CAPACITY ENHANCEMENT OF SRI CLARIFIER, AN EXPERIENCE AT RANIPUR SUGAR MILLS

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ABSTRACT

The major aim of this study was to utilize the available ample capacity of clarifier to reduce industrial sucrose losses. Brief descriptions of these modifications are given. In under given paper benefits from improved performance of clarifier with respect to reduction in inversion in clarification due to shorter retention time, levels of reducing sugar in clear juice, syrup and final molasses are discussed. The performance of the clarifier after modification revealed that shorter retention time has reduced final molasses production by 0.23%- 0.26% cane. Moreover lesser viscosity especially in low grade massecuite and better exhaustion of molasses were observed. These resulted in lesser purity of final molasses. All these factors reduced sugar loss in final molasses by 0.10% cane - 0.12% cane during season 2010-2011 and 2011-2012 as compare to season 2009-2010 and 2008-2009 (before modification).

INTRODUCTION

Ranipur sugar mills was installed in 1976 with crushing capacity 2000TCD under the name of Consolidated Sugar Mills. The plant was supplied and erected by FCB (France) with FCB designed (multi tray, 8 M Dia.) juice clarifier having holding capacity of 140 cubic meter.

Modifications at juice clarifier.

Three modifications were carried out in the juice clarifier in various tenures.

i. In 1992, the basic design of juice clarifier (FCB design) was changed into "Decanter Type" to increase the crushing capacity of the plant up to 125 TCH. But the result of the modification was negative in the coming season. To overcome the problem, a new SRI clarifier (6M dia., Clarifier No.2) having capacity of 95 cubic meter was inducted in 1993. Both clarifiers remained in circuit to cope up crushing rate up to 125TCH.

ii. In year 2000, 8 meter dia. Clarifier (clarifier No.1) was modified as SRI clarifier to cope up the crushing rate of 145 TCH.

iii. In season 2009-2010, it was tried to maintain crushing rate with single juice clarifier, but it was observed that up to the juice flow of 145M^3/Hr, the performance of the juice clarifier remained satisfactory. When the juice flow increased from 145 M^3/Hr to 160 M^3/Hr, the feed box of the clarifier overflowed, so it became compulsory to take clarifier No.2 in line. After taking second clarifier in line, the retention time rose up to 90 minutes at juice flow of 160

M^3/Hr. In season 2009-2010, the working of Juice Clarifier No.1 (modified FCB design) strictly observed and thoroughly studied for capacity enhancement with some modifications. After detailed study management of Ranipur sugar mills, in the light of study results, decided to modify the clarifier. Table No.1 shows the details of modifications carried out in the clarifier No.1. Drawings of clarifier No.1 are annexed as annexure -A, annexure -B (before modification) and annexure - C and annexure-D (after modification).

Table No.1

S.No	Particulars	Before modification	After modification	Remarks
1.	Working volume of clarifier	140 cub.M	166 cub.M	Working volume was increased by 26 Cub.M
2.	Juice Flow	160 Cub.M/Hr	200 Cub.M/Hr	
3.	Retention Time	87 Minutes	50 Minutes	
4.	Line from flash tank to juice clarifier	300 mm	350 mm	Line was replaced with larger dia.
5	Raw juice distribution line	200 mm	200 mm	
6.	Velocity of juice in flash line	2.042 ft/sec	1.708 ft/sec	-
7.	Depth of raw juice launder from top of clarifier	2325 mm	1725 mm	Existing launder was raised by 600 mm
S.No	**Particulars**	**Before modification**	**After modification**	**Remarks**
8	Dimensions of raw launder	H = 410mm W = 210 mm Slot size = 100mmx100mm	H = 410mm W = 350 mm Slot size = 100mmx100mm	Width of existing launder was increased by 140 mm
9	Velocity of juice in raw launder	0.55 ft/sec	0.539 ft/sec	-
10	Depth of clear juice launder from top of clarifier	2500 mm and 2350 mm	1900 mm and 1750 mm	Existing launder was raised by 600 mm
11.	Dimensions of clear launder	H = 380mm W = 270 mm Slot size = 100mmx100mm and H = 290mm W = 250 mm	H = 380mm W = 350 mm Slot size = 100mmx100mm And H = 290mm	Width of existing were increased by 80 mm and 100 mm.

In off season 2010, all the necessary modifications were completed. In season 2010-2011, the clarifier No.1 after modification set for trial. The juice flow rate was increased gradually with keen observations of technical results. There was no end of delight and gratification, when clarifier No.1 continuously bear and maintained the juice flow rate of 160- 170 M^3/Hr independently for 24 hours. After successful trial, clarifier No.1 taken in line for routine operation and clarifier No.2 put off to serve as standby unit for necessary internal cleaning and sanitation during season. In season 2011-2012 same practice was followed.

LABORATORY DATA

a. Comparison of total Slid load at Juice Clarifier

Table No.2

S.No	Particulars	Season 2009-2010 (with Two Clarifiers)	Season 2010-2011 (with single modified clarifier)	Season 2011-2012(with single modified clarifier)
1.	Juice Flow Rate	160 M^3/Hr	180 M^3/Hr	200 M^3/Hr
2.	Imbibition % fiber	192	220	250
3.	Total solid Load at clarifier	13.152 Tons/Hr	14.11 Tons/Hr	14.79 Tons/Hr

b. Comparison of results.

Table No.3

S.No	Particulars	Season 2009-2010 (with Two Clarifiers)	Season 2010-2011 (with single modified clarifier)	Season 2011-2012(with single modified clarifier)
1.	Purity of clear juice	78.62	78.59	78.69
2.	Purity of Syrup	78.99	78.81	78.76
3.	Purity rise in syrup	0.3786	0.222	0.0744
4.	Reducing sugar in Clear juice	0.673	0.602	0.731
5.	Reducing sugar in syrup	3.245	2.894	3.492
6.	Consumption of polyelectrolyte (ppm)	4.30	4.47	4.45
7.	Clarification Effect	8.52	9.37	9.45
8.	Lime consumption % Cane	0.064	0.061	0.064

c. **Comparison of final molasses characteristics.**

Table No.4

S.No	Particulars	Season 2009-2010 (with Two Clarifiers)	Season 2010-2011 (with single modified clarifier)	Season 2011-2012(with single modified clarifier)
1.	Final Molasses Production %cane	4.68	4.45	4.42
2.	Purity of Final Molasses	32.87	31.81	31.77
3.	Reducing sugar in final molasses	14.85	13.97	13.06
4.	Loss of sugar in final molasses	1.36	1.26	1.24

RESULTS AND DISCUSSIONS

1. After carrying out modifications, retention time of juice decreased from 87 minutes to 50 minutes at same crushing rate.
2. Clarifier No.2 remained as standby through out the seasons. Cleaning of clarifier become possible without taking any mill stoppage.
3. After modifications, single clarifier operated successfully at 11% more total solid load and gave best results.
4. Purity rise in syrup than clear juice after modification is lesser, which indicates lesser inversion rate in clarification, as shown Table No. 5

Table No.5

Retention time in minutes	Clarified juice pH (measured at 20°C)		
	6.70	7.0	7.30
180	0.83	0.42	0.21
40	0.19	0.09	0.05

Sucrose inversion losses in clarifiers in g per 100g sucrose in juice (cane sugar engineering by Dr. Albert Barten page 236)

5. Maintainability of RS levels in syrup is more accurate after the modification then before modification.
6. The consumption of polyelectrolyte enhanced by 0.15 - 0.17 ppm after modification then before modification of clarifier. But the cost of enhanced consumption of polyelectrolyte is negligible as compare to saving in sugar due to lesser inversion rate.
7. Clarification effect improved by 0.58% to 0.93 %.
8. Final Molasses production % cane decreased by 0.23 % to 0.26 %cane.
9. Due to lesser inversion rate in clarification, less viscosity was observed during

season 2010-2011 and 2011-2012 (after modification), resulted better exhaustion of molasses. That impacted on lesser final molasses purity by 1.06 to 1.10 then season 2009-2010 (before modification).

10. Reducing sugar levels reduced in final molasses after modification by 0.88% to 1.40%.
11. After modification of juice clarifier, loss of sugar in final molasses decreased by 0.10% to 0.12 % cane.

CONCLUSION

The practical evidences and available Laboratory Data revealed that after modification of the juice clarifier No.1 (modified FCB), Ranipur Sugar Mills could cope up its crushing by taking only single clarifier in line and got success in reducing retention time in juice clarification.

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