

## BIOCHEMICAL COMPOSITION AND ENZYMATIC ANALYSIS OF SUGARCANE VARIETIES Isd-16 AND Isd-28

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**Abstract:** An experiment was conducted at Bangladesh Sugarcane Research Institute (BSRI), Ishurdi, Pabna, Bangladesh. In this study, biochemical composition, enzyme activity and some chemical parameter of sugarcane juice in the varieties Isd-16 and Isd-28 were investigated. Isd-28 showed higher amount of brix (20.85%), pol (18.53%), fiber (19.93%), ash (6.95%), minerals (Na 1.36 & K 3.12 gm/100 gm ash) and lipid (0.058%) than that of Isd-16. Other compositions such as reducing sugars (0.096%), commercial cane sugar (12.55%), moisture (88.97%), protein (0.328%) and vitamin-C (0.00351 gm/100 gm juice) were lower in Isd-28. Amylase enzyme activity (44.44 unit/ml) and cellulase enzyme activity (7.15 unit/ml) were higher in Isd-28 but invertase enzyme activity (10.88 unit/ml) was lower than that of Isd-16. Purity (91.34%) and extraction percentages (54.63%) were higher in Isd-16 whereas, recovery percentage (11.17%) was lower in the juice of Isd-16 variety than that of variety Isd-28 of sugarcane. Most of the biochemical compositions analyses were higher in Isd-28 than that of Isd-16. Reducing sugars were less in Isd-28 variety indicating less invertase activity.

**Key words:** Sugarcane; enzyme; brix; pol; Isd-16; Isd-28

### Introduction

Sugarcane (*Saccharum officinarum*) is the second cash crop of Bangladesh. It is the major source of sugar (65%) of the world and the remaining (35%) produced from sugar beet (Anon., 1993). The annual production of sugar in Bangladesh is 0.22 million metric tons from sugarcane. But the country's annual requirement of sugar production has been estimated at 0.30 million metric tons (Ali *et al.*, 1989). Adopting two ways can increase sugarcane production of the country, one is to extend the cultivation area of sugarcane and the other is to increase the yield per unit area. Bangladesh Sugarcane Research Institute (BSRI), has released some locally developed improved varieties of sugarcane which produce maximum tonnage with satisfactory sugar recovery (Bull and Cullen, 1994).

Sugar is a source of instant energy and a glass of sugar helps to regain energy loss due to long hours of fasting. Nutritionist rightly advocate for taking around 15% of the required calories from sugar alone. A minimum of 13% of the body's required calorie must be provided through sugar especially at the adolescent age for balanced growth and development of the brain. Sugarcane juice contains calcium, potassium, phosphorus, iron, riboflavin, carotene besides sucrose and traces of protein and fat. The quality of cane depends on higher sucrose level, lower fiber, reducing sugars, and other impurities content in juice. Sucrose accumulation in sugarcane is infact a highly sensitive response to discrete enzyme behavior. Sucrose, commonly known as table sugar, is a disaccharide composed of a  $\alpha$ -D-glucose moiety and a  $\beta$ -D-fructose moiety linked by a  $\alpha$ -1, 4-glucosidic bond. When this bond is cleaved in a hydrolysis reaction, an equimolar mixture of glucose and fructose is generated.

Due to some biochemical changes, the qualitative and quantitative changes of sugar in sugarcane occur abundantly. Previous study regarding biochemical composition was employed using small numbers of parameters. In this study we have clarified biochemical composition using large number of parameters for Isd-16 and Isd-28 varieties of sugarcane. The present investigation was undertaken to study some biochemical compositions and parameters *viz.* brix, pol, commercial cane sugar (CCS), reducing sugars (RS), lipid, protein, ash, vitamin-C, fiber, minerals, purity, extraction percentage, recovery percentage, pH and enzymatic activities of the sugarcane varieties Isd-16 and Isd-28.

### Materials and Methods

For the experimental purpose, Isd-16 and Isd-28 varieties of sugarcane were collected from BSRI (24.07°N latitude, 89.05°E longitude and 15.2M altitudes), Ishurdi, Pabna at the harvesting time in the month of February, 2003. The cane samples were crushed in a three-roller mill (power crusher). Brix% was determined by the Brix hydrometer, standardized at 20°C. Horne's dry led method was used for the pol (sucrose) determination using Automatic Polarimeter (ADP-220). Purity% & recovery% were calculated from brix% and pol% as described by Anonymous (1970). Reducing sugars were determined by Lane and Eynon method mentioned in by Queensland Sugar Mill Laboratory Manual (Anon., 1970). Fiber content

was determined by the Prepared Cane Method (Anon., 1970). Moisture and ash content were determined by Association of Official Analytical Chemists (AOAC) (1984) method. Mineral content was determined by Flame Photometric Method. Lipid content was determined by Bligh and Dyer (1959) method. Protein content was determined by Micro-Kjeldahl (Jayaraman, 1985) method. Vitamin-C content was determined by Bessey's titrimetric method (Bessey and King, 1933). Enzyme activity was determined by Mahdeven and Sridhar (1982) method.

### Results and Discussion

The biochemical compositions of brix, pol, RS, fiber, CCS, moisture, ash, minerals (Na, K), lipid, protein, vitamin-C and some chemical parameters and enzyme activity of sugarcane were determined and analyzed. Table 1 shows the results of biochemical composition. Hasan *et al.* (2002) found almost similar result of biochemical composition. For the variety Isd-16, the composition was: brix 20.80%, pol 18.46% and RS 0.20%. For the variety Isd-28, the composition was: brix 19.60%, pol 17.60% and RS 0.25% at the harvesting stage. Almost similar results were observed by Sikder *et al.* (2001). Solomon *et al.* (1990) also found the similar type of results and reported that the brix%, pol%, CCS% and reducing sugar contents were 20.11, 19.18, 13.73 and 0.83, respectively in the harvesting stage of the sugarcane variety Co 1158. Almost similar results of brix%, pol% and reducing sugars were reported by Kundu and Gupta (1991) at the harvesting stage in the varieties Co 48211, CoH 5, CoJ 64, CoJ 76, CoS 687, Co 85015, CoH 51. Taneja *et al.* (1986) also observed almost close results in the varieties CoJ 64, Co 7314, Co 7714, Co 9614, CoH 7802, Co 1158, Co 975, CoH 7803 and Co 1148. Tania and Salamatullah (2002) found  $79.53 \pm 0.07$  % moisture,  $0.5 \pm 0.07$  % ashes,  $0.28 \pm 0.07$  % proteins and  $0.13 \pm 0.04$  % fat in Isd-16 variety. They also found  $75.83 \pm 0.06$  % moisture,  $0.30 \pm 0.01$  % ashes,  $0.26 \pm 0.03$  % proteins and  $0.12 \pm 0.06$  % fat in the variety Isd-28. Donefer and Latrille (1979) reported that sugarcane variety B 41227 contains 6.5% ash. Okuno and Tamaki (2002) reported 1.6gm/100 gm solid potassium from sugarcane before octadecylsilyl-silica gel (ODS) treatment. Islam *et al.* (2002) determined 0.051 units of lipid, 1.31 unit of protein and 0.089 unit of vitamin-C in the healthy sugarcane.

Table 1. Biochemical composition in sugarcane

Compositions		Variety	
		Isd-16	Isd-28
Brix %		19.75	20.85
Pol%		18.04	18.53
Reducing Sugars %		0.209	0.096
Fiber %		17.67	19.93
% Commercial Cane Sugar (CCS)		12.82	12.55
Ash%		4.42	6.95
Moisture%		90.88	88.97
Minerals (gm/100gms of Ash)	Na	1.31	1.36
	K	0.292	0.312
Lipid%		0.051	0.058
Protein%		0.437	0.328
Vitamin-C%		0.00378	0.00351

Table 2 shows the results of some biochemical parameters analysis. Almost similar results were reported by Hasan *et al.* (2002). They found that Isd-16 had 88.75% purity and 11.2% recovery rate whereas Isd-28 contained 89.79% purity and 10.8% recovery rates. Almost similar results were observed by Sikder *et al.* (2001). Solomon *et al.* (1990) reported that purity and extraction percentages and pH in the varieties Co 1158 were 95.29%, 55.29% and 5.47 respectively.

Table 2. Biochemical parameters of sugarcane juice

Parameters	Variety	
	Isd-16	Isd-28
Purity%	91.34	88.87
Recovery%	11.17	11.29
Extraction%	54.63	47.66
pH	5.39	5.41

Fig.-1, Fig.-2 and Fig.-3 represent the enzyme invertase, amylase and cellulase activity respectively at harvesting stages of Isd-16 and Isd-28 varieties of sugarcane. Isd-16 had higher invertase activity (14.51 unit/ml) than Isd-28 (10.88 unit/ml). Isd-28 had a higher amount of amylase activity (44.44 unit/ml) than that

of the Isd-16 (35.56 unit/ml). Isd-28 also had a higher amount of cellulase activity (7.15 unit/ml) than that of the Isd-16 (3.50 unit/ml).

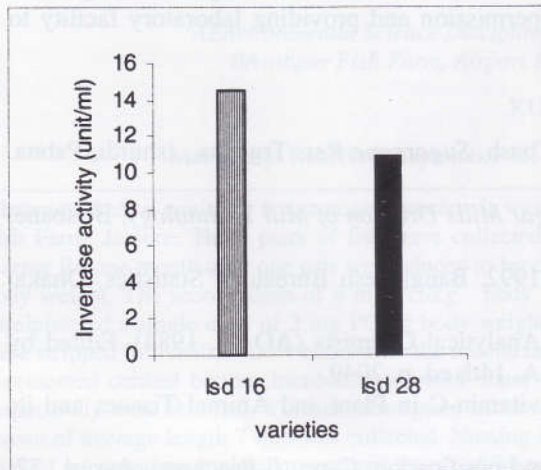


Fig.- 1. Invertase activity in Isd 16 and Isd 28 varieties of sugarcane

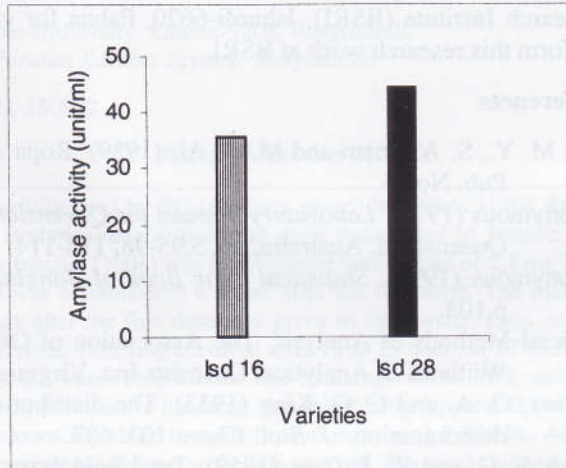


Fig.- 2. Amylase activity in Isd 16 and Isd 28 varieties of sugarcane

Hasan *et al.* (2002) found that at harvesting stage, invertase activity of Isd-16 and Isd-28 were 6.0 unit/ml and 17.37 unit/ml respectively, amylase activity was 23.0 unit/ml and 30.0 unit/ml in the variety Isd-16 and Isd-28 respectively and Isd-28 contained 4.88 unit/ml and Isd-16 contained 3.77 unit/ml cellulase at harvesting stage. It has been hypothesized that, the presence of higher invertase activity in the sugarcane reduces the amount of brix and pol but increases reducing sugars. The result shown in Table 1 and Fig.-1 is consistent with the hypothesis.

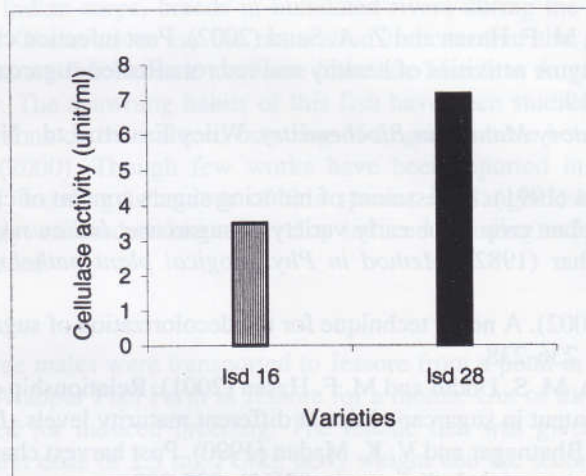


Fig.- 3. Cellulase activity in Isd 16 and Isd 28 varieties of sugarcane

Sikder *et al.* (2001) reported almost similar amount of invertase, amylase and cellulase in Isd-16 and Isd-28 varieties. Das and Prabhu (1990) reported that during maturity phase, reducing sugars content and invertase activity in sugarcane were low; they also reported 48.9 unit of amylase in variety Co 1148.

### Conclusion

Although both Isd-16 and Isd-28 are prominent varieties of sugarcane, Isd-28 contains lower amount of invertase enzyme as well as lower amount of reducing sugars and higher amount of brix and pol than that of variety Isd-16. Among the biochemical compositions, moisture content was the highest, lipid and vitamin-C content was very minute in both the variety. Due to less amount of invertase, variety Isd-28 contained less amount of reducing sugars. We can transfer this enzyme responsible gene into another variety, which would synthesize higher invertase as well as higher reducing sugar and thus the variety may be improved.

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