

LIQUID JAGGERY - Potential of Value Addition

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Abstract--Liquid jaggery may be considered as an intermediate product obtained during the preparation of solid jaggery. This form of jaggery is although viscous in nature, but highly rich in nutritive value and can be considered as nutraceutical product due to its medicinal properties. Liquid jaggery can be used in almost all the products in which jaggery is used. It provides a huge possibility of innovation and value addition of different products in the race of natural sweeteners. With the help of research work and technical support from institute like NSI Kanpur, IISR Lucknow, RSJRS Kolhapur, RARS Anakapalle and CFTRI Mysore. Liquid jaggery can play a key role in growth of cottage industry as well as it will be economically beneficial for the country. This paper aim to provide a comprehensive review of the qualitative and nutritive value of liquid jaggery along with its market potential during its upcoming years.

Keywords: Sugarcane, jaggery, liquid jaggery, value addition, nutraceutical

I. INTRODUCTION

Sugarcane comes under the genus *saccharum* of the grass family and it is used as the raw material for manufacturing of jaggery [1]. In India the production of sugarcane is around 300 MMT, of which 79.91% is used to processed white sugar, 11.29% is used to process jaggery and khandsari, 8.80% is used for chewing as cane juice and in the form of seed cane for next harvest [20]. However, presently the production as a whole has gone up & it is also being utilized for ethanol production. Jaggery is generally termed as traditional unrefined, non-centrifuged cane sugar mostly consumed in Asia, Africa, Latin America and the Caribbean [3]. It is one of the most ancient sweetener known to human and have different local names all over the world like Gur in India (vellam in Tamil or bellam in South India [4] and kakavi in Maharashtra), Desi in Pakistan, Panela in Mexico and South America, Jaggery in Burma and African countries, Hakura in Sri-Lanka, Naam Taan Oil in Thailand, Rapadura in Brazil, Panela in Latin America and Kokuto in Japan [5] [4]. Jaggery in various form has always remained a traditional sweetener in India being consumed directly or indirectly through various products. With the growing awareness among consumer for nutritive, hygienic & safe food, the quality & consumption patterns have seen a major change. As a sweetener, many have started preferring use of a jaggery over white sugar considering its overall profile. Due to Covid pandemic, because of its property of strengthening immunity, direct & indirect consumption has seen a surge with increase in sale even in market and exports.

II. JAGGERY PRODUCTION PROCESS

By definition, jaggery is the natural traditional sweeteners obtained by concentrating the sugarcane juice with or without prior purification of juice and without use of any chemical additives or preservatives, into a solid or semi-solid form [4]. Commonly, production of jaggery involves

steps like extraction of juice, heating, clarification, evaporation and concentration as well as cooling under hygienic condition [6]. The farmer's generally being economically backward, have inefficient equipment's available with them for extracting juice and converting it into jaggery. Traditionally, in the ancient times jaggery was prepared by extracting the juice from the sugarcane with the help of wooden crusher's, majority of the crushers were locally prepared and consists of roller's mounted on wooden blocks. After this, the extracted juice was collected in tin's or in earthen pots. Then mostly plant mucilages were used to clarified the juice. Clarified juice was then concentrated to desired consistency by boiling in open bels using naked fire.

Cooking to greater demands of good quality jaggery, steam boiling process for producing jaggery under hygienic condition & without use of chemicals have also been developed. Few plants of 100 TCD or higher capacities are working in the states of U.P. Maharashtra & Karnataka. As against use of iron vessels, in these plants, vessels having contacts part of stainless steel are used. These plants are energy & fuel efficient and produced good quality jaggery with reduced sugar losses (The issue of shelf life has also been addressed to a certain extent by improving the product quality, packaging and storage condition). Over the period of time, with rising awareness and technological advancement traditional methods have been are replaced by modern methods because of traditional process, unhygienic conditions, unskilled man power and poor machinery are effecting quality & recovering of jaggery. Presently, different types of crushers are used for crushing the sugarcane which is Vertical Sugarcane Crusher, Roller Horizontal Sugarcane Crusher and Roller Small Cane Crusher which facilitates higher extraction of juice from sugarcane. In the jaggery processes in mostly herbal clarificants like bhendi mucilage, aloe vera mucilage, fenugreek mucilage, flax seeds mucilage deola, kateshevari and chikani are used in the place of chemical clarificants [6] [10]. However, jaggery manufacturer's at also use chemical clarificant's like sodium hydrosulphate, sodium carbonate, alum, sodium formaldehyde, sulfoxylate, tri sodium phosphate etc. These chemicals are used due to low cost and easily accessible in market, to obtain golden colour jaggery which will enhance the market value of jaggery. Nowadays, filtration process of sugarcane juice is efficient for clarification process [12] [13]. The juice is then evaporated in pan furnace, usually 2-pan furnace system is used for the evaporation but IISR, Lucknow has developed a 3 -pan furnace system which is more effective. In this system, water is easily evaporated in lesser time as compared to 2 pan furnace system [18]. After evaporation, cooling, moulding and packaging of jaggery is done. Jaggery in general consists of 60-85% sucrose, 8-15% glucose & fructose, along with

0.45% of protein, 0.1g of fat, 0.6-1.0 g of minerals and traces of vitamins and amino acids. 100 g of jaggery provides around 383 Kcal of energy [7]. It contains vitamins viz, vitamin A, vitamin B1, vitamin B2, vitamin B5, vitamin B6, vitamin D2, vitamin E, vitamin PP and minerals viz, calcium, magnesium, potassium, phosphorous, sodium, iron, manganese, zinc copper and chloride also & this is the reason it is said to have medicinal value [5]. A good quality of jaggery can vary from golden brown to dark brown in colour.

In the market, jaggery is available in three forms viz solid, liquid and granular jaggery [8] [4]. In India, around 80% of jaggery is converted into solid form, whereas, the remaining 20% as liquid and granular jaggery [8]. Mostly, liquid jaggery is a sugar syrup obtained by clarifying and concentrating the sugarcane, date palm, palmyra and sugarbeet juice of having total soluble solids as 60-65°B [9]. Commonly, extraction of juice from sugarcane, clarification and concentration are the general steps that involves in the production of liquid jaggery. Thus in fact, for making liquid jaggery the juice is not concentrated to such a degree that upon cooling it becomes a hard mass. The quality of liquid jaggery is mostly depends upon the amount of impurities removed during clarification, types of clarificants use and the striking temperature at which the concentrated juice was collected [10]. Striking temperature for liquid jaggery ranges from 105 °C to 108 °C [11]. In India liquid jaggery is mostly consumed as the sweetening agent by the people of Bihar, Jharkhand, Odisha, West Bengal and Maharashtra [9].



Fig: 2.a: Liquid Jaggery



Fig: 2.b: Forms of jaggery

III. NUTRITIVE AND PHARMACEUTICAL BENEFITS OF LIQUID JAGGERY

Liquid jaggery is consumed as a sweetener and many a times as an alternative source of honey [11]. Chemically, liquid jaggery is composed of 30-36% water, 40-60% sucrose, 15-25% invert sugar, 0.30% calcium, 8.5-10 mg/100mg iron, 0.5/100 mg phosphorous, 0.10/100 mg protein and 14/100 mg vitamin [12]. Being a good source of micro minerals, liquid jaggery can be used as 'natural medicinal sweetening agent' both in the pharmaceutical or ayurvedic formulation (asava, arishtas, lehya, gula etc), in food industries and in daily consumption by humans.

It may also be considered to come under the category of "nutraceutical" due to the presence of carbohydrates, minerals, pigments, phenolic compounds, vitamins, amino acids and sterols. It contains essential nutrients and vitamins

which are required for the good health. Presence of vitamin B and elements like zinc & selenium, helps in boosting the immune system of human body and prevents it from viral infection. The nutrients present in liquid jaggery increase the overall nutritional quality and value of the product in which it is added. It is used as a functional food being rich in polyphenols, vitamin C, carotene and other bioactive compounds which have antioxidant and cryoprotective activities. As there is presence of iron in liquid jaggery, it helps in the prevention of anemia in women's and children [9]. It helps in the purification of blood, provides instant energy on consumption and control acidity [13]. It can be used as an alternative medicine for the treatment of hepatic and renal toxicity. In the form of jaggery supplement it reduces the toxicity of arsenic [9]. Also, liquid jaggery is said to be an excellent cleansing agent.

IV. VALUE ADDITION IN LIQUID JAGGERY

As mentioned earlier, liquid jaggery can be used for ayurvedic preparation due to its medicinal properties. A reported company engaged in production of Ayurvedic formulation is widely publishing its product "Chyawanprash" to contain jaggery as sweetener. It can be used as health supportive super food or in combination with other food. At present also, it is used in the preparation of products like reori, gazak, barfi, chikki, patti, and ramdana. Value addition can be made by making certain changes in the profile of liquid jaggery i.e by adding different natural flavours (ginger, lemon, black pepper, cardamon & cinnamon etc), as well as nutrients (protein, vitamin A and phytochemicals), and also other spices [15]. It may also be used in the preparation of beverages and confectionery. Material's like anola pulp, whey and some medicinal plants like gooseberry, aloe vera, holy basil, trifla etc may also be added to improve the nutritional value of liquid jaggery [4]. Use of jaggery can also seen in leather and tobacco industries [2]. The value addition can also be created by its use in confectionary & baking industry. Jaggery based cookies and host of other products including cakes and chocolates are now available in the market.



Fig 3.a: Ramdana



Fig 3.b: Barfi



Fig 3.c: Chikki

V. PACKAGING AND STORAGE OF LIQUID JAGGERY

The shelf life of liquid jaggery is mainly dependant upon the packaging and atmospheric conditions such as humidity and temperature. During the monsoon season the invert sugar and mineral salts which are present in liquid jaggery absorbs moisture as they are hygroscopic in nature [16]. During the storage of liquid jaggery liquefaction and deterioration of

colour are the major problems. Liquid jaggery prepared from mature sugarcane show less reduction in quality parameter as compared to the liquid jaggery prepared from immature and over aged sugarcane during storage. In order to improve the keeping quality of liquid jaggery it may be packed in glass jar or by using flexible packaging materials like LDPE/HDPE. As the moisture content increase during the storage period, it would effect the vital parameters such as pH, brix, reducing sugar and colour of the liquid jaggery. The use of moisture absorber (food grade silica gel) to absorb moisture present in the jaggery inside the package may improve the quality of jaggery and increase the shelf life of product [2]. To avoid the crystallization, citric acid is added and to enhance the shelf life of the liquid jaggery, addition of potassium metabisulphite or benzoic acid has been reported [19]. In a study it was also found that spray drying technique can be more efficient for increasing the shelf life of liquid jaggery [10].

VI. MARKET SCENARIO OF LIQUID JAGGERY

The worldwide consumption of liquid jaggery has been increased at 4.7% CAGR between 2017 and 2021. In present scenario, the market value of liquid jaggery stands around US\$ 544.8 million [20]. After the detailed analysis it has been reported that the global liquid jaggery market size is poised to expand at a high CAGR of 8.3% to reach US\$ 1.2 billion by the end of 2032. In India, liquid jaggery has potential to spur small scale enterprise as it required low investment to set up a plant. Some major global manufactures of liquid jaggery are Balaji Jaggery Farm, Vinayak Jaggery Manufacturers, Siddhagiris's Satvyk, Dev Bhoomi Jaivik Krishi Utpad, Sandeshwar Agro producer company, Dr. Jaggery etc [21].

Considering the economic change due to Covid-19 and Russia-Ukraine war influence, natural liquid jaggery demand has increased that which would create a huge market in the upcoming years. India has potential to export liquid jaggery in the market of Europe (Germany, UK, France, Italy, Russia, Turkey etc), Asia-Pacific (China, Japan, Korea, Australia, Indonesia, Thailand), South America (Brazil, Argentina, Columbia, etc), Middle East and Africa (Saudi Arabia, UAE, Egypt, Nigeria and South Africa).

VII. CONCLUSION

Liquid jaggery is an intermediate product obtained during the making of solid jaggery. Having medicinal and nutritional values as compared to other sweeteners in the market. It can be used for producing many traditional products besides in the making of cookies, toffees and beverages. The parameter of physicochemical properties plays an important role in guarding the quality of liquid jaggery. The selected chemical and herbal clarificants play a major role in final quality of liquid jaggery. It is associated with number of health benefits and highly recommendable by health experts both in rural and urban area. By increasing and promoting the value addition in liquid jaggery, it can be a tool for the growth of small entrepreneurs in the country.

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