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REVIEW PAPER ON DESIGN AND FABRICATION OF HYDRAULIC GROUNDNUT OIL EXPELLER

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ABSTRACT
A manually operated multi-application oilseed expressing machine was designed and constructed using locally available materials. The machine consists of a frame, press plate, press cage, perforated cylinder and hydraulic jack. Each of these components was analyzed and results obtained were used as parameter for sizing and fabrication of the components. Performance tests were conducted on the oilseed expressing machine using groundnut seeds that were subjected to pre-pressing treatments of roasting temperature and duration in the ranges of 30 – 120oC and 10 – 30 min and ground in to pastes respectively. The results of performance test analysis showed that pre-pressing treatments significantly
influenced the performance indices of the machine at 1% level. Extraction rate decreased with increase in roasting temperature from 30 to 120oC and duration from 10 to 30 min, while machine extraction efficiency depended on the product being processed. The maximum extraction rate obtained was 0.00125 and 0.00133 kg/s for groundnut seeds roasted at 60oC for 10min and 30oC for 10 min respectively. The maximum extraction efficiency of 45 and 46.6% was obtained at pre-pressing
treatments of 120oC and 10 min and 30oC and 30 min for groundnut seeds respectively. Groundnut seeds treated at 30 and 60oC for 10min gave the machine maximum throughput. A unit of
the machine cost NGN16,600 as at February 2011. The maintenance of the machine is simple and it is recommended for small holders, local processors and home use.

KEYWORDS: Seed oil, expeller, press, extraction rate, Hopper, oil seed processing.

INTRODUCTION

Edible oil extracted from plant seeds, nuts and pulse is one of the five essential ingredients of human diet. It contains a range of fats soluble vitamins (A,D, E and K) and the essential arachidonic (fattyacid) all of which are required for the functioning of the body. Vegetable oils are also utilized in cooking and soap making.

Traditionally, oil is extracted from oil seeds, nuts and pulse by roasting and grinding to fine particles or paste. Afterward, the paste is mixed with water and oil is obtained by cooking the mixture or the paste is mixed with hot water and oil is obtained by stirring the mixture. The oil is then finally collected in a separate container (Hans-Jurgen and Frans, 1989).

Oil extraction process, when carried out traditionally, is energy and time consuming, tedious and of low oil recovery. Also the cooking process or handling of hot mixture can be hazardous and discouraging to processors. Khan and Hanna (1983) and Ibrahim and Onwualu (2005) extensively reviewed the technologies involved in the extraction of oil from oil-bearing agricultural products and confirmed the above short comings of the traditional methods. Thus, there is the need to mechanize oil extraction to reduce the drudgery involved in the traditional means of extracting the commodity. There are a number of mechanical extractors with good oil recovery (Weiss, 1983; Oluwole et al., 2003; Oluwole et al., 2007) but the majority of these extractors are medium to large scale equipment. These equipment are normally complex and present the problem of maintenance, accessibility of spare parts and availability of power source inputs (Ibrahim and Onwualu, 2005) making them uneconomical to small-scale farmers. Therefore small-scale manually operated hydraulic oil press will no doubt be a suitable substitute to traditional means of extracting vegetable oil, because of its lower initial and operating costs and ease of handling and maintenance (Reddy and Bohle, 1993)

The main aim of this study was to design and construct a multi seed oil pressing machine. Other specific objectives are to evaluate the performance of the machine in terms of oil yield, extraction rate, extraction efficiency and machine throughput capacity.

MATERIALS AND METHOD:

DESIGN OF THE OIL EXPELLER:

The manually operated hydraulic pressing machine was designed, fabricated and assembled. Figure 1shows the design and assembly flow chart of the machine. In the flowchart, the system (machine) was separated into its subsystems. The oil press was designed to work on the principle of compression from piston (press plate) to squeeze out oil from the paste. Therefore selection of material and sizes of machine units were based on stress-strain analysis of each component as presented in Table 1. The thickness of the press plate was determined from the longitudinal stress developed inside the perforated cylinder as a result of the action of the hydraulic jack. Circumferential or hoop stress was utilized to determine the thickness of the perforated cylinder. The sizes of the top and bottom flat bars were determined from bending moment analysis due to the load developed by the hydraulic jack and weight of machine components supported by the flat bars.

Analysis of lateral and longitudinal withdrawal resistant was performed to determine the sizes of bolts and nuts suitable for fastening the machine components.

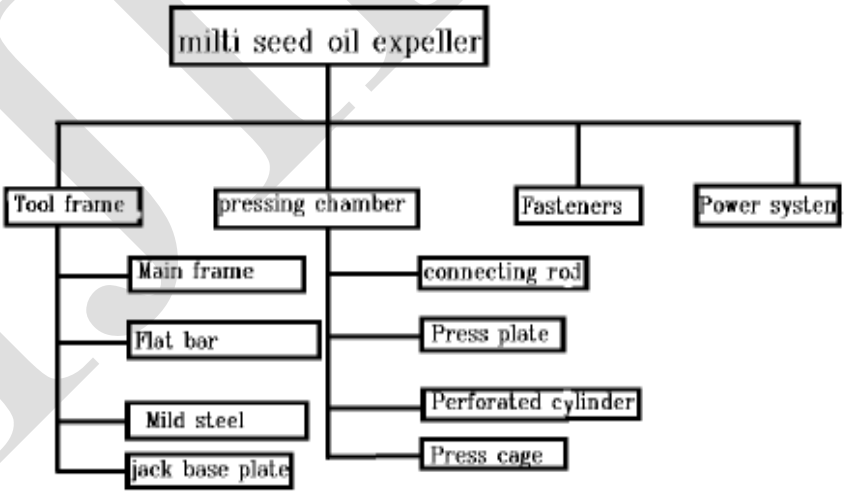

Figure 1: Design and assembly flow chart of manually operated seed oil extractor.

MACHINE DESCRIPTION AND OPERATION

The expeller with an overall height of 125cm, length of 62cm and width of 45cm, is composed of a frame pressing chamber oil collection chute connection elements and the power system. The frame is the subsystems of the machine to which all other components are attached and it is made of angle iron and flat bars. The hydraulic jack provides the power needed to carry out oil expression in the pressing chamber and

it is supported on a flat bar at the base of the machine. To operate the oil seed press, moistened and heated oil seed paste of 1 kg mass is fed into the perforated cylinder, which already has a cloth-like sieve inside. The cylinder is placed inside the press cage and the hydraulic jack spindle is raised using the pedal . As the pressure gradually increased overtime by the pumping of the pedal, the spindle raises the press cage and the cylinder that it contains. The perforated cylinder which is aligned with the press plate comes in contact with the paste of the oil seed and compresses it to release the oil. The released oil drips from the side of the perforated cylinder into the press cage. The oil flows through the delivery chute and is collected using a cup or basin. When oil flow ceases, the hydraulic jack is lowered and the perforated cylinder removed from the cage and emptied of the cake. To withstand the pressure exerted by the hydraulic jack, the frame is constructed and firmly mounted on a worked surface. The machine does not occupy large floor space and it has a sturdy outlook.

RESULTS AND DISCUSSION

Results of performance tests showing the variation of oil extraction rate, extraction efficiency and throughput for guna and groundnut seeds with roasting temperature and duration are presented in the oil extraction rate decreased with an increase in roasting temperature and duration for guna and groundnut seeds. The maximum oil extraction rate of 0.00125 kg/s and 0.00133 kg/s for guna and groundnut were obtained at roasting temperatures of 60 and 30oC, and roasting duration of 10 min respectively. Extraction efficiency for guna oil increased with an increase in roasting temperature and duration. Guna seed roasted at 120oC for 30 min gave the highest oil extraction efficiency of 45%. The oil extraction efficiency for groundnut decreased from 36.5 to 33% as the roasting temperature and duration increased from 30 to 120oC and 10 to 30 min respectively. The throughput of the extractor for guna and groundnut seeds decreased with an increase in roasting temperature and duration. The maximum throughput for the products was 0.0083 kg/s. The results indicated that the extraction efficiency of the expeller was product dependent.

CONCLUSION

A manually operated multi-application seed oil press was designed, constructed and tested to evaluate its performance. It was found to be efficient in pressing oil from groundnut seeds. Generally pre-pressing treatments influenced the machine performance indices. Extraction rate and machine throughput decreased with increase in roasting temperature and duration. However machine extraction efficiency appeared to depend more on product than pre-pressing treatment. The highest performance coefficient was observed with groundnut followed by seed. The machine is easy to operate and maintain. It is highly recommended for small-scale production of edible oil where oil extraction is done manually. It is recommended that for

good performance, hydraulic jack with large capacity should be utilized and groundnut oil seed should be thick enough to withstand the pressure developed by press plate without escaping so that it will yield much oil.

REFERENCES

1) Gomez, K.A. and Gomez, A.A. (1983): Statistical Procedure for Agricultural Research. An International Rice Book. A Wiley Interscience Publication, New York.

2) Hans-Jurgen, W. and Frans, W.K. (1989) *"Small Scale Processing of Oil Fruits and Oilseeds" Publication of German Appropriate Technology Exchange (GATE), D-65726, Eschborn, Federal Republic of Germany.*

3) Ibrahim, I. and Onwualu, A.P. (2005). *Technologies for extraction from oil-bearing agricultural products: A review. Journal of Agricultural Engineering and Technology, 13: 58 – 70.*

4) Khan, L. M. and Hanna, M. A. (1983). *Expression of oil from oilseeds – A review. Journal of Agricultural Engineering Research, 28: 495- 503.*

5) Oluwole, F. A., Abdulrahim A. T. and Aviara, N. A. (2007). *Development and performance evaluation of spindle press for oil extraction.*

6) *Arid Zone Journal of Engineering, Technology and Environment. 5: 66-75.*