

## DESIGN AND DEVELOPMENT OF OIL SQUEEZING MACHINE FOR SESAME SEEDS

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### 1. ABSTRACT

Sesame is an important export commodity for Ethiopia contributing 46% of the country's total foreign exchange earnings based on IMF 2014 report and this amounts to 10% of gross domestic product. Ethiopia is known for its high quality organic products of different type of oil seeds, among those product sesame seed, linsed seed and sun flower seed being traditional products of Ethiopia farming system found at its early stage. The farm lands are owned by small holder farmers. These farmers do not follow mechanization and neither applies fertilizers for oil seeds, nor did use improve seed. As a result the yield per hectare is not improved yet. Ethiopia is one of the leading sesame seed producer and exporter countries of the world. While Ethiopia exports almost all of its products to China, India and other countries of the world, there is still a problem to get enough income by exporting sesame seeds to the foreign countries and there are not many industries which process oil using machinery imported from foreign countries. Some small scale processing industries use locally made sesame oil processing machines. This shows that there is a need to find a new way of processing sesame oil so that one can produce quality oil and development of small scale machines for producing sesame oil so that they can be fully manufactured locally. This thesis work aims at designing and developing oil squeezing machine for sesame seeds with local talence and manufacturing capability.

Key words: export, quality, mechanization, earning, leading farm land, squeezing, talence, farm land

### 2. INTRODUCTION

Consumption of oil in Ethiopia is increased as the result of increasing demand brought about by the rapid population growth and improved living standards of the rural areas. As a result, there has been a serious shortage of edible oil on the market and exaggerated rise in price where the government was forced to intervene. The intervention of the government, however, hasn't brought about a sustainable solution and it has opted to ensure a different direction. Believing that fixing the price alone can't ameliorate the shortage sustainable; it is working hard to adopt technologies that will play pronounced role in improving the availabilities of the most demanded goods like oil by producing them locally. To assess the existing situation of the oil industries in Ethiopia, a number of researches indicate that the significance of the edible oil sub-sector in the Ethiopian economy has been declining. For instance, the edible oil sub-sector accounted for 1.5 percent of the value added of the Ethiopian manufacturing sector in 1995/96, while the level of contribution, at 0.7%, shrank by half in 2003/04. On the other hand, Ethiopia is one of the highest potential oil-rich seeds producers. Ethiopia is the fifth world producer in linseed and sixth in sesame seed and a leading producer of Noug.

### 3. RESULTS AND DISCUSSION

#### 3.1. CONCEPT OF MACHINE DESIGN

Before we design a machine and its components first we should have to know what a design concept deals about. The subject Machine Design is the creation of new and better machines and improving the existing ones. A new or better

machine is one which is more economical in the overall cost of production and operation. In designing a machine component, it is necessary to have a good knowledge of many subjects such as Mathematics, Engineering Mechanics, Strength of Materials, Theory of Machines, Workshop Processes and Engineering Drawing.

### 3.2 GENERAL CONSIDERATION IN MACHINE DESIGN

When we design a machine component we should have to undertake these considerations in our mind .among them here are some points;

- Type of load and stresses caused by the load ;
- Motion of the parts or kinematics of the machine;
- Selection of materials;
- Form and size of parts ;
- Frictional resistance and lubrication;
- Convenient and economical features;
- Use of standard parts ;
- Safety operation;
- Assembling;

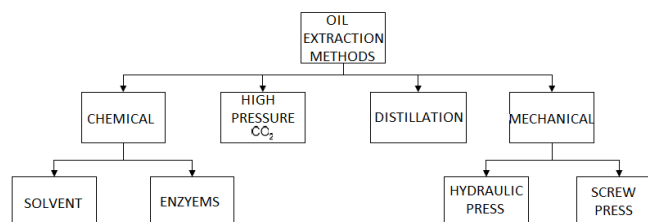
### 3.3 GENERAL PROCEDURE IN MACHINE DESIGN

In designing a machine component, there is no rigid rule. The problem may be attempted in several ways. However, the general procedure to solve a design problem is as follows:

- Recognition of need
- Synthesis:
- Analysis of forces
- Material selectio
- Detailed drawing

### 3.4 COMPARISON BETWEEN OIL EXTRACTION METHODS

There are basically four types of oil extraction methods as represented in Figure -1 ---. First one is the chemical extraction method in which enzymes or solvents are used to extract oil. In the solvent extraction type, a solvent is mixed with the ground seed. Grinding process is necessary, because the contact area of the seed with the solvent should be maximized in order to increase the oil yield. In general, hexane is used as solvent which is a petroleum distillate. Then by heating the oil up to 100°C, solvent is separated from the oil. Theoretically, after this process, oil gets free of solvent. However, microscopic portions of solvent remain both in the cake and the finished oil.



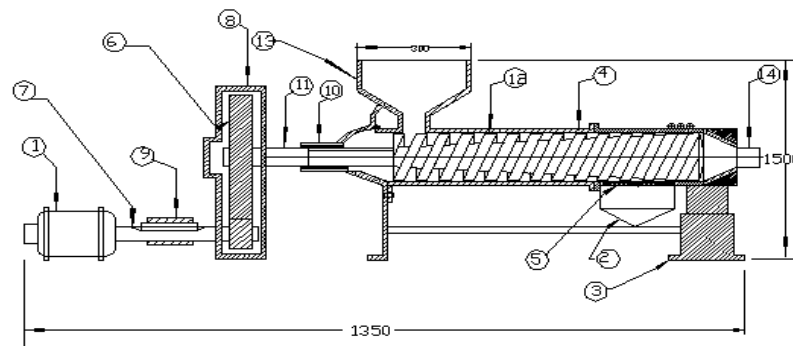
The oil extraction process by using enzymes is implemented by big vegetable oil companies because the process produces many high value products. The seeds are cooked and put into water. Enzymes are then added which digest the solid material. The basic difference of this type of extraction method from the solvent type is that the residual enzymes in the oil are separated by the use of a liquid centrifuge. In the high pressure (super critical, at 31°C and 70

bar) carbon dioxide extraction, seeds are mixed with high pressure carbon dioxide in liquid form. Then oil dissolves in the carbon dioxide. When the pressure is released, the carbon dioxide becomes a gas and the oil is left. Most essential oils are extracted using steam distillation. As the steam break down the plant, it's essential; oils are released in a vaporized form. When these pass through cooling tanks, the volatile essential oils return to liquid form and are separated and are easily isolated as pure essential plant oil. Other oil extraction method is a mechanical process. Mechanical extraction method is the oldest known method. It is based on mechanical compression of the seeds. Different mechanisms can be used for compression. There are two well-known mechanisms which are called the hydraulic press and screw press mechanisms. [8] proposed a system, this fully automatic vehicle is equipped by micro controller, motor driving mechanism and battery. The power stored in the battery is used to drive the DC motor that causes the movement to AGV. The speed of rotation of DC motor i.e., velocity of AGV is controlled by the microprocessor controller. This is an era of automation where it is broadly defined as replacement of manual effort by mechanical power in all degrees of automation. The operation remains an essential part of the system although with changing demands on physical input as the degree of mechanization is increased.

Part drawing

- 1 motor
- 2 oil tray (collector)
- 3 frame
- 4 press chamber
- 5 vessel
- 6 spur gear
- 7 key

- 8 gear box
- 9 muff coupling
- 10 bearing
- 11 shafts
- 12 screw shaft
- 13 hopper
- 14 conical type of nozzle



ASSEMBLY DRAWING OF OIL SQUEEZING MACHINE

4. CONCLUSION, RECOMMENDATION AND FEATURE RESEARCH WORK

In the part it is briefly describes the project looks like and it tells the main idea of the oil squeezing machine for sesame. And the recommendation and feature research work are also included and inserted to this part these points are the crucial things for achieving of the project in a good way and to develop or redesign by others or by us for the next research.

4.1 CONCLUSION

The project is trying to encompass the different methods of design concepts and design analysis for the screw press oil squeezing machine of sesame seed. To design that we are using different configurations of screw shafts to crush

and convey the sesame seed. In our design we already select the tapered screw shaft because the pressure increases along the screw profile. The outside diameter is constant whereas the root diameter is inclined through the screw and the seeds are fed at where the thread depth is maximum. And in the screw press oil squeezing machine the production oil recovery rate increases by using the gear reduction mechanism in order to maximize the crushing rate of torque in the screw. Because if we use a gear reduction mean when the small gear is rotated to the large gear the torque that is used to rotate and to crush ability also increases dramatically its speed of rotation decreases. Since the peoples of Welkaite are using the traditional way of oil squeezing machine by using animal power then, the production rate of oil recovery is very small and they consume much amount of time. That is why design screw press oil squeezing machine for sesame and when we compare it with the traditional way of oil squeezing machine it is more powerful and efficient based on the oil recovery rate and the time they consume.

#### 4.2 RECOMMENDATION

It is recommended that for the next generation for this particular thesis should be focused in order to accomplish the design by using two screws that are feeding the sesame seed at a time equally it produce high amount of oil recovery rate. And they should be used some special mechanisms of removing the cake from the conical type of the end of the tapered screw. Also it is recommend that for the future the design of oil squeezing machine that is done by us should be modified by others and it should be in the campus.

#### 4.3 FUTURE RESEARCH WORK

In the future research work we want to modify this type of oil squeezing machine until its manufacturing and preparing direct prototype that is used in order to change into performed function since the demand of this edible oil is very vital for human beings and even its cake is also used for animal food.

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