

A Review on Design and Development of Groundnut Peeling Machine

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Abstract

Worldwide groundnut is widely consumed by people. It is sixth most important oilseed crop in the world. It contains 48-50% oil and 26-28% protein, and is a rich source of dietary fiber, minerals and vitamins. Groundnuts are grown on a small scale by farmers in developing countries like India. The major problem in groundnut production is the lack of groundnut processing machines available to farmers, which do not satisfy the market demand. This paper mainly focuses on the review of design and fabrication of groundnut peeling machine. The various reviews show that the development of groundnut peeling machine is very helpful in domestic and small industrial application to improve the productivity, also cost effective and time saving.

Keywords: Groundnut, Red Skin, Peeling

I. INTRODUCTION

Groundnut is the sixth most important oilseed crop in the world. It contains 46-50% oil and 25-28% protein, and is a rich source of dietary fiber, minerals and vitamins. It grows best on soils that are well drained, loosely textured and well supplied with calcium, potassium and phosphorus. Over 100 countries worldwide grow groundnut. As per the FAO STAT, United Nations in 2018 the world production of groundnut was 44 million tonnes, which is led by China with 38% of the global total followed by India 16%. Other significant producers were Nigeria, the United States, and Sudan. The production in millions of tonnes as follows: China 16.6, India 6.9, Nigeria 3.0, United States 2.6, Sudan 1.8, and rest of world 44.0.

As groundnut is utilized in various food processing industries, various agriculture industries, and various domestic products. Even though India is at second position of producing groundnut in world, but still in developing countries like India, farmers take groundnut production in small scale. In addition of that there is lack of groundnut processing machineries at affordable cost. The large size groundnut processing machines are available in market but that are costly and not suitable to local entrepreneurs and farmers. In various groundnut processing industries or at local business, in the beginning the groundnuts or peanuts were separated from their shells by the workers. The output from this method was very less and could not satisfy the market demand as it was a very time-consuming process.

II. LITERATURE REVIEW

Many researchers are trying to develop the economical machines which are utilized to remove the red skin on peanuts. Many researchers try to develop the economical machine for same purpose, which will help farmers as well as small entrepreneurs, basically the research in this area is divided into two segments: the manually operated and power operated machines. Oladeji et al. [1] during his research designed and developed manually and electrical power operated roasted groundnut decortating machine. The decortating machine which is powered manually or by 0.161 HP, 1500 rpm electric motor comprises of the hopper which contains the unpeeled groundnut seeds and is opened directly to the decortating unit. The body of work is made with galvanized steel of thickness 1mm. The dimension of the body inside the frame is 580 mm x 180 mm x 580mm. The frame of the work is made with mild steel square bar of thickness 20 mm. The frame is of size 600 mm x 200 mm x 600 mm. The decortating unit comprises of rotating inner drum of length 550 mm and a diameter of 60 mm with brush-like projections and a shaft of 68mm passing through its centers and a fixed cylindrical drum of length 600 mm and diameter 120 mm. The inner drum with a rotation speed of 150 rpm is attached with the help of a v-belt and two pulleys to the electric motor which drives it in an anticlockwise direction to peel the groundnut seeds. The peeled groundnut seeds and the chaffs fall directly into the cleaning unit where an installed fan blows away the chaff and the seeds are collected directly through an opening below the decortating unit. The machine was made from locally sourced materials and it can be used in both urban and rural areas even where there is no electric power supply. The percentage of roasted groundnut seeds peeled in manual and electrical operation in three successive runs was found to be 52.3% and 61.7% respectively.

Vinay M. Nirmale et al. [2] worked on design and development of electrically operated roasted peanut peeling machine, after that the testing and analysis of peanut which includes size variation, compressive strength, roasting temperature and time of roasted peanuts. Basically there are two types of peanuts which are widely used for domestic and industrial applications of food products.

Java type and bold type respectively. During this research bold types peanuts was used as they are mostly used in confectionary and food industries also out of total peanut consumption 60% to 70% are of bold type as well as its compression strength is greater than other peanuts. Also it having long in length and sweet in test than other. The length of peanuts varies in the range of 14 mm to 18.4 mm and diameter of peanuts varies in the range of 9 mm to 10.6 mm. The average compression strength of bold type peanuts with roasting is 308 gram/cm². For effective peeling, peanut should be sand roasted and sand temperature is kept in the range of 150 °C to 160 °C for 45 seconds to 60 seconds. In testing an average of 5.042 kg of roasted peanuts was fed into the machine; this produces an average mass of 3.989 kg of peeled roasted peanuts, 0.605 kg of unpeeled peanuts and 0.448 kg of broken peanuts. An average time of 248 seconds and efficiency of 79.129 % was recorded. The fabricated machine was easy to operate and had a peeling capacity of 75 kg/hrs. The fabricated machine was useful in confectionary and food industries for need of peeled roasted peanuts. Figure 1 shows the fabricated model, also it can be used for domestic as well as for industrial applications. The weight of machine was around 18 kg so it can be transported anywhere for use. The rate of peeling of machine was about 75 kg/hr. And the efficiency of machine was 79.13%. This machine reduce manpower and production time.



Fig. 1: Peanut Peeling Machine

This research work of Agbonkhese A. Kingsley et. al [3] was focused on the design and fabrication of a portable dry groundnut husk peeling machine electrically powered by a 1 H.P electric motor in order to reduce the rigors encountered by the traditional (manual) method of peeling while optimizing the production of good quality groundnut seeds. The machine was designed, fabricated and tested. The materials for the fabrication were locally sourced which makes it cheap, easily affordable and maintainable. The performance result presented in table 1 shows that the peeling efficiency and capacity of the machine are 92.14% and 36.12 kg/hr respectively. The performance test of the groundnut husk peeling that resulted in a peeling capacity around 35 kg/hr, with a percentage of split husks at 35% and when compared with the manual method that only produces 4.2 kg/hr/person, the portable groundnut husk peeling machine using a rotary peeler could save energy and time (increasing work efficiency) and enhances productivity. The machine meet the need of small scale and medium scale farmers.

Table – 1

Test Results on Groundnut Peeling

S/N	No of Peeled Seeds (A2)	No of Unpeeled Seeds (A3)	Broken or Shattered Seeds (A4)	Partially Peeled Seeds	No. of Peeled Groundnut Seeds A5= (A2 + A4)	Peeling Efficiency (%) = (A5/A1 * 100)
1	230	16	15	6	235	91.43
2	228	12	12	5	240	93.39
3	220	12	18	7	238	92.61
4	221	14	14	8	235	91.43
5	223	17	13	4	236	91.83

Ikechukwu Celestine Ugwuoke et. al. [4] focused on the design and development of a manually operated roasted groundnut seeds peeling machine. The details design analysis was mentioned in research. Figure 2 shows the fabricated model, the machine comprises a specially designed peeling chamber which greatly reduces the amount of breakages during peeling and a transmission mechanism which greatly reduces the required effort to drive the system. It has a peeling efficiency of about 85 %. The machine is easy to operate and has a capacity of 5.4 kg/hr of roasted groundnut seeds. With such capacity, the machine can be used both in medium scale industries and also for domestic needs of peeled roasted groundnut seeds.



Fig. 2: Roasted groundnut seeds peeling machine

The design and development of a low cost groundnut decorticating machine for home and commercial use in Nigeria was developed by P.O. Ebunilo et. al. [5]. In his research work detailed designed of decorticating machine was given, During operation 4.36 Kg of roasted groundnut was fed into the machine; this produces an average mass of 3.43 Kg of peeled roasted groundnut seeds, 0.462 Kg of unpeeled groundnut seeds, 0.399 Kg of partially peeled groundnut seed and 0.07 Kg of broken groundnut seed. An average time of 488.8 seconds and an average peeling efficiency of 78.46 % was recorded. It was observed that the higher the mass of the roasted groundnut seeds the longer the time of peeling. The machine is cheap because the parts are locally fabricated. The technology provide employment and at the same time make available quality roasted groundnut seeds at low cost for domestic and commercial use. Pratima G. Mungase et. al [6] developed a screw conveyor peanut shelling machine with human power operation. The rotary motion was obtained by the sprockets of a bicycle which rotated by pedaling action. This rotary motion was used to rotate the shaft of a screw conveyor. The peanut get crushed in between the flights around the shaft and the casing of the conveyor. Peanuts are delivered into the conveyor with the help of a hopper. The overall efficiency of machine was 79.61 %.

The modeling and performance testing of a groundnut extracting machine was done by Onwuka et. al [7]. The machine was designed and fabricated by Onwuka as per for market oriented production. The formal procedure of designing was adopted which involves synthesis, design and specification of components and material selections which includes mild steel sheet, galvanize sheet, copper tubes, brass taps. The operations involved including folding, cutting, welding, brazing, etc. after the testing of this model, the result showed good agreement with performance prediction.

A roasted groundnut blanching machine was designed by A.M. Akintade et al. [8] with the aim of reducing drudgery associated with manual blanching of roasted groundnuts. Fabrication and performance evaluation were carried out at the Department of Agricultural and Environmental Engineering, Federal University of Technology, Akure, Nigeria. Roasted groundnuts purchased at a local market were used for performance evaluation. Three operating parameters: blanch clearance, blanch speed and feed rate, were considered for the purpose of this research. Three levels each of feed rate, brush speed and blanch clearance were compared. Blanch clearances were varied from 10 mm to 20 mm at an increment of 5 mm for three different feed rates of 0.2 kg/hr, 0.4 kg/hr and 0.6 kg/hr respectively, while blanch speed was varied from 100 rpm to 200 rpm with an increment of 50 rpm. The machine blanching capacity was found to be 36.91 kg/hr. Changes in blanch clearance, feed rate and blanch speed affected the blanching efficiency, cleaning efficiency, and mechanical damage. Maximum values of blanching efficiency of 89.46% and cleaning efficiency of 91.39%, and maximum mechanical damage of 53.02 % were obtained at blanch clearance of 10 mm and blanch speed of 200 rpm. Minimum values of blanching efficiency of 44.56 %, cleaning efficiency of 41.70 % and mechanical damage of 9.90 % were also obtained. Results show that the feed rate has effects on the evaluation parameters, with blanch speed having a positive relationship with evaluation parameters.

III. CONCLUSION

The above literature review shows that the roasted groundnut peeling machine is very applicable for small farmers and local business production. In some case the operation of this machine were manually and electrically. The operational and process performance showed that the machined peeled well over an average of 80 % of roasted groundnut seeds. Which can be used in various domestic application, food industries, oil industries and many more. It will save the time, energy as well as human efforts, also cost of machine fabrication is less, which will help for more production of peeled groundnuts.

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