

Jaggery : the new nutri choice

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Background

Jaggery is a traditional sweetener used in India much prior to arrival of modern sugar making technology. Jaggery is considered as a source of nutrition and flavour enhancer and is frequently used in daily meals. Jaggery making technology has evolved through centuries with traditional wisdom of Indian farmers. The process has, however, not been mechanised because of the dominant position of modern sugar which is more attractive.

Sugarcane farmers, therefore, continue to produce Jaggery by conventional methods which are laborious, open to environment, lacking controls and devoid of good packaging. Therefore, there is an urgent need to relook at the technology of manufacturing Jaggery from the view point of improving hygiene, quality, parameter control, energy efficiency, packaging etc. through automation. This will also enable better value addition, recovery of by-products, mass production and reducing cost.

Advantages of using jaggery and its nutrition / health parameters

In technical terms, Jaggery is a Non-Centrifuged Sugar (NCS). Scientific research has established that Jaggery has multiple health benefits. However, it has remained out of the purview of research on functional foods and nutraceuticals mainly because of the current unorganized way of manufacturing.

The highest benefits of Jaggery are seen in its immunological effects. Antioxidative and Cytoprotection activity is also found in Jaggery, suggesting that bioactive compounds behind

these properties are carried over from cane juice to Jaggery. Jaggery is also known to have anticarcinogenic effects. Some of these effects are due to the presence of traces of Fe (Iron) and Cr (Chromium), as well as antioxidants. Another important benefit of Jaggery is in preventing decalcification of teeth

Jaggery is equally hyperglycaemic with sucrose and honey. High bioavailability of iron in Jaggery helps it to fight anemia. Current strategies focus on the enhancement of diets by way of biofortification, which seeks to increase the iron content in fortified foods. Jaggery also contains good levels of Ca, Na and K (Calcium, Sodium and Potassium). Calcium is an important element for development of bones whereas Na and K are vital electrolytes in maintaining composition of human blood.

Development of mass-consumption products based on Jaggery, for example a fruit beverage, would be relatively cheap and market-attuned making its use commercially attractive.¹

Jaggery has several medicinal properties which are described in Ayurveda. Jaggery is used as a functional ingredient in various Ayurvedic formulations to cure cough & cold, respiratory diseases, rheumatism, cardiac ailments, disorders of digestive system, piles, kidney pain, worm infections, menstrual problems, hair problems etc.²

Food products made using jaggery

In our traditional Indian diet Jaggery has played a vital role since ancient times. Some examples of traditional preparations which use Jaggery are Puranpoli, Paysam, Kharawas, Laddoos, Chikki, Gulamba, Panha (Raw Mango Beverage), Til-

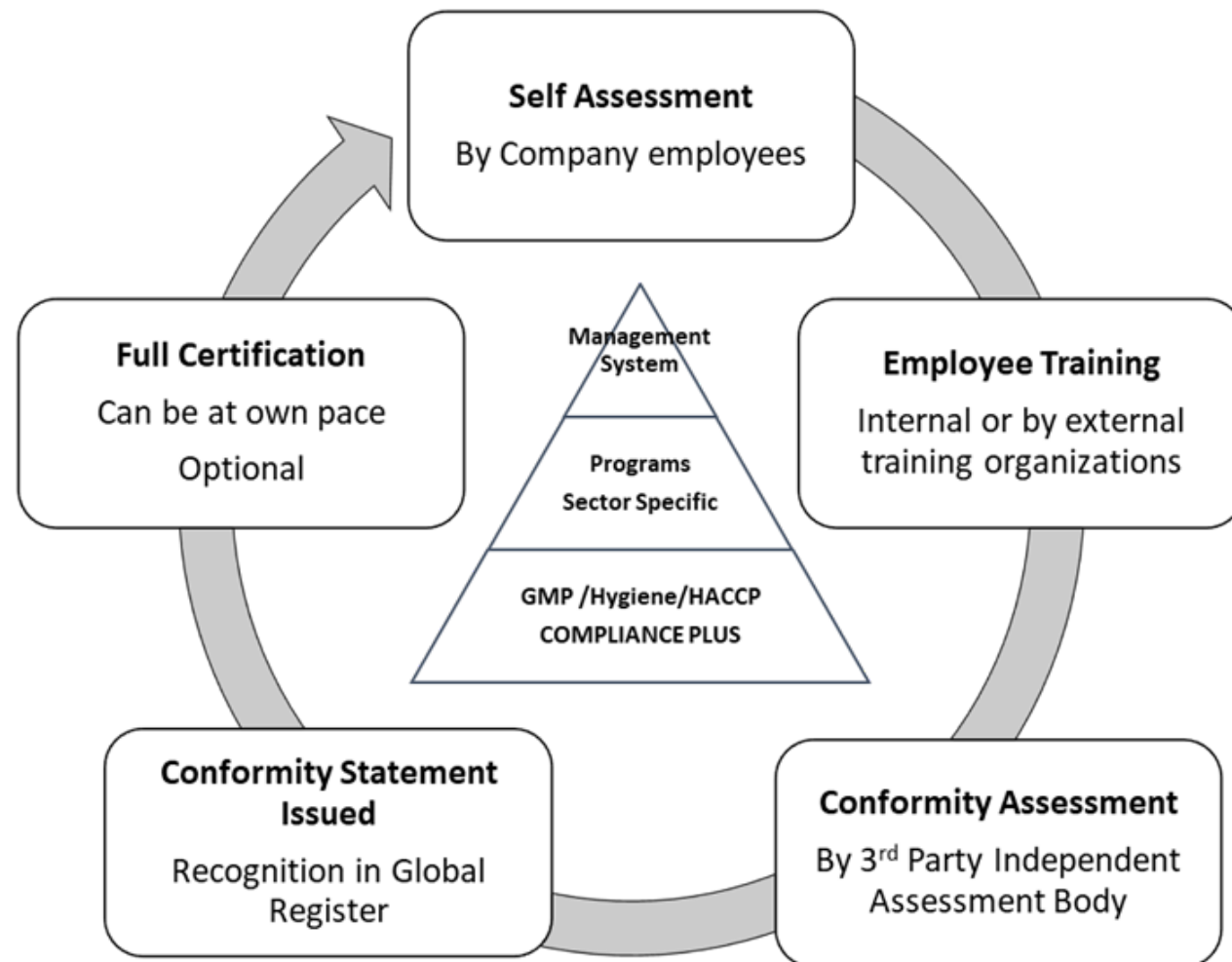


Figure 1 : Model explaining stepwise approach for achieving Compliance and Food Safety Certification for Small and Medium Enterprises (MSMEs) and Startups.

- The Third Step (Right Choice) includes implementing new programs, management routines, and a review of any programs that are ready for certification. The company can now engage with a third-party certification body to conduct an independent assessment and work on any improvements advised by them. On their satisfaction a conformity statement or certification will be awarded. Smaller companies having less people require lower duration assessments making it affordable.

Additionally, there are options for companies to pursue a full certification or to remain at the foundation level. This flexible approach provides companies with the choice to obtain recognition for their efforts in building food safety to the desired level.

FSSC 22000 is one of the international organizations to offer a brand-new Development Program that supports MSME and Startups with

a stepwise approach to achieving food safety certifications. This stepwise low-cost approach allows MSMEs engaged in the food supply chain to help achieve their dreams of going beyond the local and fulfill the goal of being recognized in the global register at conformity or full certification level. Multinational companies and large retailers often take notice of these changes. This means they may also become willing to offer help in opening new market opportunities to these small and medium enterprises and patronize their specialized regional and or novel proprietary products.

(The author specializes in certification processes with 35 years of experience and has helped a large number of companies at the Large and MSME levels in developing their systems and achieving certification. Dr. Darshane can be contacted for advice and guidance at the following email address dvdarshane@fssc22000.com. Views expressed are his personal.)

gud (A Makar-Sankranti Special) and many more. Apart from this, the dry and free-flowing Jaggery powder produced by our modern technology can be used for international food recipes using innovative methods. Such products include cakes, cookies, biscuits, chocolates, ice-creams, yoghurts, custards, desserts, energy bars, sundaes etc. Jaggery adds a distinct flavor which makes preparations appetizing and at the same time nutritious. Jaggery is rich in minerals as detailed before and can be used in the preparation of healthy food recipes and mixes.

Traditional way of making jaggery

Traditionally, Jaggery is produced in large open-air pans made of iron. In this process, lime is used to control the pH of juice and chemically synthesized okra gum powder or polyacrylamide powder is used as coagulant to separate suspended fine bagasse particles in the juice.

The naturally occurring enzymes and other compounds in sugarcane juice react with each other and several other components of the juice due to uncontrolled heating forming dark colored complex compounds. Secondly, due to excessive heating, sugars in the juice caramelize and form dark colored compounds. Finally, excessive use of lime and leaching of iron from pans also result in dark color. To improve the color of Jaggery, Sodium Hydrosulphite, a harmful chemical, is normally used. Hydros, as it is colloquially called, bleaches colored compounds and changes the color of Jaggery to golden yellow. Hydros



Manual removal of scum while boiling sugarcane juice in open pan

ultimately releases SO₂ in Jaggery which is harmful to health. The amount of SO₂ is regulated by the government through IS 12923 for Jaggery. Finally, the boiled sugarcane juice becomes a thick concentrated syrup and is poured into another pan with large surface area where it is continuously wiped using wooden ladles. While still a thick paste, it is poured into final molds of various sizes and shapes as per requirement.

The coarse bagasse from sugarcane crusher is manually fed as fuel to directly fired open pans. Frequently, such inefficient burning results in deficiency of bagasse, and to overcome this problem, harmful waste materials such as plastic, cotton, broken tyres etc. are used as fuel. These waste materials release extremely toxic gases such as NO_x into the environment. The entire process of Jaggery production is conducted manually by traditionally skilled persons without having any scientific knowledge.

Disadvantages of producing jaggery by traditional method

Even though Jaggery is a popular product, the traditional Jaggery making process has remained a point of pain for producers, consumers and the community at large for several reasons.

- Completely manual process gives an unhygienic and inconsistent quality Jaggery.
- Due to the uncontrolled nature of manufacturing, Jaggery may contain harmful chemicals such as SO_x and Polyacrylamides.



Workers emptying pans containing concentrated sugarcane juice syrup



- Inefficient and improper combustion in open pan boiling process produces high particulate laden combustion gases which pollute the surrounding atmosphere.
- The traditional process uses waste materials for fuel which produce harmful gases and adversely affect the environment.
- Traditional jaggery in the form of solid block has a high moisture content which makes it clumsy to store and use.
- Jaggery with high moisture content has low shelf life of three months.
- The process being manual, has capacity limitations.
- Many times skilled manual labour is not available thereby risking product quality.

Challenges of producing organic jaggery by traditional method

In addition to all the problems mentioned above, there is another challenge for manufacturing

Organic Jaggery. Farmers have not yet started growing sugarcane organically which makes it impossible to produce Organic Jaggery and label it so. Unless the raw material is organic the final food product cannot be labelled as organic even if the processing is organic. This is a major limitation for Indian Jaggery, and products made thereof, to reach global organic food markets.

Apparently, the main reason for not growing organic sugarcane is reduced crop output per acre. To mobilize growing organic sugar cane, government will have to incentivise its farming by providing higher pricing for the crop.

Quality standard for jaggery

Jaggery produced from naturally grown sugarcane and processed using GRAS processing aids can be termed as natural and chemical-free. For making Jaggery the brix of sugarcane juice needs to be 17% or more. Sugarcane of 86-0-32 species is best for making Jaggery though other types of sugarcanes can also be used. IS 12923 Standard defines the quality Characteristics of Jaggery as below.

Jaggery produced using traditional process

retains a higher moisture content up to 5- 8% and such Jaggery tends to develop fungus and absorb more moisture from humid environment.

Also, Jaggery produced in iron pans have higher percentage of iron which is not preferred.

	Characteristics (on Dry Basis)	Grade I	Grade II	Test Method
i	Sucrose (% by weight)	>80	>70	IS : 15279 (2003)
ii	Reducing Sugars (% by weight)	<10	<20	IS : 15279 (2003)
iii	Moisture (% by weight)	<5	<7	IS : 15279 (2003)
iv	Water insoluble matter (% by weight)	<1.5	<2.0	IS : 15279 (2003)
v	Sulphated Ash (% by weight)	<3.5	<5.0	IS : 15279 (2003)
vi	Sulphur Dioxide (p.p.m.)	<50	<50	IS : 15279 (2003)
vii	Ash insoluble in dil. HCl (% by weight)	<0.3	<0.3	IS : 12923 (1990)

Modern jaggery making technology - need of the time

It is recommended that instead of the traditional open pan direct heating process, a modern indirect heating controlled environment process be used for manufacturing Jaggery. This will enable better parameter management and give a consistent & hygienic product. In such a process, sugarcane is crushed to extract juice which is preheated and clarified using only small amounts of lime and no other chemicals. The clarified juice is concentrated by heating in steam driven energy efficient multistage evaporators. Due to controlled boiling of sugarcane juice in stainless steel evaporators, formation of dark coloured compounds is minimised.

The juice is further concentrated to its final consistency in a secondary concentrator to produce jaggery. The water evaporated during juice boiling, is recovered by condensation in various stages of the multiple effect evaporator, preheater and air-cooled condenser. The bagasse is combusted in an efficient steam boiler which fulfils energy requirements of the Jaggery plant. The remaining surplus bagasse is sold as a valuable by-product. The Jaggery thus produced exceeds grade I quality of Indian Standard IS12923.

Modern sugarcane processing plants of capacity 10, 30, and 50 ton per day require non IBR boiler which does not need a certified boiler attendant for its operation. These plants are completely factory assembled, pre-wired, insulated and chasis mounted units which are tested at factory itself. This facilitates minimum site work and

reduces possibility of problems during start-up of the plant. The 50 to 100 ton daily sugarcane processing capacity plants can also be factory assembled to the maximum possible extent. Plants above 100 ton daily processing capacity are also available.

This modern technology of sugarcane processing is awarded with Indian Patent and has won prestigious national and international recognition for the path breaking innovation.

Advantages of modern technology

Modern technology overcomes all the pain-points of traditional Jaggery manufacturing. Some of the beneficial features are as follows.

- No manual processing or handling other than feeding sugarcane to the crusher



Modern Automatic Mobile Jaggery Production Plant (Patented Technology)

- Very high shelf life of 18 - 24 months of the powdered Jaggery produced
- Sulfur-free, chemical-free and hygienic processing
- Consistent product quality
- Resource conserving product, therefore better project viability
- Compact plant constructed with food grade stainless steel contact surfaces
- Continuous production process
- Fetches higher price to farmers and producers

Quality of jaggery manufactured by modern technology

Jaggery manufactured by the above explained modern technology is consistently better than Grade 1 quality prescribed by IS12923. This jaggery powder has approximately 1% moisture content because of which it is dry, free flowing and easy to use. It has a shelf life up to 18-24 months. Since it is manufactured in closed environment without human touch it is hygienic and free of microbial contamination. It is, therefore, a healthier alternative and fetches a better remunerative price. This Jaggery is export compliant to developed countries. Jaggery powder manufactured by modern technology is currently available in the market under Jaggrut® brand as shown below.



Jaggrut® (500g pouch)



Jaggrut® (box of 25 sachets)

Export markets of jaggery and jaggery based products

India is world's second largest sugarcane grower with 354 million ton annual production and contributes to 70% of the world's total Jaggery production. About 88.5million TPA of sugarcane is processed to make 9.8million TPA of Jaggery through 40000 small units operating in the unorganized sector. Out of this about 40% is exported as interpreted from the report published by APEDA. Jaggery export market is of Rs 7500 million and domestic market of Rs 11000 million approximately. It is expected that this consumption can drastically increase by adopting modern processing technology with improved quality.

Government intervention

It is understood that critical government help is required to boost the production and export of Jaggery. The following measures are recommended.

- The food regulatory authorities have to enforce strict process hygiene and product parameters to ensure that Jaggery produced in the country meets prescribed norms.
- This will catalyse increased acceptance of Indian Jaggery in domestic and export markets. It is observed that currently consumers are not confident of product quality.
- Govt. should undertake generic publicity to promote the use of Jaggery as a healthier alternative to white refined sugar. This aspect has been discussed in various forums.
- To encourage the use of Jaggery as an ingredient in food products and nutraceutical formulations. Both traditional and innovative product formulations can be tried.
- Ministry of Food Processing Industries should provide fiscal support to Jaggery manufacturing units using modern technology. This will bring better price for Jaggery and value addition for farmers. The modern technology has advantages of scale.

(Views expressed are personal.)