Bangladesh J. Sugarcane, 35 : 88-95 *June, 2014*

Effects of Phyto Clarificant as Powder Form on *Goor* Manufacture

M.S. Arefin[1*], M.K. Begum[1], M.J. Islam[1], M.A. Rahman[2], A.K. Ghose[3] and S. Islam[4]
[1] Physiology and Sugar Chemistry Division, [2] On-farm Research Division
[3] Biotechnology Division, [4] Soils and Nutrition Division
Bangladesh Sugarcrop Research Institute, Ishurdi-6620, Pabna, Bangladesh

ABSTRACT

In *goor* manufacturing sodium hydrosulphite (hydrose) is indiscriminately used for cane juice clarification beyond recommended limits (35 g hydrose/1000 L juice) to impart light golden yellow colour to *goor*. Often level of SO_2 in *goor* exceeds beyond 70 ppm which is not suitable for human consumption. It is reported that prolonged intake of hydrose added *goor* can create bowel irritation, chronic dysentery and gastro urinal troubles. Many phyto clarificants have been studied and extracts of wild okra use. Amongst the phyto clarificants found to be quite effective juice clarificants for *goor* making. Since Wild Okra plant is not available during peak period of *goor* manufacturing, so technique has been developed to convert effective phyto clarificant as powder form for availability throughout the year for *goor* processing. An experiment was conducted in Physiology and Sugar Chemistry Division of the Bangladesh Sugarcane Research Institute (BSRI), Ishurdi, Pabna during 2011-2012 and 2012-2013 crushing year to determine the dose of phyto clarificants as powder form for preparation *of goor* through cane juice clarification. The experiment comprised of five treatment combinations following Complete Block (CBD) Design with three replications. *Goor* were prepared by simple open pan boiling method using 0 g, 20 g, 30 g, 40 g and 50 g of Wild Okra powder per 100 liter cane juice at different months (Oct, Dec and Feb). Superior quality of *goor* associated with higher sucrose content, higher colour transmittance, lower reducing sugars content, low moisture content and high *goor* recovery. The presence of this parameter in right proportion in juice is essential for producing good quality *goor* with standard keeping quality. On the basis of physical and chemical properties of *goor*, it was concluded that the treatment T_2 (30 g Wild Okra powder per 100 L cane juice) was used for better juice clarification and produce lucrative colour and better quality *goor*.

Key words: Sugarcane, phyto clarificant, powder, goor manufacture

INTRODUCTION

Sugarcane (*Saccharum officinarum*) is the main source of raw material for production of *goor* in Bangladesh (Arefin *et al.*, 2011). *Goor* is manufactured almost all parts of Bangladesh where sugarcane is grown in abundance. Selection of sugarcane varieties/clones suitable for quality *goor* production is important. The varieties suitable for

* Corresponding author: M.S. Arefin, Senior Scientific Officer
e-mail: arefinbsri@gmail.com

goor making are found to be equally good for sugar production. However, a variety suitable for sugar production may not be equally suitable for *goor* making (Singh *et. al.*, 1975). Goor quality is considered by its sucrose content, reducing sugars content, colour etc. (Gopal and Chiranjivi, 1959). Though the quality may be further modified by method of boiling and clarificants used for preparation of *goor.* Chemical composition of *goor* and its quality are dependent on composition of juice from which *goor* is made. Goor is high calorie sweetener and as it contains minerals, protein, glucose and fructose, it is known to be healthier in comparison to white sugar. A good quality *goor* contains more than 70% sucrose, less than 10% of glucose and fructose, less than 5% minerals and less than 3% moisture (Nath *et al.*, 2015). *Goor* production involves extraction of juice and its clarification. The clarification of juice depends on the composition of juice that affects the quality of *goor.* Besides sugars, it contains suspended impurities in the form of coarse particles and colloids. Soil particles, wax, fat, protein, gum, pectin, tannins, and coloring matters are extracted from the cane during juice extraction and they remain in colloid form (Rao, 1984).

In contrast, the plantation white sugar contains only 99.5% sucrose without any minerals. Commercial sugar has been implicated as a causative factor in certain heart diseases and also causing as a primary factor in dental problems. Therefore, the nutritional potential of *goor* is considerable value for majority of the population living in rural Bangladesh. Compared to *goor* the white sugar takes away calcium and potassium from the body during digestion apart from difficulty in digestion of white sugar. A quality *goor* is one having golden yellow colour, hard in texture, crystalline in nature, sweet in taste, less in impurities and low in moisture. The quality of *goor* is influenced by the variety of cane grown, quantity of fertilizers used and quality of irrigation water and the method of processing adopted. The common man is often misguided by the impression that the brightly coloured *goor* is the best quality *goor.* This is mostly wrong since in the present day for obtaining better colour most of the *goor* is produced by the use of harmful chemical clarificants. Many a times in order to get solidification of *goor* from bad quality juice and to get bright colour the *goor* making artisans add several unrecompensed chemicals and substances.

In the present day *goor* is prepared mostly from sugarcane grown by using chemical fertilizers, herbicides and pesticides and also preparation of *goor* involves mostly chemical clarificants. The quality of *goor* prepared with the commonly used chemical clarificants such as hydrose, sodium carbonate, sodium bi-carbonate, sajji, super phosphate, alum etc., not only has temporary improvement in colour, salty taste and poor storability but also excess use of them may result in harmful residues such as sulphur dioxide beyond prescribed limit. Many times the market *goor* has been found to contain excess quantities of harmful chemicals like sulphur dioxide. Due to use of such chemicals the taste and storability of such *goor* is also affected. An analysis results of available *goor* in the market has revealed that most of the *goor* are prepared by the use of chemicals which contain more than 80-120 ppm of sulphur di-oxide, which are well above the prescribed norms of 50 ppm by Indian standard (IS 12923): 1990. This high amount of sulphur di-oxide is detrimental to the beneficial intestinal microflora leading to digestive disorders and gastrointestinal problems etc., and also can cause breathing problems in asthmatic patients. It can also cause colon/rectal cancer and can also destroy the formation of vitamin A and vitamin B_1.

In this context, growing of sugarcane only with organics without chemical fertilizers, weedicides and pesticides and also preparation of *goor* with use of organic clarificants assumes importance in order to produce quality *goor*. There is a growing demand for organically produced *goor* both within the country and in the export market. In general term clarification means the extraction or separation of desired material and discarding the rest in a particular system either by means of chemical treatment or by mechanical operation. At times both may be applied for ultimate degree of separation requirement. In the instant proposition the cane juice which is a colloidal suspension of inorganic and organic non-sugars along with dissolved impurities needs dual operation followed by thickening, crystallization and centrifugation for the manufacture of sugar. Clarification of sugarcane juice can be classified into two categories such as chemical clarification and mechanical clarification. Commonly vegetative clarificants are used in boiling pan. Some chemicals such as hydrose (sodium hydro-sulphite), lime (calcium oxide), sodium bicarbonate, sodium carbonate, super phosphate and alum have been used in combination with the vegetative clarificants. A good flocculant should increase the settling rate of insoluble solids, decrease the mud volume, produce good clarity of clarified juice with the least turbidity and should produce good filterability of mud, with good clarity of filtrate (Panda *et al.*, 2008).

The synthetic clarificant like Bhendi powder SNi @ 2 ppm with herbal clarificant bhendi plant @ 2 kg/1000 liter were found effective in improving non reducing sugar (NRS), Colour, *goor* recovery and maximum removal of scum, showing better effect on quality of *goor* and also helped in maintaining higher NRS and better colour *goor* during storage (Patil *et al.*, 2005). In *goor* manufacturing sodium hydrosulphite (hydrose) is indiscriminately used for cane juice clarification beyond recommended limits (35 g hydrose/1000 L juice) to impart light golden yellow colour of *goor*. Often level of SO_2 in *goor* exceeds beyond 70 ppm which is not suitable for human consumption (Bureau of Indian Standard I.S.12923, 1990). It is reported that prolonged intake of hydrose added *goor* can create bowel irritation, chronic dysentery and gastro urinal troubles. Chemical clarificants adversely affect the human health beings since traces of chemicals remain in the final product (Anjal, Tagare 1972). All these chemicals (except lime) brighten colour of *goor* initially, but the colour of the *goor* becomes dull during storage. So alternative methods of clarification is being explored to alleviate the use of chemical clarificants (Vishal, 2003). Many plant clarificants have been reported during the last 60 years. Amongst the plant clarificants frsesh Wild Okra plant was found to be quite effective juice clarificant for *goor* making. Since Wild Okra plant is not available during peak period of *goor* manufacturing, so technique has been developed to convert effective phyto clarificants as powder form for availability throughout the year for *goor* processing. The present experiment was undertaken with objectives to determine the dose of phyto clarificants as powder form for cane juice clarification

MATERIALS AND METHODS

The experiment was conducted in Physiology and Sugar Chemistry Division of the Bangladesh Sugarcane Research Institute (BSRI), Ishurdi, Pabna during two crusing seasons 2011-2012 and 2012-2013. The experiment was laid out in complete block design (CBD) with five treatments combination and replicated three times. *Goor* was prepared by simple open pan boiling method using 0 g, 20 g, 30 g, 40 g and 50 g of wild

okra powder per 100 liter cane juice at different months (Oct, Dec and Feb). The powder clarificant was prepared from Wild Okra stem collected at seed formation and maturity growth stages of the plant. Wild Okra stem was thoroughly washed by clean water. After air drying stem and branches were separated out and then scrapped by using hand sharp knife. The scrapped sample material (bark) was dried by air under shade for several days. The shade dried stem was subjected to grinding machine for preparation of powder. After grinding, powder was sieved out from fibrous stem material. Different doses 0 g, 20 g, 30 g, 40 g and 50 g of Wild Okra powder was suspended in 2 liter clean water and mixed thoroughly. After 1 hour mucilaginous extract was filtered. Mucilaginous filtrate was used for clarification of 100 liter of boiling cane juice. The commercial variety was used as test crop. *Goor* was prepared with and without powder phyto clarificant. Physical and chemical properties of prepared *goor* viz., texture, crystalline nature, colour in solid state, taste, sucrose%, colour transmittance (at 0.25N solution), pH, reducing sugars per cent etc. were determined by following method of Roy (1954). Data on sucrose%, colour transmittance, moisture% and reducing sugars% of prepared *goor* were recorded. Recorded data have been presented graphically for discussion.

RESULTS AND DISCUSSION

Physical and chemical properties of *goor*

The physical and chemical properties of *goor* had been studied immediately after its preparation. *Goor* is normally priced in the market for its colour. The higher colour unit indicates better is the quality. In case of physical properties of *goor*, treatment T_1 (20 g Wild Okra powder per 100 L cane juice), T_2 (30 g Wild Okra powder per 100 L cane juice), T_3 (40 g Wild Okra powder per 100 L cane juice) and T_4 (50 g Wild Okra powder per 100 L cane juice) showed superior quality *goor* due to golden colour, good crystalline nature and taste compared to T_0 (control) (Table 1).

The colour transmittance of *goor* is shown in the Figure 3. It is seen that the highest colour transmittance of goor was obtained from the treatment T_2 and the value is 67.0% followed by T_1 (57.0%) and T_3 (50.0%). The lowest colour transmittance was obtained in the treatment T_0 (45.0). It is evident from the data that colour transmittance of *goor* prepared from the treatment T_2 (powder phyto clarificant 30 g/100 L cane juice) was comparatively highest value. Similar findings were also reported by Sarker, *et al.* (1985) that light coloured *goor* is always preferred by consumers for eating purpose and good quality *goor* is characterized by light colour.

The highest sucrose% of *goor* was recorded from the treatment T_2 (75.2%). The second highest value of sucrose% *goor* was observed from the treatment T_3 (71.29%) which was statistical similar with the treatment T_1 (69.05%). The lowest sucrose% *goor* was obtained in the treatment T_4 (Figure 1). It is universal that sucrose% being the main sweetening factor of *goor*. It was seen from the figoore 2, the lowest reducing sugars% of *goor* was found from the treatment T_2 (5.65%). The highest reducing sugars% of *goor* was observed from the treatment T_4 (6.67%) which is statistically similar to the treatment T_3 (6.32%). Results agree with results obtained by Jabber *et al.* (2005) who reported that a good quality *goor* should have higher sucrose% and lower reducing sugars%. *Goor* containing higher percentage of reducing sugars are generally hygroscopic, low shelf-life and ultimately poor quality in nature.

From the figoore 4, we observed that there was no significant difference in pH of prepared *goor* from all the treatments. Lower pH indicates acidic in nature. Figure 4 shows that the highest pH value of *goor* prepared from the treatment T_2 (5.79) followed by the treatment T_3 (5.61), respectively and prepared *goor* from these treatments are suitable for consumption. This result agreed with Arefin *et al.* (2010). Figure 5 mentioned that there was no significant difference in moisture% of prepared *goor* from all the treatments. The highest moisture% and the lowest moisture% obtained from the treatment T_3 (7.91%) and the treatment T_2 (7.15%). Higher percentage of moisture containing *goor* is not suitable for long term preservation (Gaur *et. al.*, 1979). Figure 6 stated that the highest recovery% of *goor* was obtained from the treatment T_2 (10.15%) which is statistically similar to the other treatments.

On the basis of above results, it may be stated that superior quality of *goor* associated with higher sucrose, high colour transmittance, lower reducing sugars content, low moisture content and high *goor* recovery. The correct proportion of this parameter is essential for producing good quality *goor* with standard keeping quality. From the observed physical and chemical properties of *goor*, it may be concluded that the the treatment T_2 (Powder phyto clarificant 30 g/100 L cane juice) was found better result for juice clarification and produce lucrative colour and better quality *goor* (Figure 7).

Table 1. Physical properties of *goor* under different treatments

Variety/Clone	Texture	Crystalline Nature	Colour in Solid State	Taste
T_0 = 0 g WOP/100 L juice	Hard	Good	Dark Brown	Sour
T_1 = 20 g WOP/100 L juice	Hard	Good	Golden	Good
T_2 = 30 g WOP/100 L juice	Hard	Good	Golden	Good
T_3 = 40 g WOP/100 L juice	Hard	Good	Golden	Good
T_4 = 50 g WOP/100 L juice	Hard	Good	Golden	Good

WOP = Wild Okra Powder

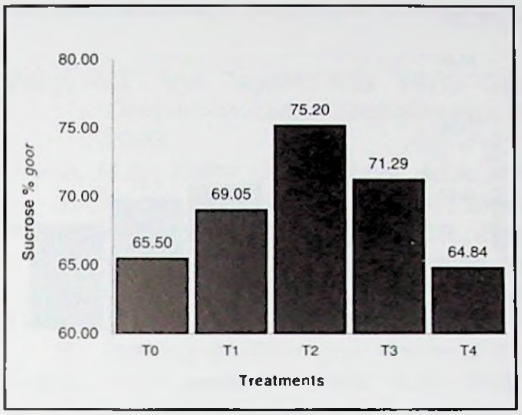

Figure 1. Sucrose% of *goor* under different treatments

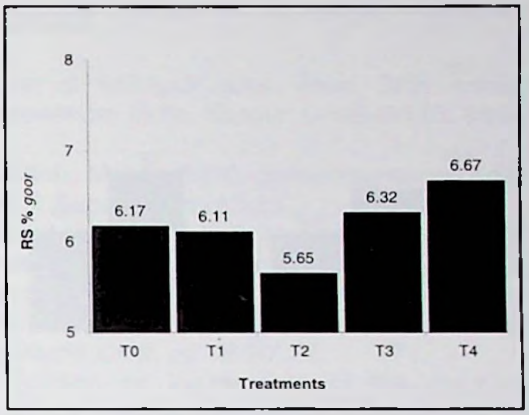

Figure 2. Reducing Sugars% of *goor* under different treatments

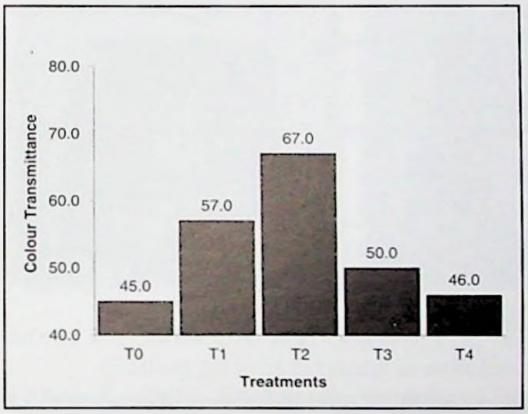

Figure 3. Colour transmittance of *goor* under different treatments

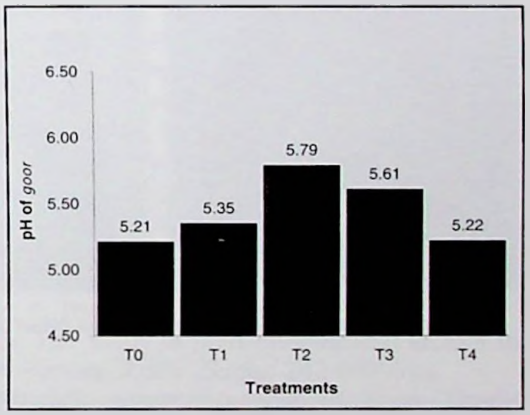

Figure 4. pH of *goor* under different treatments

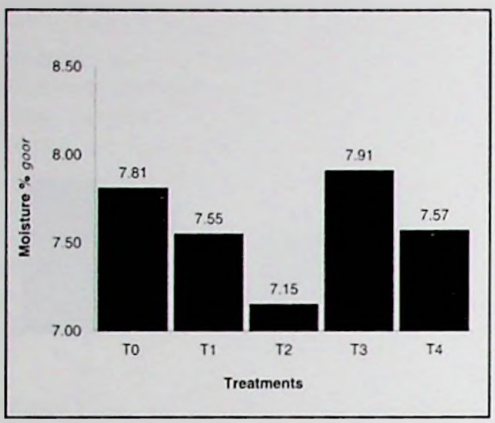

Figure 5. Moisture% of *goor* under different treatments

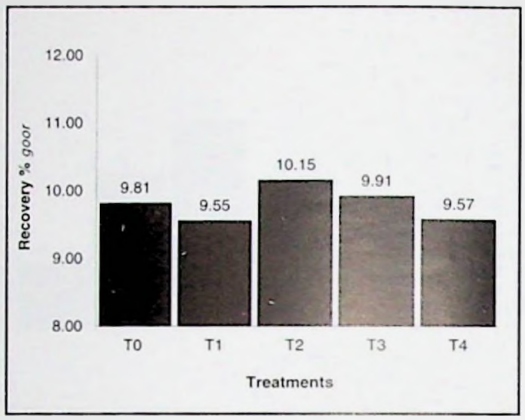

Figure 6. Recovery of *goor* under different treatments

Powder form phyto clarificant

Goor under T_0 treatment

Goor under T_1 treatment

Goor under T_2 treatment

Goor under T_3 treatment

Goor under T_4 treatment

Figure 7. Photograph of powder form phyto clarificant and gur under different treatments

REFERENCES

Anjal, S.T. and Tagare, A.G. 1972. Grading of kolhapur goor. *Proc. 38th Annual Convention, Sugar Technologists; Association, India, Kanpur.* G105-G113. India 2006.

Arefin, M.S.; Alam, M.R.; Jabber, M.A. and Miah, M.A.S. 2010. Screening sugarcane clones for goor manufacture. *Pakistan J. Sugar.*, **25(4)**:17-23.

Arefin, M.S.; Jabber, M.A.; Alam, M.R.; Begum, M.K.; Islam, M.S. and Islam, M.S. 2011. Goor quality of some sugarcane varieties cultivated under flood stress condition at Chunarughat. *Bangladesh J. Sugarcane*, **32**: 132-137.

Gaur, S.L.; Ranadive, S.L. and Jawalekar, D.V. 1979. Effect of sugarcane varieties on the keeping quality of goor. *Indian J. Sugarcane Crop*, pp.18-20.

Gopal, A.K.V. and Chiranjivi, R.K. 1959. Studies on the relation of the chemical composition of cane juice and the quality of jaggery with special reference to the new Co. canes. *Proc. ISSCT.* **10:** 825-828.

Jabber, M.A.; Ghafur, M.A.; Begum, M.K. and Arefin, M.S. 2005. Maturity status of new promising sugarcane genotypes and evaluation for goor quality. *Bangladesh J. Sugarcane*, **24-27:** 41-46

Nath, A.; Dutta, D.; Pawan Kumar and Singh, J.P. 2015. Review on recent advances in value addition of jiggery based products. *J. Food Process Technol.*, **6**:4

Panda, T.C.; Omre, P.K. and Kumbhar, B.K. 2008. Effect of different parameters on clarification efficiency of mechanical clarifier. *J. Techn. Sc.*, **11**:1-10.

Patil, J.P.; Shinde, U.S.; Nevkar, G.S.; Jaswant Singh. 2005. Clarification efficiency of synthetic and herbal clarificants in quality jaggery production. *Sugar Tech.*,**7(2)**: 77-81.

Rao, P.J.M. 1984. Administration in the Indian Sugar Industry. *Sugar Technol.*, **52(9)**: 19.

Roy, S.C. 1954. Monograph on the goor industry of India, pp. 55-64.

Sarker, M.A.A.; Jabber, M.A.; Alam, M.R. and Hoque, J. 1985. Sugarcane variety for goor production. *Bangladesh J. Sugarcane*, **7:** 76-78.

Singh, B.; Sareen, K. and Sharma, H.L. 1975. The study of physico-chemical factors for grading goor of sugarcane varieties in Punjab. *Indian Sugar,* **24 :** 947-949.

Vishal, K. 2003. Studies on centrifugal clarification sugarcane juice. M. Tech. Thesis, G.B. Pant University of Agriculture and Technology, Pantnagar, Uttaranchal, India.