Project Report of Group #14

Sristi UNICEF summer innovation school 2017

Manual Cold Press OIL Extraction

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I would like to thank the almighty for giving me the strength and health to do this project work.

I wish to express my deepest gratitude to Sristi UNICEF summer innovation school for constant guidance, encouragement and support. I warmly acknowledge and express my special thanks for inspiring discussions and infallible suggestion.
I also grateful to Professor. Anil K. Gupta, Founder, Honey Bee Network, who has been a constant source of inspiration for me throughout this dissertation.
Thanks to The Almighty, my Parents and my Brother for their continuous support and encouragement to strive for my goals.

Finally, I would like to thank all my friends who are always beside me.

ABSTRACT

In this thesis Manual Oil Extracting Machine at a small scale can be used as a main source of income from forest produce. A simple control technique has been proposed for maximum power output with less effort and a large band of operation. Description of the proposed Manual Oil Extraction Machine along with model results which as certain its feasibility are given to demonstrate the availability of the proposed machine in this project.

In this project, a stand-alone Manual Oil Extraction Machine consisting of different techniques has been proposed.

Figure 1 Cage Press Prototype

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Chapter 1 Introduction

1.1 Overview

At the Sristi Summer Innovative School, we were guided by Professor Anil Gupta and we have started working on the problems which are faced by the tribal people living in the Udaipur North Forest Area.

With the guidance of Om P. Sharma (very decorated officer of Rajasthan Forest Department). His very intellectual and initiative team, in case of bringing the backward class people or for the people who are still living in Tribes. As following there guidance we are going make a low cost machine due to which high employment rates can be provided to the people living in remote place or in Tribes.

To solve the problems related to the Tribal people who are living in the forests, we have gone in between the Tribal people in their area and we had spent time with them and notice difficulties which are faced by them and some of their difficulties are also experienced by our group. To properly study the difficulties we have gone to three sites and meet the people at their livelihoods. Where we were assisted by Forest Ranger Shree Bhupendrasingh Bhanawat and Shree RF Rajesh Goswami for understanding the problems of tribal people.

The students interacted with Tribal People to understand the difficulties faced by them in everyday life and observe the impact of VFPMC (Village Forest Protection and Management Committee, Rajasthan). Three locations in Dewla district were visited. Total 50000 hectares of forest region is included in the Udaipur North Forest Region. Whereas 11000 hectares of forest area is under the observation and guidance of Forest Ranger Shree Bhupendrasingh Bhanawat.

Why Manual Oil Extraction Machine?

This specific Oil Extracting Machine presents many benefits to the tribal people. More specifically for individual person, group, family, etc. Therefore it can be operated during the period when there is no electrical supply using the man power to continue its function. For this reason, Manual Oil Extraction Machine work well together in a remote place and they provide a more consistent year-round output than electrically operated. Finally, it is economically sound and advantageous to use non finite resources.

1.2 Objective and Concept

- To harvest high nutritional and herbal content from the forest resources.
- To minimize the use of materials.
- To use the single machine to harvest Oil and herbal extracts from seeds.
- To use the single type of machine at the multiple places.
- To save the materials by stopping the unwanted production of machines.
- To come near to have this machine as the base source of income.

- To start the output at low power input by the man power.
- High dependability on forest produce/resources.
- High reliability on the income from the forest produce/resources.
- To increase the efficiency of the machines which extract the oil from the seeds
- Multiple designs of the machine can be implied on the same base of concept of this machine.

This machine can be modified as per the various factor which includes, topography where it is to be used, density of seeds resource, as per the flow of renewable energy blades can be modified, ETC.

1.3 Oil Extraction

- An oilseed press is a machine that lies at the center of vegetable oil extraction. This is due to the fact that this technology is designed to release oil from oilseeds.
- Multiple oilseed press layouts have been developed over time to complete this process, with each having its own distinct set of advantages and disadvantages.
- Moreover, the products that are created by oilseed presses, namely oil and oilseed meal, possess great nutritive benefits for humans and livestock respectively.
- The oilseed press, being at the center of the oil-extraction process, is joined with various other pieces of equipment and procedures that form a pre- and post-extraction system.
- Breaking it down to its simplest formulation, the process that oilseed presses carry out appears is quite simple.
- Oilseed presses essentially extrude or 'press' vegetable oil from oil-bearing seeds, which include soybean, sunflower, peanut, safflower, canola, sesame, niger, castor bean, linseed, mustard, coconut, olive, and oil palm.
- The simplicity of this procedure is shadowed by the diversity of oilseed press designs that perform it.
- As seen in Table 1, oilseed press designs can be placed into the three major classes of traditional, manual, and mechanical presses.

Chapter 2 Problem Statement

- The main problem that the area is have a lack of electricity due to the poor transmission lines.
- Because of this they are unable to do many basic things like processing wheat, storing vegetables etc.
- The people are unaware of the economic potential of the products they collect.
- Another basic problem is unemployment.
- The medical facilities for these people is nearly 60Km's from the village.
- As the tribal peoples have to pay 2Rs/Kg if they go to oil extraction site and receive only the oil which is enough for the eating and extra oil is kept by the person having oil extraction machine.
- The aloe vera grinding machine at the processing unit is very large and there is the minimum amount of 20 litres required to run the machine, which may not be available all the time.
- Forest fires are very common in the season of Apr-May (nearly 45 days).
- Leg pain because of excessive walking atleast 10 to 15 Km's per day
- Death of the new-born due to unavailability of medical support and vaccination.
- The tribals are humiliated in terms of proper pay by the markets and the mandis where they sell the seeds.
- Because of lack of awareness these people are not given the profit according to the market price of the seeds.

2.1 Observations & Discoveries

As officers who are not just doing their jobs, Om P. Sharma, the officer of Rajasthan Forest Department and his team working under his enthusiastic environment has helped to provide employment to the Tribal people by manufacturing the herbal products, allowing the people to collect specified oil seeds and herbal plants and to grow new trees as per the requirement of the forest.

There is an association formed by the forest department officers and the tribal people, in which there is the committee of 200 persons where 15 of them are representative of the tribes and there is special provision for the women's representation as the rate of women's which are employed is nearly 100%.

Figure 2 Field Interaction with Tribals

As we observed that the houses of the tribal people are very far from each other and mostly on the top of the hill. And in case of emergency they signal each other by playing drums. They also select to live on the hill to guard their farms and to be safe from wild animals.

70-80% of the tribal people are dependent on the forest and the forest produce. Most of the men from the village go for the labour work to the nearby areas, which include road construction, forest cultivation, digging pits for rain harvesting (which is seasonal from Feb-March).

We also found that at least one person from every house goes for the seed collection, so from this we get a clear idea that seeds are available to each and every household.

Whereas by collecting the oil seeds and selling it to the middle men or to the traders, proper valve of the seeds are not paid to the people and due to that the sufficient need of the people is not satisfied in some cases. The work process in which the local women collect seeds from the forest produce. The rotten seeds are removed and best ones are collected and sold to the middle man and to the mandis (marketing yards operated by Forest Department). The price which is paid to the tribal people for the oil seeds are:-

Item	Price per Kg (INR)
Mahua	30
Malkangni	150-200
Ratanjyot	22

When the season for the above mentioned work and labour is not suitable, the villagers go for cattle farming which usually include goats only. The villages are involved in the plantation of the forest where they have to dig pits 45Cm * 45Cm which they think is the toughest job for them as a soil in the area where they work is tightly packed and contains a lot of rocks so they can only dig 15 pits per day.

They usual family income of most tribal is upto rupees five month per month. While returning from the site we saw many children selling forest fruits on the highway.

2.2 Recommended Solution

Traditional presses include ghanis, water extraction systems, and other methods. Aside from the ghani, these designs are generally low yielding and particularly labour intensive. Moreover, all the traditional forms mentioned operate on a batch system. This entails that only a given amount of oilseed can be processed at a given time and, when the oil has been extracted, the pressed oilseed must be cleaned out of the machine. Despite these setbacks, traditional oilseed presses are basic in their design and are composed of easily obtainable or easy-to-manufacture equipment.

As for manual presses, cage style and ram presses are the general layouts. While cage presses operate on a tedious batch system,[3] the operation of ram presses is continuous. The latter point about the ram press design is joined by multiple other advantages that are listed in Table 1. These advantages are especially attractive for developing nations.

The final major class of oilseed presses, the powered press, is dominated by the expeller. These presses also exhibit continuous operation. Furthermore, they are available in a great range of sizes that can process anywhere from a few kilograms per hour to multiple tons per hour. These and other positive attributes (Table 1) are countered by how powered expellers require electricity or fossil fuels and how the components of expellers can wear quickly.

Chapter 3 Methods of oil Extraction

Methods of oil extraction with their devices are described below in the table.

Table 1: Advantages and Drawbacks of Various Oilseed Press Designs

Oilseed Press Class	Oilseed Press Design	Description	Advantages	Disadvantages
Traditional	Ghani	Ghanis originated and are still used widely on the Indian subcontinent. They essentially consists of a large mortar and pestle. Motors or bullocks are utilized to rotate the pestle within the mortar, Some motor-powered ghanis possess a rotating mortar and stationary pestle. The pestle forces out oil and allows it to run out of a small hole in the base of the mortar. When a sufficient amount of oil is extracted, the meal is removed and a new batch of oilseed is added.	-No preliminary grinding of oilseed is required. -Fair yield of high-quality oil -Low operating costs and can be manufactured locally	-Within 3 to 4 hours, a bullock operating a ghani becomes tired and must be replaced by another. -Manual models are slow and require a skilled operator for optimum oil extraction.
	Water Extraction	Ground oilseed is boiled for several hours and oil is skimmed off the surface. The oil is then heated to remove any water that persists.	-Equipment is readily available, uncomplicated procedure -Final heating removes water and improves shelf life of oil	-Low yielding -Laborious process -Long boiling sessions consume substantial quantities of fuel -Oil-water emulsions can form and these cause for issues in removing traces of moisture in the final process.

	Other	There are various methods of extraction including wedges, levers, heavy stones, and twisted ropes.	-Simple machines, easy to access equipment	-Low yielding, small capacity, physically demanding
Manual	Cage Press	A press plate or piston is forced through a vertical perforated cylinder via a threaded rod, large scissor levers, or a hydraulic cylinder.	-Maximum pressure can be maintained for a short period of time, allowing for the small amount of remaining oil to be squeezed out. -Simple to use	-Like the traditional designs, cage presses operate on a batch system. Only a set amount of oilseed can be pressed at once and the press must be cleaned out after each batch. -When using a hydraulic cylinder for applying pressure, care must be taken so that hydraulic fluid does not leak into the product.
	Ram Press	The ram press consists of a piston that is manually forced through a horizontal perforated cylinder via a lever. Upon the piston's return stroke, more seed automatically falls into the compression chamber, which is otherwise closed off by the piston. A hole at the end of the chamber provides an exit for pressed material and can be adjusted to regulate the pressure exerted.	-The gap at the end of the cage and the piston's ability to act as its own valve allow for continuous operation. -Smaller models can be operated with ease by women. -Buckets, screens, plastic sheets, and containers are the only extra equipment required. -The design allows for increased 'shearing' action which contributes the breakdown of material and extraction of oil. -Much higher efficiency with some materials as compared to cage presses. -High pressures of 190 to 200 kg/cm^2 are attained. This is similar to the 170 kg/cm^{2}pressures applied by small	-Attempting to press particularly hard seeds causes for decreased oil yield and may result in the press being damaged.

			expellers and is greater than the maximum 125 kg/cm^2 applied by cage presses. -Can be effectively manufactured and repaired locally -Unlike for cage presses, the seed coats of soft-shelled seeds do not have to be removed.	
Powered	Expeller	Oil expellers are composed of a rotating worm within a horizontal cylinder that gradually increases the pressure on the oilseed within. Like for the ram press, an adjustable choke at the end of the cylinder can adjust the pressure that is applied.	-Continuous operation -Predominant power-driven oilseed press design in the world -Models that process anything from a few kg/hour to tons/hour are available. -Friction within the cylinder generates heat that improves oil yield. -Small and medium-sized powered expellers exert high pressures on the raw product.These pressures are 170 and 540 kg/cm^2 respectively.	-Electricity or fossil fuels are required to drive larger models. -Motorized expellers produce lower-quality oil as compared to cold-press systems. -The rings, choke, and the end of the worm wear down quickly. Ready access to parts and skilled labour is a requirement.

Note: *Pressure is a good indicator of pressing efficiency for oilseed presses.

3.1 Proposed Method

3.1.1 Roller crusher

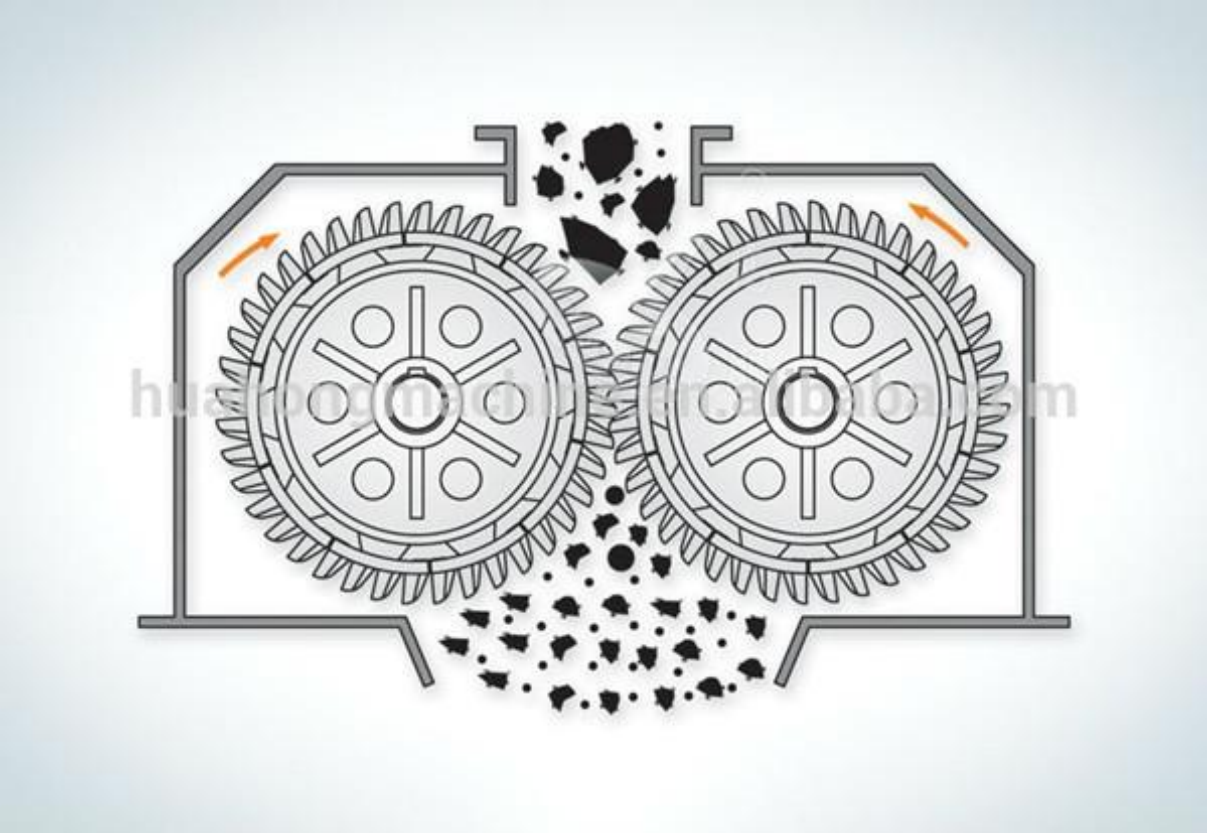

Figure 3 Roller Crusher

Roller mills are mills that use cylindrical rollers, either in opposing pairs or against flat plates, to crush or grind various materials, such as grain, ore, gravel, plastic, and others. Roller grain mills are an alternative to traditional millstone arrangements in gristmills.

As described in patent application no. 486825 filled on 9th July 2017. Has a problem of shaft breakage due to uneven loading when the screw press is feed directly. This problem can be removed by just adding a roller crusher before the screw press.

While working, motor or manually drives the hanger of the grinding roller to rotate through V pulley and centre bearing. The roller, which is hung by bearing and pendulum shaft, will roll along the inner circle of the roll ring while the hanger is rotating. A dust removal blower will generate negative pressure at the inlet and outlet of the grinder to prevent dust and radiating the heat in the machine.

3.1.2 Screw Press / Expeller Press

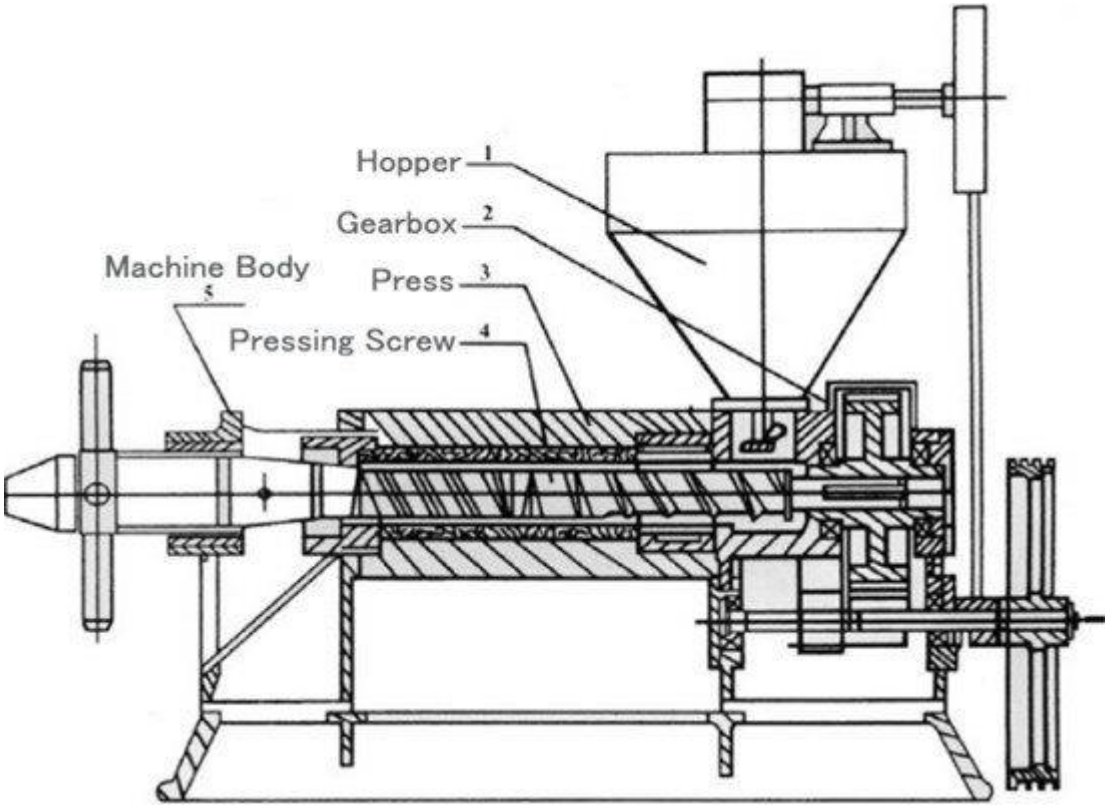

Figure 4 Screw / Expeller Press

Expeller pressing (also called oil pressing) is a mechanical method for extracting oil from raw materials trademarked by Anderson International Corp. Mr. Valerius D. Anderson founded the V. D. Anderson Company in Cleveland, Ohio in 1888. In 1900, Mr. V. D. Anderson created the first successful continuously operated Expeller press. The raw materials are squeezed under high pressure in a single step. When used for the extraction of food oils, typical raw materials are nuts, seeds and algae, which are supplied to the press in a continuous feed. As the raw material is pressed, friction causes it to heat up; in the case of harder nuts (which require higher pressures) the material can exceed temperatures of 120 °F (49 °C).

An expeller press is a screw-type machine that mainly presses oil seeds through a caged barrel-like cavity. Other materials used with an expeller press include but are not limited to meat by-products, synthetic rubber and animal feeds. Raw materials enter one side of the press and waste products exit the other side. The machine uses friction and continuous pressure from the screw drives to move and compress the seed material. The oil seeps through small openings that do not allow seed fibre solids to pass through. Afterward, the pressed seeds are formed into a hardened cake, which is removed from the machine. Pressure involved in expeller pressing creates heat in the range of 140–210 °F (60–99 °C). Some companies claim that they use a cooling apparatus to reduce this temperature to protect certain properties of the oils being extracted.

Expeller processing cannot remove every last trace of liquid (usually oil) from the raw material. A significant amount remains trapped inside of the cake left over after pressing. In

most small-scale rural situations this is of little or no importance, as the cake that remains after the oil has been removed finds uses in local dishes, in the manufacture of secondary products, or for animal feed. Some raw materials, however, do not release oil by simple expelling, the most notable being rice bran. In order to remove oil from commodities that do not respond to expelling or to extract the final traces of oil after expelling, it is necessary to use solvent extraction.

By merging both the mechanisms we can get near to the optimum output and reduce the maintenance of the machine. Here is the photograph of the combined mechanism.

3.1.3 Cage Press Oil Expeller

Figure 5 Cage Press Oil Expeller

A press plate or piston is forced through a vertical perforated cylinder. Via a threaded rod, large scissor levers, or a hydraulic cylinder. Maximum pressure can be maintained for a short period of time, allowing for the small amount of remaining oil to be squeezed out.

- Simple to use
- Like the traditional designs, cage presses operate on a batch system.
- Only a set amount of oilseed can be pressed at once and the press must be cleaned out after each batch.
- When using a hydraulic cylinder for applying pressure, care must be taken so that hydraulic fluid does not leak into the product.

Chapter 4 Mind Map

4.1 Oil extraction

- Low cost manual oil extraction of oil bearing seeds

4.1.1 Material Input

1 Mahua

Figure 6 Mahua

Figure 7 Mind Map of Mahua

2 Jyotismati

Figure 4 Jyotishmati

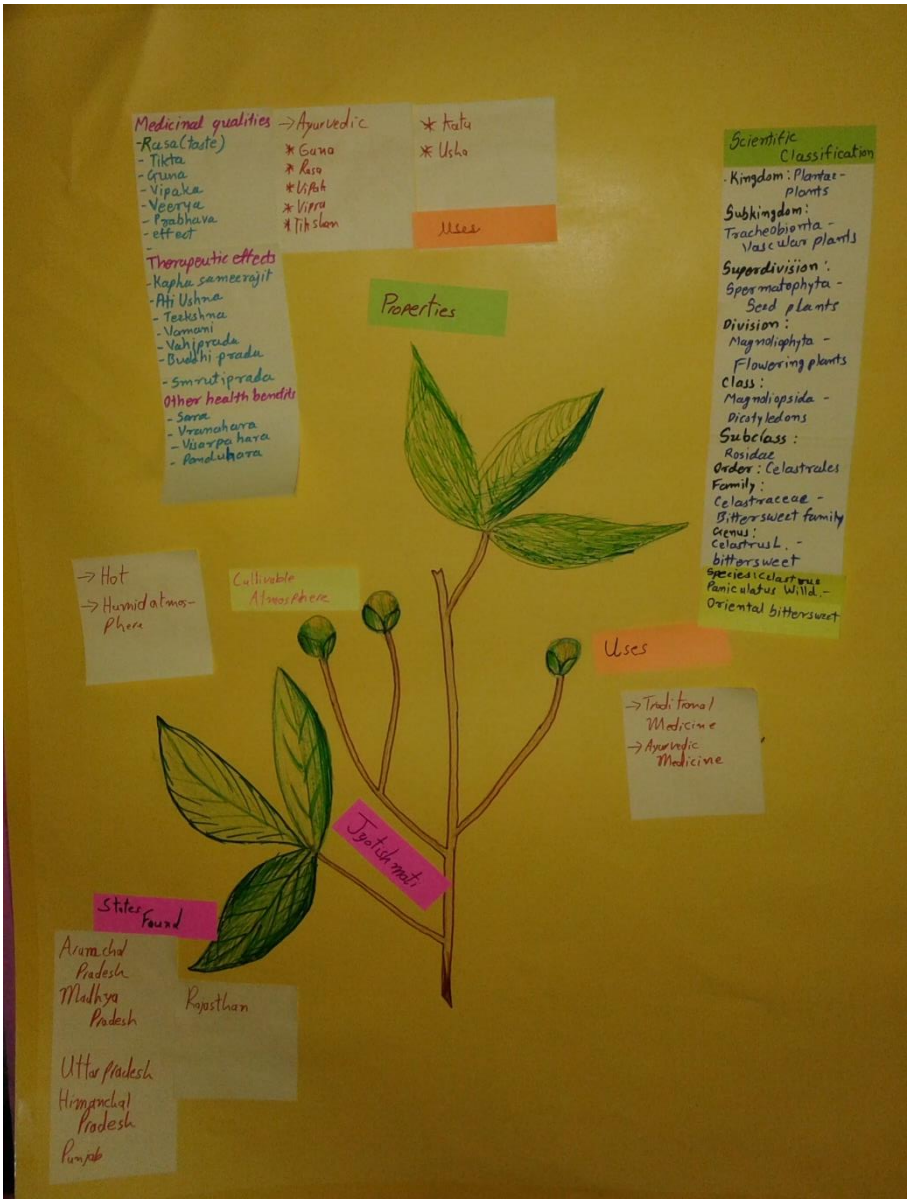

Figure 8 Mind Map of Jyotismati

3 Neem leaves and Seeds

Figure 9 Neem leaves and seeds

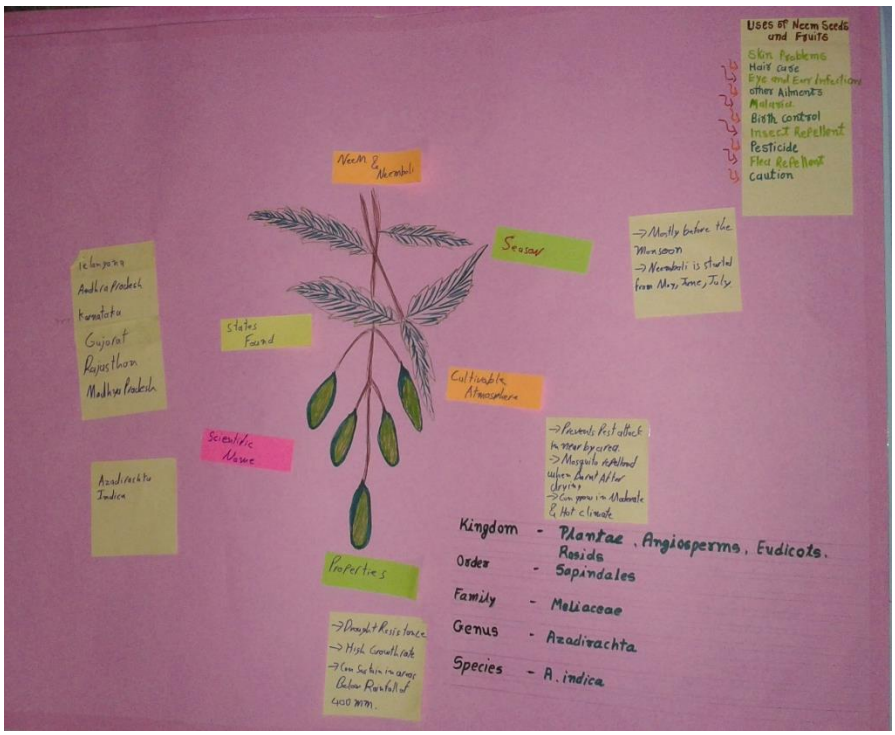

Figure 10 Mind Map of Neem leaves and seeds

4 Nagod

Figure 11 Nagod

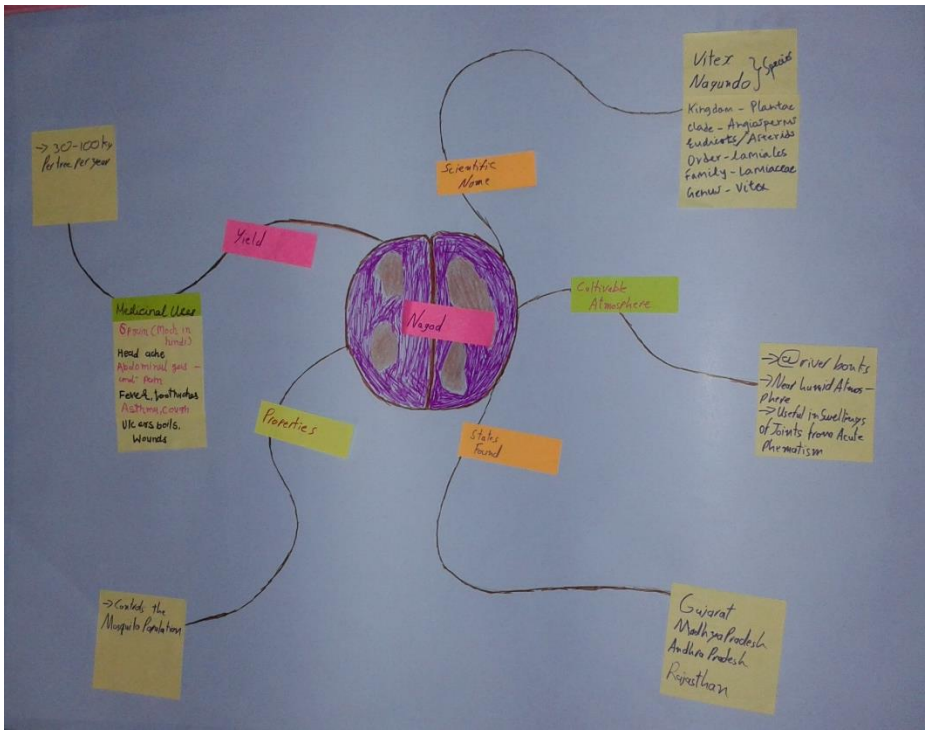

Figure 12 Mind Map of Nagod

5 Karanj

Figure 13 Karanj

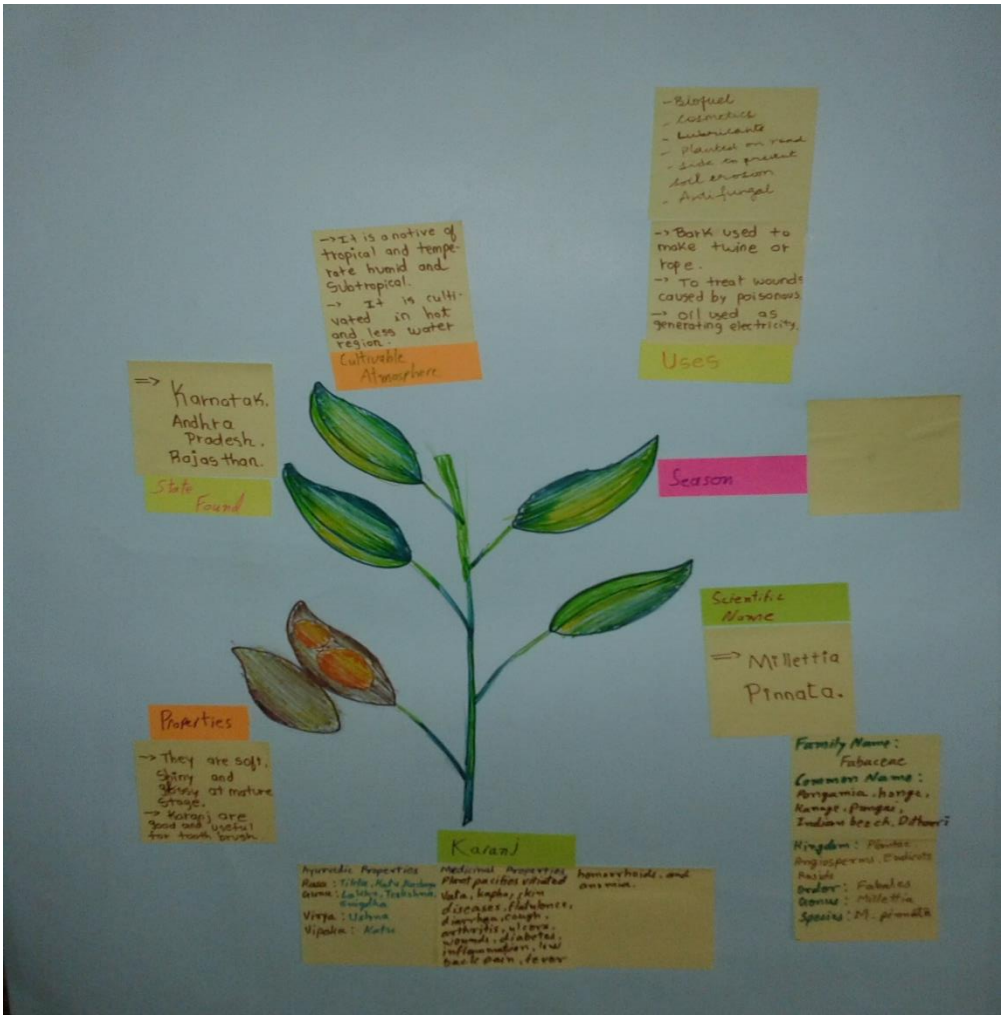

Figure 14 Mind Map of Karanj

6 Chirmi

Figure 15 Chirmi

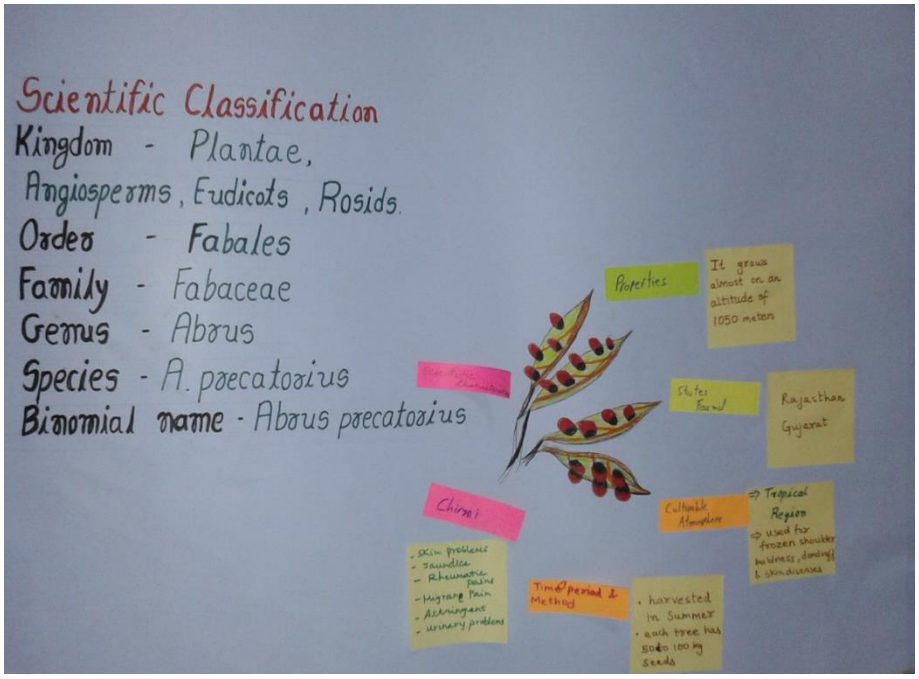

Figure 16 Mind Map of Chirmi

7 Sundari

Figure 17 Sinduri

Figure 18 Mind Map of Sinduri

8 Ratanjot

Figure 19 Ratanjot

Figure 20 Mind Map of Ratanjot

9 Katkaranj Seeds

Figure 21 Katkaranj seeds

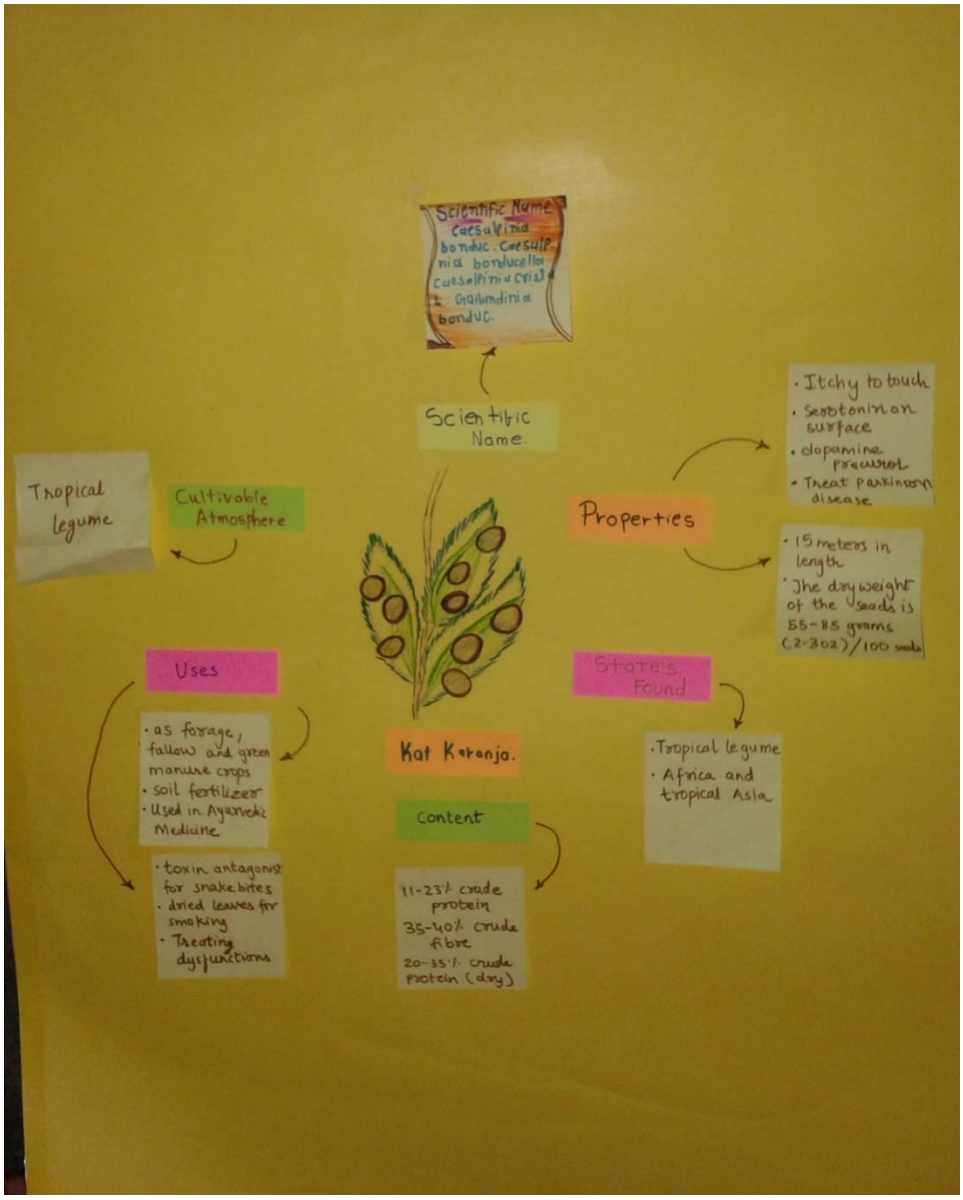

Figure 22 Mind Map of Kat Karanja

4.1.3 Current Method

4.1.3.1 Traditional Ghani

- Low output
- Time consuming
- Cattle driven
- Heavy weight
- Oil absorbtion

4.1.3.2 Centralized Electrified Ghani

- Dangerous for operator
- Costly in terms of operating cost

4.1.3.3 Centralized electrified Oil press

4.1.3.3.1 Advantage:

- Mass production

4.1.3.3.2 Disadvantage:

- Over-heating resulting in destruction of nutrient contents (temperature must be under 70 degree Celsius)
- Heavy weight and therefore not portable
- Costly in terms of machine cost and operating cost
- Shaft failure due to uneven loading

4.1.4.1 Oil/herbal extract

- Home use
- Medicinal use
- Small scale business

Figure 23 Information Mind-Map

Chapter 5 Conclusion

Villagers were aware that extracted oil has much higher value than unprocessed seeds sold, which was quite a surprise for us as we didn't expected this awareness from 'tribals', which was possible due to dedication and hard-work of forest department.

Out of all the problems discussed with DFO Mr. O.P. Sharma and forest Ranger Bhupendrasingh Bhanawat, we are taking up the problem of low cost manual method for oil extraction which according to them is something approachable and almost all the tribals are associated with seed collection which will be served as value addition to their labour and raise their income and thereby improving their life-style.

Forest department is very persuading us to prototype a machine for oil extraction which will in-turn help and benefit the tribal people.

Chapter 6 Credits & Gallery

- Hemang Vellore
- Raj S.Faldu
- Dharmish K. kadchha
- Aadil A. Ahanger
- Foram J. Chandarana
- Indrajitsinh V. Chavda
- Vihaji A. Delvadiya

Figure 24 Group Photo

Figure 25 Having Study on Aloe Vera Extractor

Figure 26 Products of Forest Department

Figure 27 Tribal women’s preparing bamboo sticks

Figure 28 On the way to tribal areas

Figure 29 Forest Rangers providing solar lamps to the Tribal people

Figure 30 wide spreaded tribal village

Figure 31 Hemang Vellore

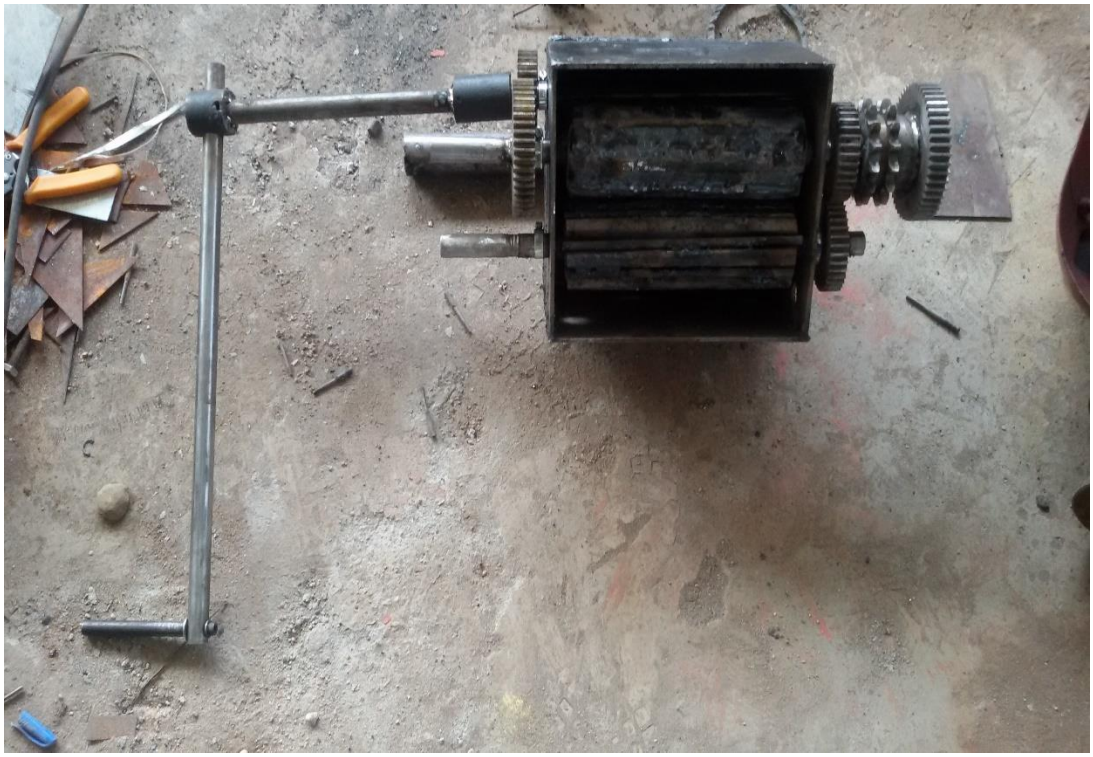

Figure 32 Prototype

Figure 33 Machining

Figure 34 Basic transport Facility

6.1CREDITS

Figure 35 Vihaji A. Delvadiya(Drawing helper)

Figure 36 Indrajitsinh V. Chavda

Figure 37 Deep Parmar

Figure 38 laboratory Incharge Mr. Anil sir