Case 3 - Mahuda Seed Cracker
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**Introduction**

The Mahua tree is a widely found tree in the central and northern part of India. Its flowers and fruits are used for various purposes. The flowers are used to produce alcohol and also used for its medicinal properties for getting relief from cough/cold and joint pain when used for massage. The seeds inside the fruit are used to extract oil which is mainly used for cooking purposes. Mahua tree

- 35-40ft high
- 25-30ft in span
- Flowers are harvested in the month of March
- Seeds mature in the period of May-June
- Flower: succulent in nature.
- Dried before using it to make alcohol
- Brown in colour after dried

**Brainstorming**

We brainstormed around potential issues, concerns and opportunities before our visit to be able to gain deeper insight once in the field.
Field Visit

We visited the village of Rangpur near the city of Chhota Udepur in Gujarat, which is close to the MP-Gujrat Border. This place was chosen for its Mahua tree growth and access to the tribal community there. Chhota Udaipur is also home to oil mills where the residents of the nearby areas get the oil extracted. On the first day, we met Parsingh Rathwa, who is a small farmer and a teacher along with his wife Bhawna Rathwa, who is a homemaker and an aspiring advocate. Parsingh told us all the necessary background knowledge about the Mahua tree and its social dynamics. The next day we talked to an Oil Mill Worker, Karan Bhai and Bibli Ben Rathwa and continued talking with Bhawna Ben.
The trees in this area are treated as a community resource and the fruits are shared by all. Everyone picks up the flowers or fruits that are fallen on the ground. Since the ripe flowers/fruits fall to the ground anyways, no one usually picks them off the tree. Unless monsoon has arrived after the first rain people quickly pick the remaining fruit off the trees as
they turn useless after rain. The people in the area go around collecting the flowers all day during flower season as the more time they spend collecting, the more they will have. It is easier in fruit season since it suffices to go twice a day. Usually, the whole family (including children) is involved in the process of collection.

Then we learnt about the processes that the collected products undergo.

**Flower to Alcohol**
The Alcohol apart from being used as an intoxicant has a multitude of uses. It is used to treat cold, cough & joint pain in patients as young as infants both as a rubbing agent (massage) and as an oral medicine. One little-known use that was also told to us was its usage in treating paralysis after mixing the alcohol with pigeon’s blood.

Process:
1) Dry the flowers for 3-4 days in the open
2) Soak the flowers in a pot of water for about a week and keep away from direct sunlight and
3) Boil another pot of water and add to the first pot
4) Put the whole mix in the distilling setup
5) Distil the alcohol to a concentration of choice

Distillation setup:
An upside down pot is stuck to the mouth of an upright pot and sealed using clay. A pipe is added to a hole in the top pot and the vapour is condensed in another bottle.
**Seeds to Oil**

The oil is used for cooking and for massage for relief in joint pain. The oil is extracted from the innermost core of the seed which is obtained by cracking open the hard shell which itself is covered by a green fleshy coat.

**Process:**

1) the fruits are stored in a cool and dry place until the further place. The green covering is left in sun to dry so that the covering is easy to remove with hand.

2) After the covering is removed, the next step is to take the seed out from the hard brown cover. A stone is used to force open the seed by hammering it on a specific place on the seed.
3) The seed is separated from the broken covering by hand. All the seeds are dried in the sun for 2-3 days.

4) The seeds are taken to an oil extraction machine in Chhota Udaipur. The cost of extraction of oil from 1kg of seeds is 3Rs.

Re-Brainstorming
After the field visit, we revisited the mindmaps and also engaged in making process maps. This helped us deepen our understanding of the problem and the context. It also helped us to better identify key areas where work could be done effectively.

Problem Definition
The problem of breaking the seed open before pressing it for oil is one that is chosen since making the process faster will make it possible for the people to free up a lot of time in the day. The current process takes around 20 minutes per kg of Mahua seeds.

“How might we reduce the time needed to crack open the Mahua seeds”

We looked for existing seed crackers used for groundnuts and other nuts. We also looked at methods used across industries for breaking things.
Proposed Solution

We ideated around the problem and decided on using a horizontal rotating drum with steel balls in it. This technique is currently used for crushing stones to a fine powder. We chose this technique because it is robust, cheap and easy to implement and replicate.

The prototype consists of a steel drum with a handle to rotate it. Seeds and the Steel balls are added to the drum. The handle is then turned to make the balls and seeds collide and

Details of design:

Steel drum 10” diameter, 5mm thickness
Handle made of 4mm steel sheet
Pillow block ball bearing
Steel balls 30mm*10, 50mm*5 diameter
Rubber wheels with fix castor*2
The design went through two versions:

v1.0 Steel cylinder with the smooth surface was not able to take the balls up to a significant height for suitable impact.

v1.1 Added fins inside the cylinder to help take the balls to a greater height for a larger impact.

Process
To make the drum a 5mm steel sheet was bent into a cylinder of diameter 10” and depth 8”.
Two 3mm steel circles were also cut to make the front and back of the drum. One of the sheets was welded to the cylinder. The other was cut in two parts along a chord and a hinge was added there to make the door. On the fixed plate side, an axle was welded to help mount the handle and the bearing. The fins were made out of 3mm steel sheet as well. Strips of metal were cut and welded to the inside of the drum.
All welding was done using an arc welding machine. The whole mechanism was supported by and mounted on a scrap piece of wooden board. The supporting wheels were screwed to the board, After determining the correct height for the supporting pillow block bearing a small welded structure was made out of steel angles to raise it to the correct height. This structure was also screwed to the baseplate.

User Testing
The prototype is able to crush seeds now. The users reported excess noise, a great increase in performance on tilting the device, a need to improve the locking mechanism for the door, a need to make it easier to empty the drum once it is used.

**Way Forward**

Future plans for it include optimising the design to reduce weight and increase efficiency. Another possibility that needs strong exploration is making the product with widely available objects like Milk Containers/Paint Cans, Bicycle Pedal arms etc. Material exploration in the current design is also a possible field of work. One wild but possible exploration is also the possibility of cold oil extraction as well.