

## Some Studies on Sugarcane Juice Clarificants

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The manufacture of jaggery is an important cottage industry in this state, and nearly 70% of the cane crop grown is being converted into jaggery. It is not possible to get jaggery cent per cent free from colour and impurities. The quality of jaggery produced depends on the variety, soil, manurial and cultural treatments and the clarification of juice. The aim of clarification is to remove as far as possible all the impurities that may be present and to prevent non sugars being formed again in the juice. The object is therefore to produce jaggery of light colour and good quality. There is thus need for adoption of a suitable clarificant.

Various clarificants are used in the different states of India. Lime is popular in Madras and Andhra, and lime with superphosphate in Bombay. In subtropical India, vegetable clarificants like juice of *Bhindi* (*Hibiscus esculentus*) are being used. In Trichy, Salem and Coimbatore districts of this state, hydros (sodium hydrogen sulphite) is used. (Roy, 1951) There is a marked improvement in color by the use of this salt, but the keeping quality of the jaggery is very much affected. It has been reported from Bihar (Khanna and Chakravarthi 1955) that the process of clarification of juice by a water extract of castor seed or groundnut seed, showed outstanding results. It has also been reported that the gur prepared by using soyabean tablets (soyabean flour supplemented by a small amount of monocalcium phosphate), was found to be superior to that obtained with the use of castor seed extract. The work done at Anakapalle (Mohanrao and Narasimhan, 1954) indicated that the jaggery obtained by clarification with both castor seed and groundnut seed extracts was poorer compared to the normal lime treatment. This jaggery did not set properly and was also softer than that from lime treatment.

**Materials and Methods:** In order to assess the relative efficiency of three clarificants, soyabean tablet, castor seed and groundnut seed extract, alone and in combination with lime, as compared to lime alone, four boilings were conducted at Sugarcane Research Station, Gudiyattam. The addition of lime was adjusted so that the pH of the juice was between 6.1 and 6.4. The variety of cane chosen was Co. 419.

The samples of jaggery from the various treatments, were analysed for moisture, sucrose, reducing sugars, acidity, color, turbidity and pore space. The methods of analysis followed are given below :

(i) *Moisture* : Determined by drying samples mixed with prepared stand, in a steam oven.

(ii) *Sucrose* : Determined in half normal solution by the usual polarisation method.

(iii) *Reducing sugars* : Determined in half normal solution by titration with Fehling's solution after lead clarification and deleading.

(iv) *Acidity* : Determined in standard solution by titration against N/50 alkali using phenolphthalein as indicator.

(v) *Colour* : Intensity of color was measured in  $\frac{1}{4}$  normal solution, after filtration through a double layer of No. 3 filter paper, by means of Klett Sommerson photo electric colorimeter.

(vi) *Turbidity* : Was determined in  $\frac{1}{4}$  normal solution by means of Klett Sommerson photo electric colorimeter. The ratio of the scale readings of the instrument in the original solution and that after filtration through a double layer of paper, is a measure of turbidity.

(vii) *Pore space* : Measurement of pore space was done by soaking weighed samples of jaggery in kerosene for 24 hours and finding out the volume occupied by kerosene.

**Results and Discussion** : The results of analysis of the samples of jaggery from the seven treatments are given in the accompanying table. The data were statistically analysed.

(a) *Sucrose* : Obviously, a jaggery of high sucrose content indicates its good quality. The highest sucrose content has been recorded by the treatment "lime+soyabean", closely followed by "lime alone" and the lowest by "soyabean alone". The treatments "lime alone" and "lime in combination with the other three clarificants" are found to be significantly superior to the two clarificants, soyabean tablet and groundnut seed extract.

(b) *Reducing sugars* : A low glucose content characterises jaggery of good quality. The treatments "lime alone" and "soyabean alone" have registered the lowest and the highest reducing sugar contents respectively. As regards reducing sugar content, lime alone is observed to be significantly better than the other three clarificants.

(c) *Moisture*: A low moisture content is a sign of good quality in jaggery, as the rate of deterioration will be less. The lowest moisture content is found in jaggery from lime treatment and the highest from soyabean treatment. Anyhow the treatment differences were not significant.

(d) *Acidity*: This denotes bad taste and as jaggery deteriorates, this constituent increases. Lower values would therefore indicate better quality. Not much of difference is noticed in the samples of jaggery from the various treatments.

(e) *Colour*: Of all the quality factors, color is the most important in the market yard; in the determination of quality of jaggery. Light coloured jaggery is preferred to dark coloured.

The pH is over 7.9, when lime is used in excess in the process of clarification, and then the colour of the jaggery is affected. In these trials, pH was controlled at 6.1 - 6.4, thereby limiting the quantity of lime used. As regards colour, there was no significant differences among the various treatments, though lime alone and in combination with groundnut seed extract has given jaggery of lighter colour than others.

(f) *Turbidity*: A smaller value of turbidity generally indicates the greater purity of jaggery. In these trials, "lime" has given the lowest value and "castor seed extract" the highest. Lime is found to be significantly superior to groundnut and castor seed extracts. No significant differences were observed, among the three clarificants, soyabean tablet, castor seed and groundnut seed extracts.

(g) *Pore space*: Measurement of pore space gives an idea of the texture. An open texture denotes better crystallisation. Samples of jaggery from the two treatments 'lime alone' and 'lime in combination with soyabean tablet', are found to possess a slightly more open texture than those from other treatments. Further, the addition of lime to the other clarificant seems to have slightly improved the texture of the jaggery.

**Physical Features**: Regarding hardness and crystal formation, the jaggery from the lime clarified juice was found to be better than that from other treatments. Softness and lack of crystal formation was observed particularly in jaggery from three treatments, "soyabean tablet", "castor seed" and "groundnut seed extracts" alone. The combination of lime with clarificants, appeared to produce a better product with regard to physical features.

On a comparison of the relative efficiency of the four clarificants, lime, groundnut seed extract, castor seed extract and soyabean tablet, lime appears to be the best though it was not significantly superior in respect of all the chemical constituents. In most of the cases, the addition of lime seems to have improved the efficiency of the other three clarificants tried in this experiment. The general conception is that the jaggery obtained by clarification with lime is dark coloured. In these trials, juices from mature canes have been used, and in such cases if liming is suitably adjusted, it is quite possible that jaggery of good quality and fairly light colour may be obtained. But, of course, in the case of juices of overripe and young canes, they require more lime i. e., high pH and hence the color is affected and this aspect requires further investigation.

**Summary:** Trial boilings were conducted with Co. 419 juice, at sugarcane Research Station, Gudiyattam and the efficiency of the various clarificants, lime, soyabean tablet, castor seed and groundnut seed extracts, alone and in combination with lime, was studied. The samples of jaggery from the various treatments, were analysed for their physical and chemical characteristics, and it was observed that lime appeared to be a better clarificant than the other three. The addition of lime to the particular clarificant is also observed to improve the quality of jaggery.

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Results of analysis of samples of jaggery.  
(Average of four boilings)

Factors of analysis.	Treatments							Significant or not P=0.05	Critical Difference
	A	B	C	D	E	F	G		
1. * Moisture	4.65	6.44	6.25	5.81	5.23	6.30	4.31	No	0.55
2. * Sucrose :	76.66	67.70	73.30	68.41	72.61	71.01	76.07	Yes (1)	5.57
3. * Reducing sugar :	11.78	14.05	11.76	12.75	11.60	11.94	10.17	Yes (2)	1.58
4. Acidity (number of ccs of N alkali per 100 gm. of jaggery.	5.30	5.38	4.85	5.58	5.05	5.43	5.05	No	0.93
5. Color (N/4 Solution)	29.5	33.5	27.3	32.8	30.0	30.8	26.8	No	6.07
6. Turbidity (N/4 Solution)	3.48	3.76	3.34	4.72	4.09	4.90	2.89	Yes (3)	1.30
7. Pore space (ccs per 100 gm)	2.09	0.72	1.65	0.96	1.31	1.03	1.83	No	0.36

\* Expressed as percentage on oven dry basis.

(1) A C C E F D B (2) B D F C A E G (3) F D E B A C G