Semi-Automation in Jaggery Production

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Abstract :Indian agriculture is known for its good quality. But sometimes due to older traditional methods of the farmers they have to face losses in the production due to less productivity and large production cost. In this project, the main objective is to increase the production rate and reduce the labor cost using various methods of engineering. Jaggery making and marketing in India is the larger agricultural based occupation. In India, jaggery production is considered as big cottage industry under unorganized sector. Jaggery making plants are generally small units which are fabricated by local artisans and run by villagers in different parts of India. These plants are fabricated on the basis of age-old expertise without any technical support.

IndexTerms **- Jaggery Industry, Hopper, Stirring Mechanism, Indexing Mechanism, etc.**

I. INTRODUCTION

Jaggery processing is one of the largest agro-based cottage industries of unorganized sector in India. It is a traditional form of sweetener produced and utilized in rural villages. From many decades structure of traditional jaggery plant is still same. It contains 2-3 big size pans which are used to boil juice of sugarcane. Heat is supplied to pans by furnaces. It is batch and traditional process with zero maintenance. It does be happening for almost 200 years and there is not much change in jaggery process.

Fig.1: Extraction of syrup.

Fig.2: Mould making.

In this project, the fabrication of the prototype unit and the working on a jaggery and also new process for jaggery molding process is done. The jaggery molding unit should be semi-automatic, compact, labor efficient. It will enhance product quality, hygiene and the economic benefits of premium jaggery products in markets. The proposed project will increase the rate of jaggery production and also the number of workers will reduce.

II.PROBLEM STATEMENT

- The traditional method of jaggery production requires more labor than the automated system and uneconomical due to high labor cost and has less production rate.
- The jaggery production plant is having a high temperature nearby jaggery handling process area which is not safe for labor.

III. OBJECTIVES

- To modify the method of jaggery handling with the more automation nearby high-temperature area.
- To reduce the labor cost
- To reduce the workload of labor near high-temperature zone.
- To maintain the purity, hygiene, cleanness and the quality of the product.
- To increase the production rate.

IV.METHODOLOGY

- Identify problem.
- To find a different solution.
- Market survey.
- Implementation of the machine.
- Identify part needed.
- Work distribution.
- Design of Hopper Mechanism, an Indexing mechanism, and Shaft.
- Fabrication of model.
- Final testing of the model.

V. WORKINGPROCESS OF MODEL

- First, the jaggery syrup is poured into a hopper which is already clarrified.
- In the hopper, the mixing of syrup is done by baffles simultaneous the cooling of syrup is done by natural convection.
- After the few minutes, the density & viscosity of syrup is increasing with time.
- The requirement of baffles is to stir the whole syrup & maintain the smooth texture of semi-solid jaggery syrup.
- After that this syrup is filled into the mold which is placed on the ring of indexing with the help of cock (ball valve) which is provided in the bottom section of the hopper.
- After filling of mold the cock is closed & the lever handle of indexing is actuated.
- After the actuating, the lever the lever pin is pulled out from the hole of indexing plate to the next hole of indexing plate.
- The lever pin is pull in the next hole & the motion of indexing stop at that position where the next mold is placed.
- And the process of filling of a mold is repeated.
- After filling, another operator replaces the filled mold with empty mold.

VI. ACTUAL WORKING PROTOTYPE MODEL

Fig.3**:** Actual working prototype model.

VII. COST SAVING ANYALYSIS

1) Cost of operation by using project model:

Time required for process = 15-20 min
Operational time of plant = 14 hrs per day
Voltage = 240V
Frequency = 50Hz
Motor power = 0.5hp =0.372 kW

We know that,
Number of unit consume per day = (Rated power * Number of equipment* number of hours)
Number of unit consume per day = (0.372* 1* (14))
Number of unit consume per day = 5.208 kWh = 5.208 Units
Total units consumed per month =5.208*30 = 156.24 Units
Cost of power consumption = 5.208 * 7
Cost of power consumption = 36.456 RS per day
= 1093.68 RS per month=1100 RS per month
Amount paid to the labor for one day = 300 RS per labor
Total cost of operation = 1100 + 300*30 = 10100 RS
2) Cost of operation by traditional method
Minimum Number of Labors for Moulding Process = 3
Total cost of labors for process = 3*300*30 = 27000 RS
3) Cost saving
Total saving of cost = 27000 – 10100 = 16900 RS
Savings in % = (16900 / 27000)*100
= 62.59 %

VIII. APPLICATION

It is especially for small-scale industries (ex. Industries of the farmer). Not only for Jaggery making but also for other food products.

IX. FUTURE SCOPE

The project has a good future scope in any engineering industry. The main constraint of this device is the high initial cost but has low operating costs. There should be of high strength. Savings resulting from the use of this device will make it pay for itself within the short period of time & it can be a great companion in any engineering industry dealing with rusted and unused materials. The device affords plenty of scope for modifications by providing the sensors further improvements & operational efficiency, which should make it commercially available & attract.

X. CONCLUSION

In this project, we are working on a new mechanism for jaggery processing. Hence implementing a new system for cooling and moulding process of jaggery. The boiled liquid Jaggery (kakavi) is transferred into the hopper of this system. As the temperature falls, the Jaggery begins to crystallize. By stirring the juice slowly to avoid the loss of granular structure, the semi-solid mass is then put into molds when the Jaggery solidifies. These molds are made to take the shape of a bucket of different weights. The time for moulding process will be less. It will increase the production rate. So there no direct handling of the material by the worker, the hygiene is maintained during this process which is not maintained as in usual traditional method, also the safety of the worker is added. Due to the simplicity of this project, this system can be handled by only one person. Due to this project, the number of workers reduced. Also, the labor cost is reduced. The maintenance of this system is very low, so maintenance cost will be reduced.

XI. REFERENCES

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