough can be used to measure the Co-efficient of friction, rolling resistance and angle of repose with different moisture contents.**

I. INTRODUCTION

In order to design a cassava sett planter some physical properties affected by moisture content are to be known. Based on some preliminary experiments coefficients of static friction were introduced as the key characteristics of cassava planter. There is no work has been published yet relating to moisture-dependent physical properties of cassava sett. Hence, it has to be measured for this study for cassava sett and also this instrument may be used for measuring the co-efficient of static friction, angle of repose and rolling resistance.

II. MATERIAL AND METHODS

Cassava physical properties such as static-coefficient of friction, rolling resistance and angle of repose have been influencing the designing criteria. Apparatus was designed using solid work software 2016 and test rig was fabricated in department of Farm Machinery and Bio energy, agricultural Engineering College and research institute, Kumulur. The components of test rig apparatus consists of trapezoidal frame, feed trough, shaft, design of bush, screw shaft, angle indicator. The mentioned above components were described below.

Design of Inverted trapezoidal frame

STwo designed inverted trapezoidal frames of top width, bottom width and vertical height from the ground level were 235, 986 and 685 mm respectively which were fabricated with mild steel L-Angle size of 40×40×3mm. However, top width and bottom width slightly bended and straightened for the stability of frame. In addition to both inverted trapezoidal frames left, right, back inner side of frame was arrested by mild steel L angle width, length and size were 257mm 510 mm and 40×40×3mm respectively at height of 307 mm from the top frame. The space between two frames was 210 mm. Front side of frame was not arrested hence feed trough was moving freely. Additionally lateral support was provided on both the trapezoidal frame at a height of 70 mm from the ground level using 25×3 mm flat size to arrest the lateral movement which shown in Figure1.

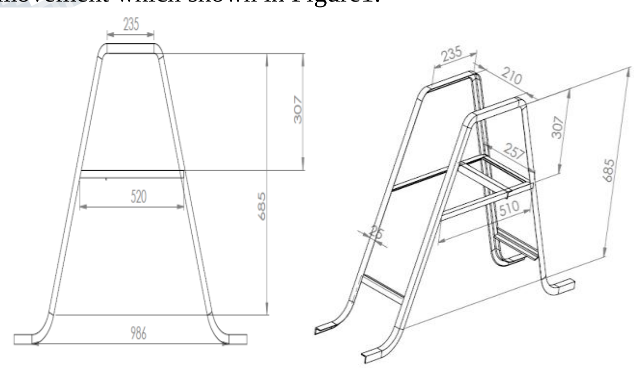

Figure.1. Developed inverted trapezoidal frame in laboratory (all dimensions in mm)

Design of Feed trough

Many researchers were reported that static coefficient of friction was found by using cylinder diameter of about 75 mm and depth 50 mm which filled with sample (Tabatabaeefar, A., 2003.,Ghasemi Varnamkhasti et al., 2008, Riyahi,et al.,2007). According to that rectangular feed trough of 75 mm depth was considered for designing. Hence, it can be used to measure the physical properties of cassava. Designed rectangular feed hopper consists of length; width and height were 500,200 and 75 mm respectively using thickness of 3 mm sheet. Length 103 mm and width of 30 mm flat welded on both side of the rectangular box which is shown in Fig.2.

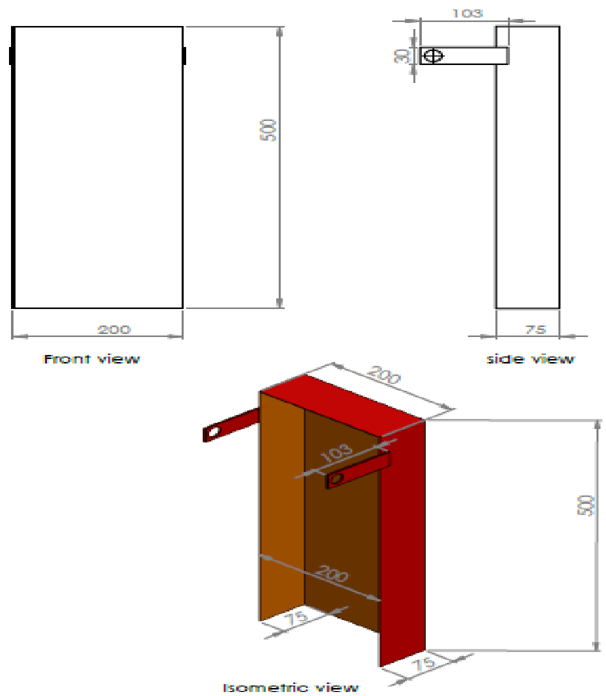

Fig.2. Developed feed trough (all dimensions in mm)

Design of Shaft

Total length of shaft was taken as 325 mm, in which shaft steps were taken in the left and right side were 50 and 75 mm made of 16 mm diameter by lathe machine and center shaft diameter 20mm with a length 200mm which is shown in Fig.3.

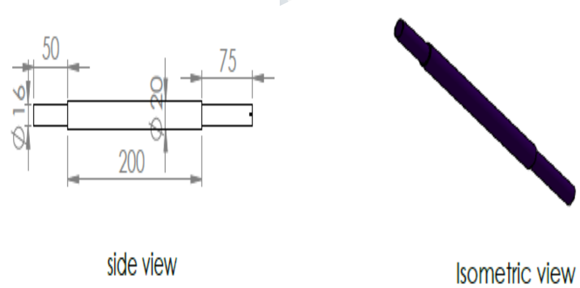

Fig.3.Developed shaft (All dimensions in mm)

Design of bush

20 mm round rod was taken which was bored 16mm diameter by lathe machine and length bush was of 35mm.additionally bush was welded over the flat using size of 30×3 mm and length flat was 85 mm Design of screw shaft 20 mm diameter of round shaft was taken and made of helical screw throughout shaft length was 400 mm and pitch to pitch distance of 5mm done by lathe machine. In addition to L shape handle welded the end of screw shaft. The dimension of L shape height and length were 170 and 70 mm respectively which are shown in fig.4.

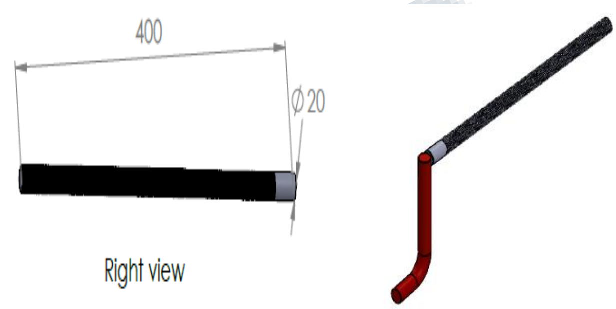

Figure.4. Developed helical screw shaft (all dimensions in mm)

Complete Assembly of developed test rig unit

A commercially available protector with angular divisions and 3mm thickness with 18mm radius was used as angular indicator for measuring the angular displacement .the protector was graduated with a least count of 0.5.A aluminium sheet was bolted at the top of the main frame and the protector was fixed to the aluminium sheet such that the center of the protector lies on the axis rotating shaft and point zero of the protector lies on the parallel to the feed hopper. One needle was fixed on the rotating shaft such that as angle indicator is free to stay at the maximum angular displacement. angle indicator needle was welded on 5mm thickness plate washer and the plate washer fixed over of the 20mm hollow bush.

Both end of shaft diameter was 16mm connected through the bush diameter of 16mm which was support by top of trapezoidal frame and arrested by bolt and nut. The rectangular feed box welded by one flat hole of 16 mm diameter was connected through the16 shaft diameter between inverted trapezoidal frame. The clearance between inverted trapezoidal frame and rectangular feed box was 5mm .The helical screw shaft was connected through a bush. The diameter of bush was 25 mm which was welded by inner support frame. The bottom rectangular feed box welded one small flat length of using size of 30×3mm MS similarly same flat size welded on bush. The bush was connected in front helical screw shaft .the size of bush was 25 mm diameter.

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Both end of flat was bored by 8mm diameter its connected one length of flat 200mm using size of 30×3mm through the hole. The flat was tightened by bolt and nut .the complete assembly of developed test rig apparatus shown in Fig 5.

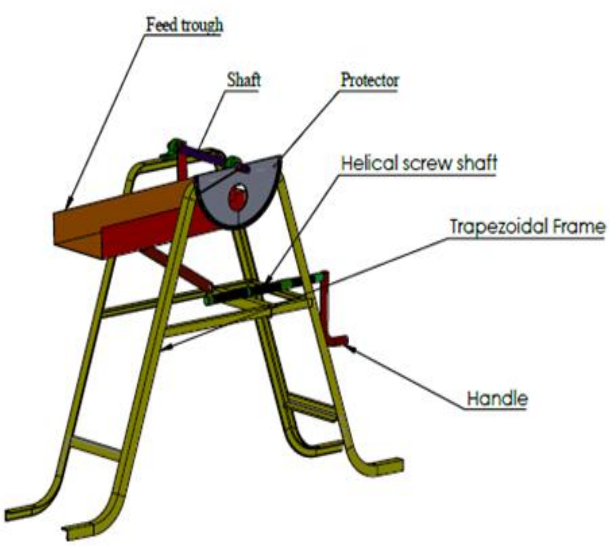

Fig.6.developed complete assembly of cassava physical properties apparatus

III. CONCLUSIONS

This experiment explained that design and development of cassava physical properties apparatus. Preliminary experiment was conducted and evaluated the influencing parameter such as co-efficient of static friction; angle of repose for cassava planter was analyzed. These instruments were worked well and the result was satisfied. The cassava setts were placed on the different material surface like mild steel, galvanised steel sheet, aluminium and acrylic sheet and observed the co-efficient of static friction with different moisture content. Moisture content decreased with respect to decreased co-efficient of static friction. Co-efficient of static friction was varied depends upon the material surface. Acrylic sheet was obtained the lower co-efficient of static friction. The developed cassava physical apparatus can also be used to measure grain gravimetric properties (i.e., angle of repose) as well as frictional properties (i.e., static coefficient of friction).

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