*ejpmr, 2018,5(8), 291-293*

SJIF Impact Factor 4.897

EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.ejpmr.com

Review Article

ISSN 2394-3211

EJPMR

# PREPARATION OF TRADITIONAL SWEETENER AND AUTOMATION TECHNIQUES IN INDIA

**[1]*Vinod K. Barote, [2]Ganesh M. Agnihotri and [3]Raosaheb K. Barote**

[1,2]Department of Physics, Sant Dnyaneshwar Mahavidyalaya, Soegaon. 431120 (M.S.) India.
[3]Department of Zoology, Sant Dnyaneshwar Mahavidyalaya, Soegaon. 431120 (M.S.) India.

***Corresponding Author: Dr. Vinod K. Barote**

Department of Physics, Sant Dnyaneshwar Mahavidyalaya, Soegaon. 431120 (M.S.) India.

**Article Received on 08/06/2018** **Article Revised on 28/06/2018** **Article Accepted on 18/07/2018**

## ABSTRACT

Jaggery is one of the main agricultural products which are widely used in individual Households, eateries, restaurants, hotels, clubs and industrial applications. Jaggery is particularly made in the villages by concentration of sugarcane juice in open pans using underground furnace and bagasse fuel. The exhaust gases are released through a vertical chimney. The improved design of furnace and chimney as well as the charging systems result in increase in productivity, 20% savings in fuel and improved quality of jaggery having a light brown colour. Due to efficient fuel combustion, the smoke in the flue gases is significantly reduced thereby mitigating environmental pollution. The plant life is also enhanced. This proposed modern technique is designed to monitor, control and maintain the earth furnace temperature using thermocouple and proper design of furnace as well as curve shape of exhaust to save the bagasse to process of manufacturing traditional sweetener in Marathwada region. The open pan is lifted by Power mechanism system which helps to carry it towards cooling pit. In this paper an automation system is used to improve the production rate, increase the quality of product and to address the labor problems in the plant is presented.

**KEYWORDS:** Design techniques, Preparation technique, Temperature controller, use of Additives.

## 1. INTRODUCTION

The traditional sweetener making is the most ancient agent who is prepare in small or large scale in cottage industry in India.[1] This is low grade non-centrifugal sweetener mostly consumed in India, Africa, America, Bangladesh, Pakistan, Myanmar and other countries. It indicates that about 30% sweetener need is provided by jaggery. It is a pure, unrefined traditional form of sweetener. It has good source of nutrients like calcium, iron, and phosphorous and good health proteins. In last few decades the consumption of jaggrey has fallen significantly by almost half due to use of chemicals in preparation of jaggery. Chemicals like lime, phosphoric acid and hydros powder are used as clarificant to enhance colour of jaggery. Traces of these chemicals in jaggery are harmful to human health. Historically, the sugar cane cultivators used crushers which were ox-driven. Conventional jaggery making with a pan furnace consumes all bagasse for evaporation of water.[2]

The conventional method of jaggery making is done manually which more time is consuming; having lots of wastage like molasses, bagasse and it need more human monitoring throughout the manufacturing process.[3] This manual manufacturing mechanism may leads decreases the production rate, quality of jaggery and increases man power requirement.[4]

To overcome this all difficulty in preparation of traditional sweetener (jaggery) use of automatic power crusher, open pan lifting mechanism, proper furnace mechanism for pollution control, thermocouple for sensing temperature to overcome the use of bagasse, it improve quality of jaggery. The quality of jaggery helps to get more profit in single pan mechanism as well as decrease the labor problems.

## 2. Design techniques

The proper design of earth furnace for preparation of jaggery plays vital role in single open pan. To improve the heat utilization efficiency ~10% and to get quality product in less time, the furnace height as well as exhaust of flue gases in account to save the bagasse and to overcome the pollution of flue gases. The conventional design of plant is shown in fig.1.

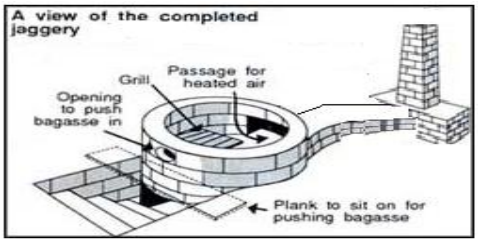


**Fig. 1: The proper design of earth furnace.**

The number of parameters like size of pan (thickness of metal at bottom 0.003 m and height 0.002 m) is more efficient for preparation, furnace and chimney, flue gas flow patterns, orientation and air inlets, bagasse firing practices, etc. In addition to this, these units are mainly designed and developed through past experiences. Saving of bagasse gives additional revenues to the farmers.[5] The design pattern of furnace is given in table 1.

### 3. Preparation technique

Jaggery is a traditional Indian sweetener prepared using sugarcane. The preparation techniques show in fig.2. Farmers make jaggery in their own farms using juice obtained after

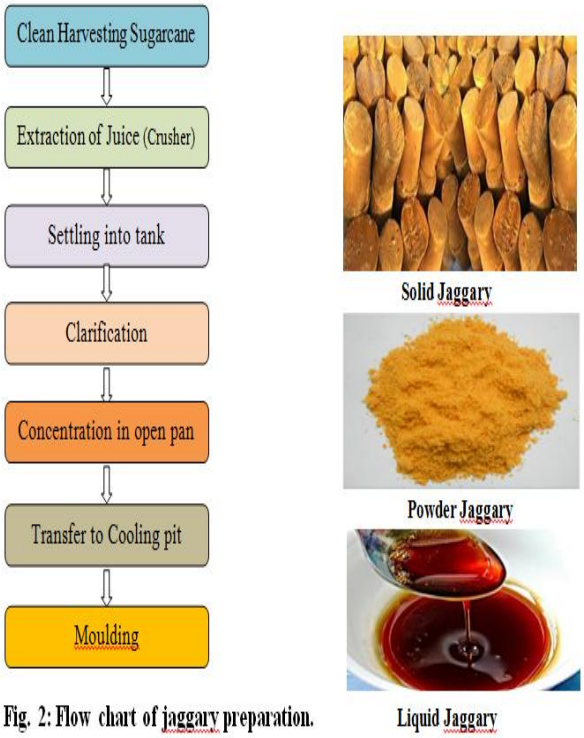


**Fig. 2: Flow chart of jaggary preparation.**

crushing sugarcane with a crusher. The increase in number of rollers did not significantly increase juice extraction beyond 71% in dry-crushing. Horizontal crushers were found 25% more efficient in juice extraction than vertical ones. Small-scale maceration as well as improvement in crusher design is underway to increase extraction percentage. The horizontal stainless steel three roller crusher is more efficient for 98% yield of juice; only 2% juice is remaining after crushing in bagasse. The average capacity of crusher unit is about 10 tcd (tonne per day), The efficient and clean crushing techniques can improve the productivity of jaggery. After crushing the juice is settled in a tank. The filtered juice is passing through PVC pipe for boiled in open pan with continuous stirring and, simultaneously clarificants are added in required quantity. Various vegetative clarification used in Jaggery making such as Okra, Bhindi, Phalsa, Castor etc. Chemical clarification also used by many farmers in early part of crushing such as sodium hydro sulphite, Lime, sodium Carbonate, sodium Bicarbonate etc. After the clarification the juice boiled briskly for 3 hours with the object of evaporating large quantity of water in it. While boiling up to $60^0$C the wood particles come to upper surface which separate out by handle mesh, brownish foams come at the top to $80^0$C which are continuously removed to get golden yellow color of jaggery. The main objective of clarification is to make juice clear and light in color. During this period the temperature of boiling juice gradually rises from $90^0$C to $100^0$C. When the temperature is about $110^0$C the juice start frothing and from this time onwards the fire is to be regulated to prevent caramelization of the sugar. At $115^0$C temperature stage, this syrup has to be constantly stirred to prevent charring and spilling over the sides of the pan. At this stage castor/ soya/ pam oil 20 ml to 30 ml is added. This prevents frothing to a certain extent, and also facilitates easy flow of Jaggery from the pan to the cooling pit. The striking point corresponds to temperature range from $119^0$C to $120^0$C shown in fig.3.

**Fig. 3: Open pan mounted on power mechanism lifter and drain into cooling pit.**

The optimum temperature is found to be $122^0$C once the striking point is achieved the pan is removed from the fire and the open pan is lifted through Power mechanism and move on track towards cooling pit.

### 4. Temperature controller

The temperature monitoring and controlling is very important in preparation of jaggery. The PT-100 ($-250^0$C to $800^0$C) RTD sensor is used to monitor the temperature which operates on 5V supply and other interface components shown in fig.4.

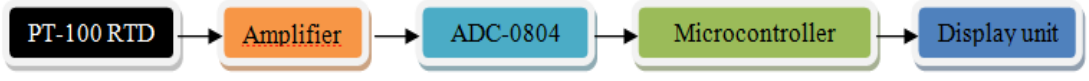


**Fig. 4: Flow chart of PT-100 RTD sensor.**

The sensor is connected to open pan system to sense the accurate temperature. When filter juice is poured into open pan than it sense the initial temperature and provide the output in the form of analog signal in volts to operational amplifier-741. The amplified output is given to ADC-0804 which convert analog signal into digital and provide to microcontroller-8051 which convert change in resistance to temperature in degree Celsius for monitoring and display on LCD. The 7-Segment display unit used to read and monitor the proper temperature.[6]

**5. Use of additives**

The additives can be used as a clarificant in preparation of jaggery. Various vegetative and chemical clarificant viz deola, okra, phalsa, sukhlai, castor, groundnut, soya bean, hydros (sodium hydrosulphite), lime, ash and sodium carbonate, superphosphate and alum, were tried for clarification of juice for production of quality jaggery. Out of the various clarificant okra has been found very effective at juice pH of 0, which belongs from genus abelmoschus/ esculentus from family malvaceae. Producing superior quality jaggery with high-sucrose content and low-reducing sugars, absorbing minimum possible moisture and having better storability add 500ml of okra juice in 5 ltr water for single pan which gives more residues for quality and pure organic jaggery is prepared. The quality of the jaggery is judged by its color; brown means it is higher in impurities and golden-yellow implies it is relatively pure. Due to this grading scale there are malpractices of adding color or harmful chemicals to simulate the golden color.

**6. CONCLUSION**

This system automates power mechanism overcome the labor problem up to 80% less, which helps to reduce the cost of preparation of jaggery. The temperature sensor helps to address the required temperature. When the juice starts frothing from this time onwards the fire is to be regulated to prevent caramelization of the sugar. This indirectly helps to save the bagasse which gives additional revenue. The manufacturing of the Jaggery production against the traditional manufacturing method is to benefit the rural economy. It provides organic and hygienic quality Jaggery by increasing the rate of production utilizing very less man power and thus using all the resources efficiently. The system uses low cost machinery and fewer infrastructures.

**ACKNOWLEDGEMENT:** I am very much thankful to Sadguru Jaggery plant for providing information of mechanism and preparation techniques.

**REFERENCES**

1. Singh J, Solomon S, Dilip K, "Manufacturing Jaggery, a Product of Sugarcane, as Health Food", *Journal of Agrotechnology*, 2013; S11: 1-3.
2. Jaggery manufacturing. http://www.organicfacts.net/nutrition-facts/others/jaggerymanufacturing.html.
3. H. Rohloff., "Some Notes On Automatic Control in African Sugar Factories", Proceedings of the Twenty' Seventh Annual Congress of the South African Sugar Technologists' Association, 1943; 74.
4. Hunsigi, G. Jaggery/Gur or Gur Manufacturer. Chapter 16 pp 205 -214. *In* Sugarcane Alternatives Sugar, Biofuels and Environment (Ed G.Hunsigi). PRISM Book Pvt Ltd, Bangalore (2012).
5. Shahi HN (1999) Sustainability of jaggery and khandsari industry in India. In: Singh J (ed), Status, problems and prospects of jaggery and khandsari industry in India. Indian Institute of Sugarcane Research, Lucknow, India, 19-27.
6. Automatic Jaggery production.http://mechsters.blogspot.in/2010/12/automatic-jaggery-making-machine.html.