KHOVA MAKING MACHINE

SECTOR: AGRI - ALLIED

MODEL BANKABLE DOCUMENT

SELCO FOUNDATION

NABARD

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1. INTRODUCTION

In India, the milk plants usually receive substandard milk due to unhygienic conditions of milk production, the existence of middle man and adulteration, high ambient temperature, inadequate cooling facilities and transport arrangement and lack of appreciation for production of A grade milk. The rejection of substandard milk adversely affects the commercial interest of milk producers especially during summer. The high acid unsold milk can be profitably converted into danedar (granular) khoa for the preparation of Kalakand, Birthday cakes, Toffee and related sweets, etc. Traditional products account for over 40% of all dairy products consumed in the country. Due to lack of adequate processing and preservation methods, the manufacture and trading these products is confined to Halwais. Although credible statistical data are not available, it is estimated that the value of Khoa and chhana based sweets business put together would be valued more than Rs.100,000 million which is double the value of milk handled by the organized dairy sector.

1.1 Current Practices

Khova production is the easiest way of preserving milk produced in rural areas. For khova production, generally traditional method (i.e. open pan evaporation process) is followed in which milk is headed in an open pan oven non-smoky fire and continuously, stirred and scraped with the help of scraper to avoid the scorching of milk solids sticking to the pan. The milk is heated till it attains a semi-solid mass consistency of dough. Thereafter, the product is removed from the fire and rolled up into a solid mass known as khova pat.

The traditional method of khova making requires large quantity of energy and in the presence era, energy saving is needed to pay more attention. In rural India generally wood and cattle dung, coal and bio-waste are used in open chulha as fuel for khoya making. Khoya making involves intensive heating during the desiccation process with an aim of evaporating the large quantity of energy water present in the milk. The traditional method of khoya making has a number of drawbacks. Some of the major drawbacks are:

- Time and labor consuming
- Large variation in quality
- Poor keeping quality
- Small scale production
- Smoky smell

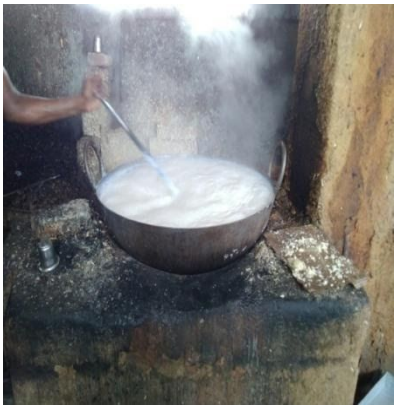
Different typologies of khova business

1. Entrepreneur model
2. Dairy farm model
3. Small khova making unit
4. Sweet making model

1. Individual entrepreneurs: In this type, user collects milk from nearby dairy farmers and processes it in range of 50L to 200L. They used traditional methods chulha to makes the khova. One or two family members are involved in this process. We have observed different practices adopted by users in different areas as below.

1. Make in 20L kadhai (White khova): Users makes a khova in small 20L size kadai, they pour 5L milk at time and steering continues 20min. The khova texture will be white granules. They repeat this process and work for 6hr. This type of khova they sell at Rs 250/kg.
2. Make in 100-150L kadhai (brown khova): Uses makes a kova in big size 100-150L kadhai. They pour all 50-80L milk at a time and steer it continues till milk getting into khova form. They used firewood or corn bio-waste to feed into chulha.
3. Make in 500L flat base round kadhai: This practice mainly adapted in Jankhanddi, Bagalkote district users. They pour milk at time 100-200L into big kadhai and start steering once milk get thick. They use sugarcane bio-waste to feed into chulha.





2. Dairy farmers: The farmers who have dairy farm of cow and buffalo they process that 50-100 milk by own and make khova. They used any one of the above methods mentioned in the individual entrepreneurs model. Either one family member involved or dairy labor used to this work.

3. Small khova making units: This small khova making units process 1000L-2000L milk and produce 100-400Kg khova. This kind of units runs by entrepreneur where milk is available. This unit consists of 3-5 traditional chulha and hired a 3-5 laborers for process milk. They get milk from different dairy farmers till morning 7.30am and then start the work. They used firewood/biowaste/cashew nutshell for burning.

4. Pedha/sweet making: Entrepreneur makes sweet out of the milk, they pour a 10-20L milk in khadai and add sugar into it and make peda and sell in local markets.

Marketing: The khova are packed into 5-10Kg in plastics and either taken to the middle men or directly send to sweet makers like Thakur Pedha, Big Mishra by bus. Payments made once a week.

2.NEED FOR SOLUTION

- As per traditional practice, khova making process is drudgerous, considering that maintaining the texture and quality of the khoya is difficult where intervention of a machine can counter this issue.
- To cater to this increasing market demand for khova, relying on unstable labor supply is difficult. Usage of machine makes entrepreneur independent of such issues.

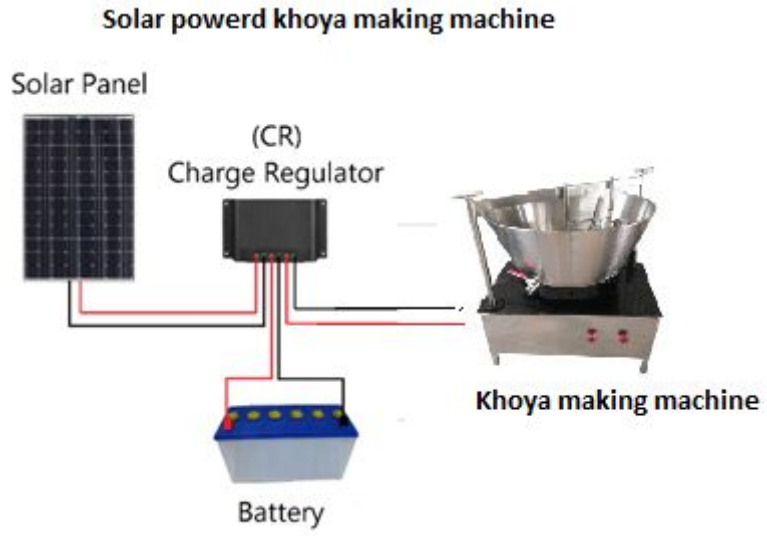
- In comparative market pricing, it's always advantageous to maintain the product prices at a lower level. But in an urban scenario, considering the expensive services, it is difficult to maintain the competitive pricing. In the rural areas, the resources are comparatively cheaper, but at the same time rural areas are more vulnerable to power cuts, so powering the machine with solar is an option to counter this issue.
- Some of the entrepreneurs are using the machine but they are facing power cuts issues. for them solar power machine make sense to avoid spoilage of khova and saving the generator set fuel cost.

3. CRITERIA FOR SELECTION

The major selection criteria for the sites could be:

- An entrepreneur who is preparing khova manually and it is the reason for his/her body pain/drudgery or quality huge quantity.
- An entrepreneur who is preparing khoya manually but cannot cater to the full market demand, as manual khoya making requires too much time.
- An entrepreneur who is preparing khoya using the machine and is facing power cut issues, which is spoiling his/her khoya batch.

4. SCHEMATIC DESIGN



5. TECHNICAL SPECIFICATION

a) 65L and 130L gas model

Sl.No	Load Type	Wattage	Nos	Hours
1	Khawa making machine - 0.5 hp	336 W	1	4
2	DC LED Light	5 W	1	3

Sl. No.	Products	Capacity	Qty
1	Solar Module (72 Cells)	300 Wp, 24 V	2
2	Solar Battery	200 Ah, 12 V	2

3	MMS	300 Wp, 1M	2
4	Charge controller - Phocos CML Solid Charge controller 30A	30 A, 24 V	1
5	Cables red+black (M-M)	4 sq mm	2 m x 2
6	Cables red+black (M-B)	10 sq mm	15 m x 2
7	Cables red+black (B-B)	16 sq mm	2 m x 2
8	Cables red+black (B-L)	10 sq mm	8 m x 2
9	AJB with SPD & MCB	2 IN, 1 OUT	1
10	Earthing Cable	10 sq.mm.	10 m
11	Earthing Kit		1
12	Double pole MCB (Load side) with box	32 A	1
13	AC to DC converter	20 A, 24 V	1
14	Change over switch	32 A	1
15	DC LED light	5 W, 24 V	1
16	Consumables		1

b) 110L bio-waste model with blower

Sl.No	Load Type	Wattage	Nos	Hours
1	**Khova making machine**	**290 W**	**1**	**4**
2	**Blower**	**30 W**	**1**	**4**
3	**DC LED Light**	**5 W**	**1**	**3**

Sl. No.	Products	Capacity	Qty
1	Solar Module (72 Cells)	300 Wp, 24 V	2
2	Solar Battery	200 Ah, 12 V	2
3	MMS	300 Wp, 1M	2
4	Phocos CML Solid Charge Controller	30 A, 24 V	1
5	Cables red+black (M-M)	2.5 sq mm	4 m x 2
6	Cables red+black (M-B)	10 sq mm	15 m x 2
7	Cables red+black (B-B)	16 sq mm	2 m x 2
8	Cables red+black (B-L)	6 sq mm	8 m x 2
9	Cables red+black (B-L)	2.5 sq mm	8 m x 2
10	Earthing Cable (Load side)	10 sq.mm.	10 m
11	Earthing Kit (Load side)		1
12	Double pole MCB (Load side) with box	16 A	1
13	Two way switch with box	10 A	1
14	DC LED Light	5 W, 24 V	1
15	Consumables		1

c) 190L bio-waste model with blower

Sl.No	Load Type	Wattage	Nos	Hours
1	**Khawa Making machine -0.75 hp**	**480 W**	**1**	**4**
2	**Blower - 50 W**	**50 W**	**1**	**4**

Sl. No.	Products	Capacity	Qty

1	Solar Module (72 Cells) - 1 in Series	325 Wp, 24 V	3
2	Solar Battery	200 Ah, 12 V	4
3	MMS	325 Wp, 1M	3
4	Solar Charge Controller - Phocos - CXNsolid (50 A)	50 A, 24 V	1
5	Cables red+black (M-M)	4 sq mm	6 m x 2
6	Cables red+black (M-B)	10 sq mm	15 m x 2
7	Cables red+black (B-B)	16 sq mm	3 m x 2
8	Cables red+black (B-L)	16 sq mm	10 m x 2
9	AJB with SPD & MCB	3 IN, 1 OUT	1
10	Battery Rack	200 Ah X 4 Nos (1 Rack of 4 Batteries)	1
11	Earthing Cable	10 sq.mm.	30
12	Earthing Kit		2
13	Double pole MCB (Load side) with box	32 A, 230 Vac	1
14	Consumables		1

6. KEY FEATURE

- As more time can be spent on processing the milk, the production can be increased substantially.
- The fuel cost of diesel generator set can be avoided.
- This multipurpose machine can also be used in making various sweet items such as burfi, peda,basundi on a large scale.

7. INSTALLATION

7.1. Khova Making Machine

- Set the food grade scraper in such a way that it slightly touch to bottom surface.
- Machine should rotate anticlockwise so do the connection accordingly.

7.2 Module:

- While unboxing module to install two people should care handle module instead of one person.
- Identify shadow-free location on roof top for installation and clean the area. Mark points to place RCC (Reinforced Cement Concrete) on the floor.
- Depending upon geography and type of roof it will be decided whether MMS has to be customized or not.
- If needed with the help of local fabricators it has to be made possible.
- Identify south with the help of magnetic compass and mount the panel facing South.
- Please maintain the optimum tilt angle of the solar panel so as to maintain the efficiency and increase the life of the panels.
- Depending upon the type of footing Roof mounting and ground mounting, configuration of tilting angle in particular angle- Summer Tilt and winter tilt

- The type of footing will depend on the type and angle of roof for rooftop mounting. In case of ground mounting, it depends on the type of soil.
- Isolated footings are most commonly used footings for Reinforced cement concrete column because it is simple and most economical.
- Combined footing: the aim is to get uniform pressure distribution under the footing.
- Earthing of panels: in order to protect the entire solar system and people using it has to be connected to earth.
- Panels are interconnected such that the voltage of the system is achieved. They are connected to the Array Junction Box by MC4 Connectors. Panels are interconnected such that the voltage of the system is achieved.

7.3. Charge controllers:

- Fuse has to be removed prior to installation.
- First connect positive and negative terminal of the battery to the charge controller.
- Then connect the positive and negative terminal of the load to the charge controller.
- Then fuse has to be reinstalled.
- Finally connect the positive & negative terminal of the panels to the charge controller.

7.4. Batteries:

- For ventilation holes are made in the rack to give space for air to pass through.
- Batteries should not stacked one above the other.
- Keep polarities of all the batteries adjacent to each other on the same side.
- Batteries should be stored in a cool, dry and shaded area free from sunlight.
- Best room temperature for storing batteries is 20°C.
- In DC systems, while making connections, always connect negative wire first and then positive wire.
- While disconnecting, disconnect positive wire first and then negative wire. This is for safety reasons and to avoid sparks at the battery terminals while doing connections
- Keep air safety distance between batteries of at least 20mm.
- Use wire lugs at battery terminals to avoid loose connections.
- Do not use grease on battery lugs as it has a high melting point and is a bad conductor of electricity. Use petroleum gel instead.
- Lugs should be dry and should not be hot. Lugs get hot due to loose connections, improper wire size or poor quality of lugs
- Always keep top of batteries clean and keep the lids sealed to avoid contamination by dust.
- To measure battery voltage, first disconnect electric load and solar input
- To get more accurate current readings, connect ammeter in series to the battery and load.
- Battery Connections: Do the battery interconnections such that the system voltage is achieved. Keep them well in the battery box.

8. MAINTENANCE

8.1. Khova Making Machine

- Clean the machine after use.
- Check quality scrapper once in two months

8.2. Module:

- Clean the panels at least once a month.
- Do not displace the panels from the mounting structure.
- Tilt angle has to be checked.
- Check if there is any deformation in the panels.
- Check if there are any wire/ wires directly exposed to sunlight.
- Do not drop, allow objects to fall on, stand or step on solar modules.
- Do not walk, lean, sit or rest heavy objects on solar panels.
- Prevent the direct contact of the positive and negative terminals of Panels.
- Solar modules have a protective glass front. Broken solar module glass is an electrical safety hazard (electric shock and fire). These modules cannot be repaired and must be replaced.

8.3. Charge controllers:

- Care has to be taken to frequently check the indicators to ensure proper functioning of the system
- Do not place any metallic or fire prone object close to the charge regulator. A minimum of 12” space should be maintained all around for free air circulation.

8.4. Battery:

- Check the acid level in the battery at regular intervals. Fill with distilled water if the acid level is low.
- Do not overuse the system.
- Apply Petroleum Gel on both terminals of the battery.
- Prevent the direct contact of the positive and negative terminals of batteries.
- Batteries store a large amount of energy. Never short circuit the external contacts of battery under any circumstances

9. SAFETY

9.1. Khova Milking Machine

- Always reduce the flame of gas/fire before pouring in the milk and pouring out khova.

9.2. Module:

- If wiring line voltage is higher than 70 Volts it will be Hazardous.
- Wear insulated safety gloves, industrial shoes while working on the system
- Do not touch the panels junction box during day time, as DC voltage is always present when solar modules are exposed to sunlight
- MCB has to be turned off in solar combiner box of the Solar Array before you work on them.
- Always check positive or negative polarity of any wire with multimeter before connecting it to any device
- Do not leave any wire open, it can touch other terminals causing short-circuit.

9.3. Charge controllers:

- Do not allow water to drip or splash on the charge regulator.
- Avoid children touching the charge controller.
- Keep the machine and other parts clean and free from dust & water.

9.4. Battery:

- Provide a ventilation in the battery room for the hydrogen gasses generated to move out.
- Do not allow water to drip or splash on the battery.
- Avoid children touching the charge controller.
- No Smoking warning sign has to be hanged if needed outside**.**
- Wear safety glasses for protecting the eyes from the acid.
- If acid comes in contact with eyes, wash for 15 minutes and report to a doctor immediately
- If acid comes in contact with skin or clothing, rinse off for several minutes and try not to spread the electrolyte. Report to a medic/doctor after rinsing

10. TROUBLESHOOTING

10.1. Module :

- Disconnect the fuse
- Cover solar modules with thick blanket or cardboard
- Check the interconnection polarity between the modules
- Check the bypass and reverse blocking diodes for correct polarity
- Check for any loose connection
- Replace the fuse.
- Uncover the solar modules
- Check the output voltage of individual modules using clamp meter /Multimeter
- Check the output voltage of solar array at terminal blocks.

10.2. Charge controllers:

- Check for Fuse if the wire inside the fuse is shot, replace with new fuse.
- Check for series charging, if not then there might be complaint with the circuit.
- Check for panel, battery and load voltage

10.3. Battery:

- Check specific gravity of the battery if the specific gravity is low then send it

- Check the terminal voltage after the load is disconnected from the battery terminal.
- Remove corrosion on the terminal posts
- Use self-leveling filler that automatically fills the battery to a predetermined level.
- While topping take care not to splash from the cell opening

11. COST & ECONOMICS

Methodology: The cost economics based on the service demand translating to profits per month which is required to service the EMI cost of acquisition of the system.

Assumptions:

a) System cost is Rs 150000/- (incl of solar component). Margin money Rs 30000 and loan amount Rs 130000.

b) The total cost to end user is Rs 130000/- with payment tenure of 42 months and interest rate of 12%. The EMI is coming to Rs 3806/-.

Approximate revenue during the month

Raw Material	Cow Milk
Per Unit Price	₹ 28.00
Batch Quantity (L)	30
Total Cost Of 1 Batch	₹ 890.00
Cost Of 3 Batches	₹ 2,670.00
Khava Price per unit	₹ 200.00
Khava Prod. Per Batch (kg)	5.454545455
Prod. Per Day (Kg)	16.36363636
Per Day Khova revenue	₹ 3,272.73
Monthly Income	₹ 81,818.18
Monthly Income	₹ 8,818.18

Additional expenses during the month

Monthly Expenses :	
Labour Charge	3750
Firewood/gas	2500
Gas	0
Total Expense	6250

EMI Calculation	
Loan Amount (Rs.)	130,000
Interest (% p.a.)	12%
Time Period (Years)	3.5
EMI (Rs.)	(3806)

Expected Increase in Profit after Intervention

S no	Particulars	Amount/month
1	Savings from cutting down labour expenses	3750
2	Expected increase in productivity (20%)	600
3	Expected increase in expense (20% input cost)	525
4	Total expected increase in profit (1+2-3)	3825
5	Expected loan repayment	3806
6	Maintenance cost	000
7	Existing profit	8818
8.	Profit after intervention (4+7-5-6)	8837

The intervention is expected to increase the entrepreneurs income by Rs 8837 on an average post payment of EMI.

12. CASE STUDY

Vilas Hakke, from Solapur district of Maharashtra is an individual entrepreneur. It's a home based unit and he is khova making business from one and half year. Pandharpur is well known pilgrimage town, there is a lot of demand for Prasad (temple sweet). All sweet shops make khova and pedha as prasad to sell.

He has been bought machine from Kolhapur to start khova making unit which machine has 190L vessel capacity and is a firewood operated model. He started his work but during working time because of power cut issue, he bought DG sets also. He makes 40Kg khova/day and delivers to sweet shops in Pandharpur on the same day. He collects milk from nearby dairy farmers.

Due to erratic power supply in the area, he loses his daily earning and also had to invest in diesel generator for operating the machine. In addition to this, family of entrepreneur consists of two aged members who are adversely affected by the noise of the generator. To overcome these problems, entrepreneur found a solution in the solar system.

Power cut in the area is around 4hr daily for 15 days a month. In addition to this Entrepreneur also spends around 2000 to 2500/- per month on the diesel. When the power cut occurs during the Khowa making cycle, it spoils the complete batch of the Khova. As a solution to this problem, a system with a 4 hours Solar Backup was designed for running two motors of 0.5 HP and 0.25 HP, one for rotating vessel and another for air blower respectively.

Business Details:
Monthly Revenue = 15K to 20K
Monthly operational cost(transport+ firewood)= Rs1500-Rs 2500
Net profit= 13K to 15K
Monthly Diesel Expense = 2000/- to 2500/-

Impact:

- Solve energy issue by sustainable solar energy.
- Reduced operational cost and sound pollution in working area of DG set
- Increased income by Rs 2500/month
- Now he is planning to expand his business

13. INSTALLATION PHOTOS