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PRODUCE MORE SUGAR AND POWER USING ALFA LAVAL DECANTER CENTRIFUGES

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ABSTRACT

Installing Alfa Laval SugarDec decanters instead of Rotary Vacuum Drum Filters (RVDF) for sugar muddy juice dewatering saves energy, Sugar and operational costs. Payback of an installation is estimated to be less than one year. Sugar mills, throughout the World, have conventionally used Rotary Vacuum Drum Filters (RVDF) to dewater the sugar mill mud that is produced after lime treatment or sulphitation of the sugar juice and subsequent sedimentation in Short Retention Time Clarifiers (SRTC) or in conventional clarifiers. An alternative technology for clarification of the sugar muddy juice and dewatering of the sugar mud, using Alfa Laval Decanter Centrifuges (henceforth referred to as "Decanters") has been established with encouraging results. The advantages by using Alfa Laval Decanter Technology are:

- *Higher electricity output from the Co-gen plant due to savings in bagacillo.*
- *Increase in the recovery of sugar by maximizing mud cake dryness*
- *Lower steam consumption in the sugar juice evaporator since there is no wash water to dilute the juice.*
- *Reduction in the power consumption required for mud dewatering.*
- *Easy disposal of the mud due to the very low moisture content and reduced mud quantity as there is no addition of bagacillo as a filter media.*
- *Avoid or reduce inversion losses arising due to longer residence time in the RVDF system and bacteria associated with the addition of bagacillo as filter aid.*
- *Smaller foot print thereby saving space and installation cost compared to the RVDF.*

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In the last few years several major decanter installations have been commissioned with SugarDec 400 decanters manufactured by Alfa Laval in India. Performance of the decanters was established by sampling and analysis of the feed, de-sweetened mud and centrate. Mud cakes with very low moisture content and residual pol levels could be produced using the decanters. The centrate clarity was such that it could be recycled to the process for recovering sugar content. Substantial savings could be generated by using decanters in place of RVDFs.

INTRODUCTION

Alfa Laval SugarDec decanters are appreciated on the sugar market both from the process performance standpoint, as well as the mechanical reliability standpoint. Rotary Vacuum Drum Filters have been traditionally used for sugar mud de-sweetening in sugar mills. While the drum filters support a continuous process, they tend to have certain disadvantages with respect to decanters in terms of performance parameters and operating costs. These observations were made at a sugar mill in South India where the first Alfa Laval SGDM 400 decanter (henceforth referred to as **SugarDec 400**) was supplied and operated on a commercial scale for sugar mud de-sweetening in 2007. On the basis of that success, 37 more SugarDec 400 decanters were supplied between 2009 and 2013 to nine other sugar mills for sugar mud de-sweetening and proper analysis was conducted at these decanter installations after commissioning.

We determined the moisture content and dissolved solids in the final mud cake to assess the sugar recovery and also worked upon getting optimum quality of liquor / centrate for recycling back to the process. The study also involved economic analysis of operating Decanters vis-à-vis RVDFs.

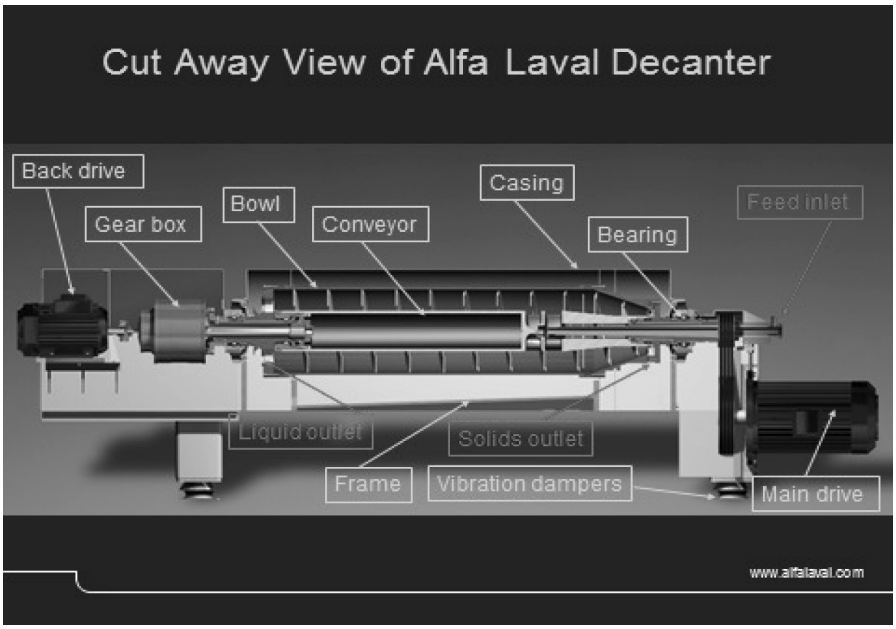
WHAT IS A DECANTER CENTRIFUGE?

A decanter separates suspended solids to a much higher degree than Rotary Vacuum Drum Filters. A decanter is a sedimentation centrifuge for separation of suspended solids from one or two liquids using a very high “gravitational” field generated by rotation. It has a cono-cylindrical rotor equipped with a conveyor for continuous unloading of sediment solids. Separation takes place in the horizontal bowl which is equipped with a variable pitch screw conveyor. The slurry is fed into the bowl through a stationary feed tube and smoothly accelerated by the inlet distributor. Centrifugal force causes the sedimentation of the solids on the wall of the bowl. The conveyor and bowl rotate in the same direction but at different speeds with the scroll slightly slower than the bowl. The solids are lifted out of the liquid and are centrifugally dewatered before being discharged into the casing. The clarified liquid overflows into the casing through openings in the end of the bowl. An electrical motor and a V-belt transmission drive the bowl. Power is transferred to the conveyor by

means of a two- or three stage planetary gearbox. The speed difference between the bowl and the conveyor may be obtained by a fully automatic back drive system that compensates for variations in the incoming solids. A compact, in-line frame carries the rotating part with main bearings at both ends. Vibration isolators are placed under the frame. The rotating part is enclosed in a casing with a cover and a bottom section in which the solids and liquid outlets are integrated. The bowl, conveyor, inlet tube, outlets and other parts in direct contact with the slurry are made of stainless steel. The discharge ports as well as the conveyor flights and feed zone are protected with highly erosion resistant sintered tungsten carbide. The frame is made of mild steel with an epoxy enamel finish.

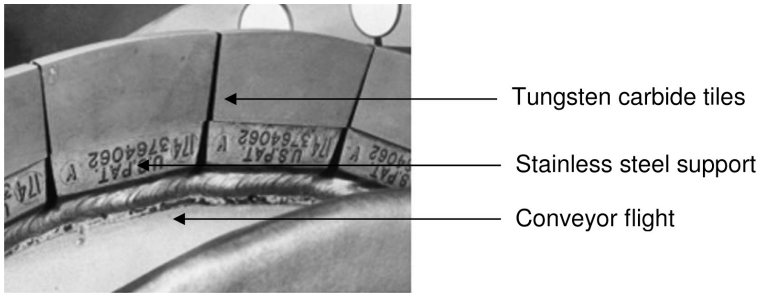
The main components of a Decanter are:

- Bowl
- Conveyor
- Gearbox
- Frame with the casing
- Feed and discharge arrangements
- Motor/s
- Control panel

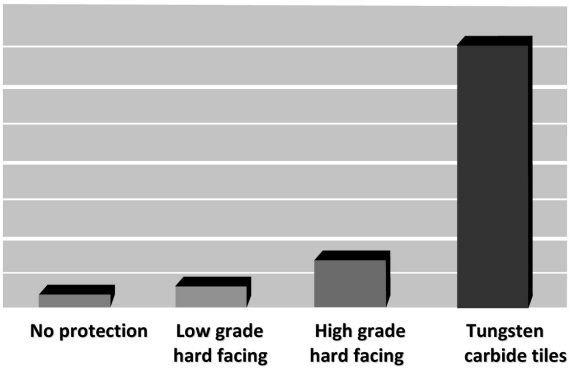


WEAR PROTECTION

Alfa Laval SugarDec decanters have an enhanced wear protection package which has been the key to low maintenance and operation costs. The conveyor flights can be protected with varying types of hard surfacing depending on the degree of abrasion presented by the process. For this application, we include sintered tungsten carbide tiles (brazed) as the muddy juice may contain abrasive particles such as sand, etc.

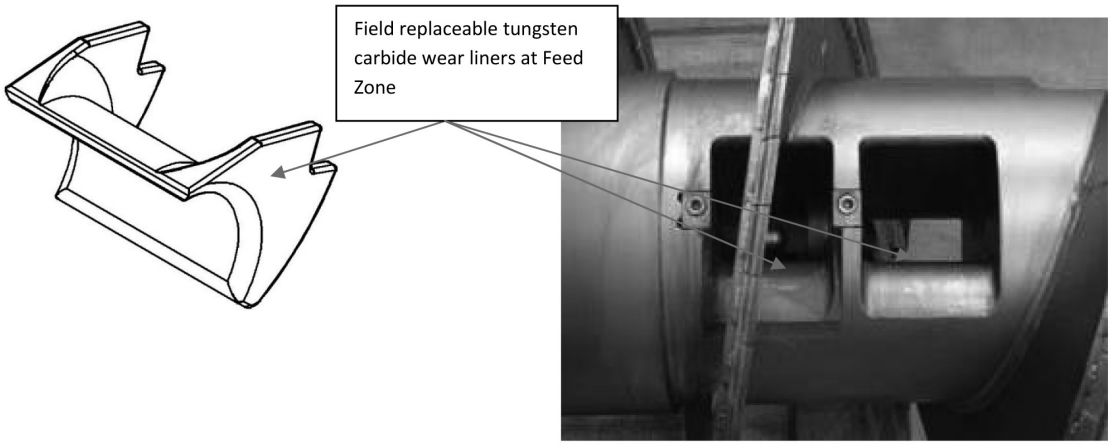


The below graph gives an idea about the operating life of various types of wear protection.



Conveyor with TC tiles protection.

Apart from the conveyor flights, the conveyor feed zone is equipped with field replaceable tungsten carbide wear liners.



The solids discharge outlet ports of the bowl is protected with tungsten carbide inserts on saddles, field replaceable.

EVOLUTION OF ALFA LAVAL DECANTER TECHNOLOGY FOR THE SUGAR INDUSTRY

Sugar mills using SugarDec decanters really appreciate the benefits by using this new technology over Rotary Vacuum Drum Filters which is evident by the number of new installations. From the first commercially viable decanter installation at Sakthi Sugars, Modakuruchi unit, Alfa Laval has come a long way with 41 decanters operating successfully at the below-mentioned sugar mills and orders for another 11 decanters at various stages of manufacturing/ installation.

- Sakthi Sugars Ltd. and Bannari Amman Sugar Ltd in Tamil Nadu,
- Vijayanagar Sugar Pvt. Ltd, Davangere Sugars, Bannari Amman (Kolegal) in Karnataka

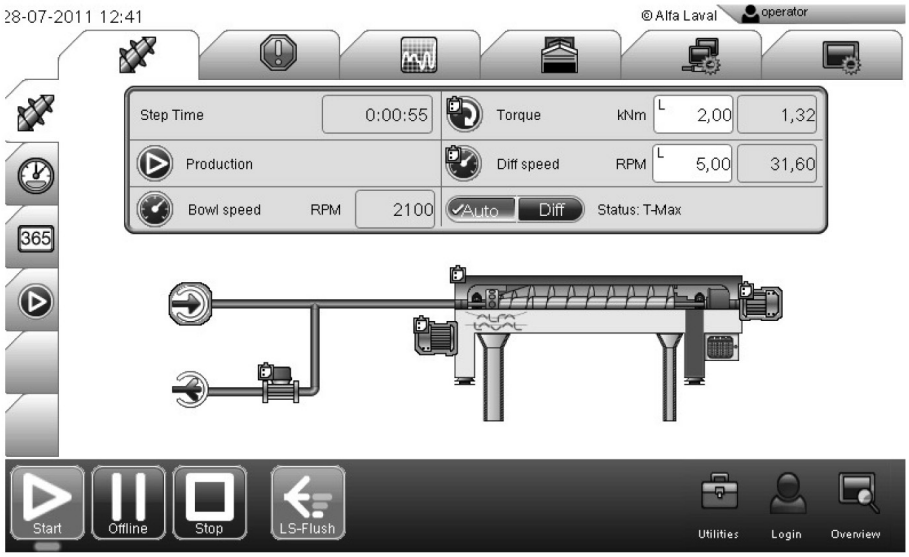
- Gangakhed Sugar & Energy Ltd, Vitthalrao Shinde SSK, Shree Chhatrapati Shahu SSK Kagal and Hemraus industried ltd, Lokmangal Mauli in Maharashtra.

Thus there will be at least 52 Alfa Laval decanters operating on muddy juice dewatering at the start of the next sugar campaign.

Alfa Laval started initially by offering decanters with countershaft transmission (that is, basic design without automation) as the concept of Decanter Technology was new to the industry. This technology has been well received by the industry and the company has specially developed decanter model **SugarDec-400** with advanced features for the Indian Sugar Industry.

SugarDec-400 is equipped with back drive automation using state-of-the-art Basic Core Controller (BCC) and HMI. The BCC controls package is designed to serve as a complete system for SugarDec-400 fitted with a VFD back drive in which the differential speed is controlled by varying the speed of the back drive motor. The BCC limits the maximum torque and excessive speed, while operating in differential speed or torque control mode. Torque control mode allows the differential speed to modulate while keeping the torque constant, thus optimising/maximising the solids dryness. A touch screen HMI on which different parameters such as the Bowl Speed, Torque and Differential Speed can be monitored is also a part of the BCC controller. Additional features such as temperature sensor for main bearing and vibration sensors can also be included with this controller.

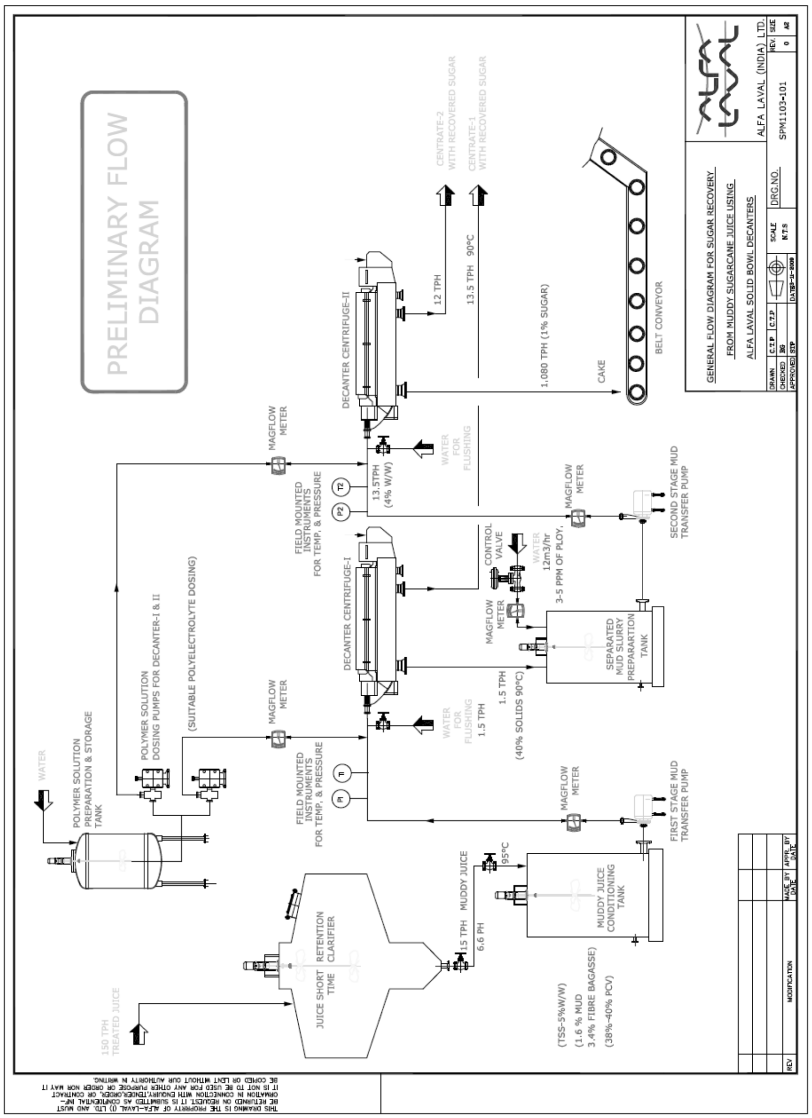
HMI OF THE ALFA LAVAL BCC CONTROLLER



COMPLETE TECHNICAL SOLUTION

As a natural extension of the technical solution, Alfa Laval has developed an engineering package for the complete Decanter station and has supplied Decanters with BCC automation along with design and engineering. The fact that Alfa Laval has been allowed to engineer the complete Decanter station shows that Alfa Laval has become a respected player and partner in the sugar industry in India.

Typical flow sheet with decanters for sugar mud de-sweetening



RESULTS OBTAINED AT SOME OF THE ALFA LAVAL DECANTER INSTALLATIONS

1. Shree Chhatrapati Shahu Sahakari Sakhar Kharkhana, Kolhapur, Maharashtra; have installed 3 units of SugarDec 400 for sugar mud dewatering with one in the first stage, one in the second stage and one common stand by for stage I and II.

Suviron Equipments have constructed the Decanter station at Shree Chhatrapati Shahu SSK. This is the second sugar factory in the co-operative sector in India to embrace the Alfa Laval Decanter Technology. It is an existing sulphitation mill of 5000 TCD capacity with 3 large drum filters for dewatering the muddy juice. The mill has a conventional RapiDorr-444 clarifier that gives an underflow consistency of 6 to7% by weight.

Separation efficiency of more than 95% was achieved on Alfa Laval decanters at Shree Chhatrapati Shahu SSK. Total polyelectrolyte consumption was found to be around 1.00 kg/ton of dry solids for the first stage and 0.75 kg/ton of dry solids for the second stage or 5.72 ppm for the first stage and 3.80 ppm on Juice flow for the second stage.

The quantity of hot water used for re-slurrying is in the range of 7 to 8% cane. The resultant centrate from the second stage decanter is sent to imbibition. This avoids additional load on evaporation unlike in drum filter where the wash water gets added to the filtered juice thereby increasing the load on evaporation. The pol% press mud achieved at Shree Chhatrapati Shahu SSK is in the range of 1.5 to 1.6%.

The Pol is normally 55 to 60% of the dissolved solids content, due to none-sucrose and none-sugars being included in the solids cake.

AUTOMATED SUGARDEC 400 DECANTERS AT SHREE CHHATRAPATI SHAHU SSK-KAGAL-KOLHAPUR

DECANTER CENTRATE – STAGE I

FINAL CAKE – STAGE II

	Sugar Mud Mass Balance		**12-02-2014**		
	Customer : Shree Chhatrapati Shahu SSK	**Sugar Dec-400 (m/c 1-I stage)**			**Sugar Dec-400 (m/c 2-II STAGE)**
Sugar Muddy	**Total m3 / hr**	24	**Feed 2**	**Second Stage**	
Juice	Suspended Solids %	5.76%		Dilution Water (kg/hr)	17000
	Suspended Solids (kg / hr)	1382		Net Water in Cake (kg/hr)	4781
	Dissolved Solids %	16.00%		Dissolved solids in cake (kg / hr)	852
	Dissolved Solids (kg / hr)	3840		Suspended D.S. in cake (kg / hr)	1322
	Water (kg / hr)	18778		Total Feed to 2nd Decanter (m3/hr)	23.96
	Dissolved concentration in water	16.98%		Suspended Solids %	5.52%
	Total Solids in Feed %	21.76%		Suspended Solids (kg / hr)	1322
				Dissolved Solids %	3.56%
Poly	Addition kg/t dry basis	1		Dissolved Solids (kg / hr)	852.36
	Concentration	0.05%		Water (kg / hr)	21781
	Addition rate m3/hr	2.76		Dissolved concentration in water	3.77%
	Polyelectrolyte consumption Kg/hr	1.4		Total Solids in Feed %	9.07%
Feed + Poly	Total m3 / hr	26.76	**Poly 2**	Addition kg/t dry basis	0.75
	Suspended Solids %	5.17%		Concentration	0.050%
	Suspended Solids (kg / hr)	1384		Addition rate m3/hr	1982
	Dissolved Solids %	14.35%		Polyelectrolyte consumption Kg/hr	0.99
	Dissolved Solids (kg / hr)	3840			
	Water (kg / hr)	21541	**Feed 2 + Poly**	Total m3 / hr	26
	Dissolved concentration in water	15.13%		Suspended Solids %	5.10%

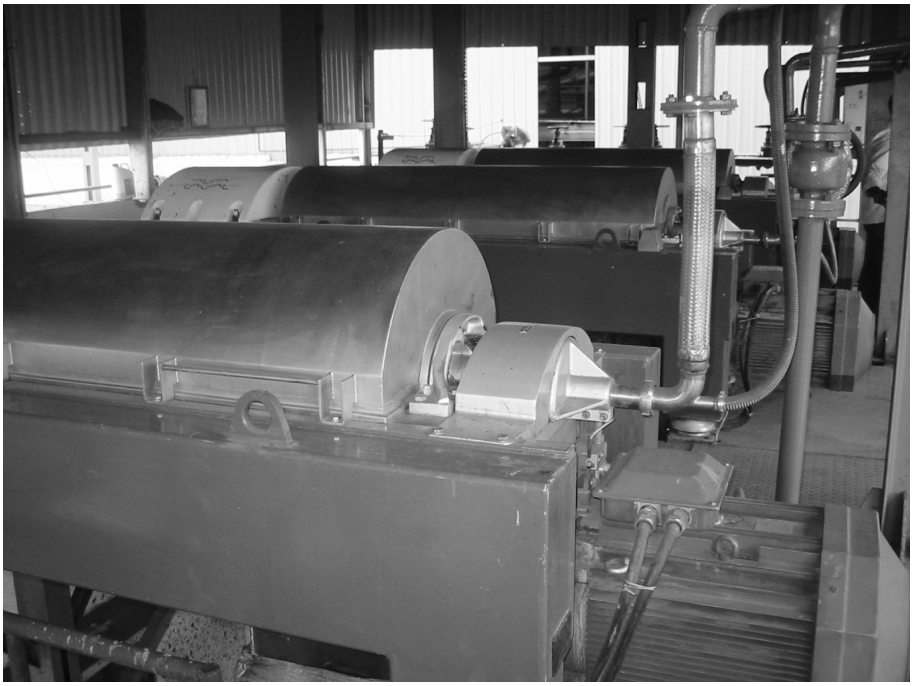
	Total Solids in Feed %	19.52%		Suspended Solids (kg / hr)	1323
				Dissolved Solids %	3.29%
Reslurry	Suspended Solids Recovery Rate	95.50%		Dissolved Solids (kg / hr)	852
Cake	Suspended D.S. in cake (kg / hr)	1321.5		Water (kg / hr)	23763
	Suspended dry solids in cake (%)	19.00%		Dissolved concentration in water	3.46%
	Total cake (kg / hr)	6955		Total Solids in Feed %	8.38%
	Net liquid in cake (kg /hr)	5634	**Waste Cake**	Suspended Solids Recovery Rate	98%
	Dissolved solids in cake (kg / hr)	852		Suspended D.S. in cake (kg / hr)	1289
	Net water in cake (kg / hr)	4781		Suspended dry solids in cake (%)	22.00%
	Total D.S. in cake (kg / hr)	2174		Total cake (kg / hr)	5861
	Total D.S. in cake (%)	28.00%		Net liquid in cake (kg /hr)	4572
				Dissolved solids in cake (kg / hr)	158.31
				Net water in cake (kg / hr)	4413
Sugar Juice	Suspended solids (kg / hr)	62		Total D.S. in cake (kg / hr)	1448
Filtrate	Water and T.D.S. (kg / hr)	19747		Total D.S. in cake (%)	31.00%
	Dissolved solids centrate (kg / hr)	2988		Dissolved solids in Cake (%)	2.70%
	Total effluent (kg / hr)	19809		Dissolved solids loss from feed %	4.12%
	Dissolved solids in centrate (%)	15.08%		Pol in Cake	1.50%
	Suspended Solids centrate (%)	0.31%	**Imbibition**	Suspended solids (kg / hr)	33
	Total Solids in centrate (%)	15.40%		Water and T.D.S. (kg / hr)	20043
				Dissolved solids imbibition (kg / hr)	694
				Total effluent (kg / hr)	20077

				Dissolved solids in imbibition (%)	3.46%
				Suspended Solids imbibition (%)	0.16%
				Total Solids in imbibition (%)	3.62%

2. **Hemarus Industries Ltd.**, Maharashtra, have installed 3 units of SugarDec 400 for sugar muddy juice separation on their 3,500 TCD Sugar Mill and Suviron Equipments have constructed the Decanter station. This was commissioned in the 2010 season. Their results are excellent, as reported overleaf.

Separation efficiency was 98% of suspended solids, very low polyelectrolyte consumption, a 30% wt suspended solids cake from a basic decanter and less than 1.5% pol in the sugar mud cake.

The clear centrate is recycled to the main juice clarifier for recovery of sugar. The centrate from the second stage decanters is pumped to the mills as imbibition water. The final mud cake from the second stage is transported on a conveyor belt to be dropped into a hopper from where it goes into a tractor trailer or truck for disposal. The mud cake is a rich source of nutrients and is therefore used as manure for the crops by local farmers.



SUGARDEC 400 DECANTERS AT HEMARUS TECHNOLOGIES

	Sugar Mud Mass Balance		**11-01-2014**		
	Customer: Hemarus Ind. Ltd. (OLAM AGRO)	**Sugar Dec-400 (m/c 1-I Stage)**			**Sugar Dec-400 (m/c 2-II Stage)**
Sugar Muddy	**Total m3 / hr**	12.0	**Feed 2**	**Second Stage**	
Juice	Suspended Solids %	8.24%		Dilution Water (kg/hr)	10000
	Suspended Solids (kg / hr)	989		Net Water in Cake (kg/hr)	3211
	Dissolved Solids %	13.80%		Dissolved solids in cake (kg / hr)	509
	Dissolved Solids (kg / hr)	1656		Suspended D.S. in cake (kg / hr)	930
	Water (kg / hr)	9355		Total Feed to 2nd Decanter (m3/hr)	14.65
	Dissolved concentration in water	15.04%		Suspended Solids %	6.35%
	Total Solids in Feed %	22.04%		Suspended Solids (kg / hr)	930
				Dissolved Solids %	3.48%
Poly	Addition kg/t dry basis	0.55		Dissolved Solids (kg / hr)	509.18
	Concentration	0.05%		Water (kg / hr)	13211
	Addition rate m3/hr	1.09		Dissolved concentration in water	3.71%
	Polyelectrolyte consumption Kg/hr	0.5		Total Solids in Feed %	9.82%
Feed + Poly	Total m3 / hr	13.09	**Poly 2**	Addition kg/t dry basis	0.36
	Suspended Solids %	7.56%		Concentration	0.050%
	Suspended Solids (kg / hr)	989		Addition rate m3/hr	0.670
	Dissolved Solids %	12.65%		Polyelectrolyte consumption Kg/hr	0.33
	Dissolved Solids (kg / hr)	1656			
	Water (kg / hr)	10442	**Feed 2+ Poly**	Total m3 / hr	15
	Dissolved concentration in water	13.69%		Suspended Solids %	6.07%

	Total Solids in Feed %	20.21%		Suspended Solids (kg / hr)	930
				Dissolved Solids %	3.32%
Reslurry	Suspended Solids Recovery Rate	94.00%		Dissolved Solids (kg / hr)	509
Cake	Suspended D.S. in cake (kg / hr)	930		Water (kg / hr)	13880
	Suspended dry solids in cake (%)	20.00%		Dissolved concentration in water	3.54%
	Total cake (kg / hr)	4650		Total Solids in Feed %	9.40%
	Net liquid in cake (kg /hr)	3720		Waste Cake Suspended Solids Recovery Rate	96%
	Dissolved solids in cake (kg / hr)	509		Suspended D.S. in cake (kg / hr)	893
	Net water in cake (kg / hr)	3211		Suspended dry solids in cake (%)	24.00%
	Total D.S. in cake (kg / hr)	1439		Total cake (kg / hr)	3721
	Total D.S. in cake (%)	28.00%		Net liquid in cake (kg /hr)	2828
				Dissolved solids in cake (kg / hr)	100.08
				Net water in cake (kg / hr)	2728
Sugar Juice	Suspended solids (kg / hr)	59		Total D.S. in cake (kg / hr)	993
Filtrate	Water and T.D.S. (kg / hr)	8378		Total D.S. in cake (%)	30.00%
	Dissolved solids centrate (kg / hr)	1147		Dissolved solids in Cake (%)	2.69%
	Total effluent (kg / hr)	8438		Dissolved solids loss from feed %	6.04%
	Dissolved solids in centrate (%)	13.59%		Pol in Cake	1.46%
	Suspended Solids centrate (%)	0.70%	**Imbibition**	Suspended solids (kg / hr)	37
	Total Solids in centrate (%)	14.30%		Water and T.D.S. (kg / hr)	11561
				Dissolved solids imbition (kg / hr)	409
				Total effluent (kg / hr)	11589

				Dissolved solids in imbibition (%)	3.53%
				Suspended Solids imbibition (%)	0.32%
				Total Solids in in imbibition (%)	3.85%

3. Lokmangal Mauli Ind. - have installed 5 units of SugarDec 400 decanters for muddy juice de-sweetening. There are 2 decanters for the first stage, 2 for the second stage and the 5th as a standby. Clarifier underflow is taken into a mud tank from which a progressive cavity pump (1 opr + 1 st.by) feeds to the first stage decanters. The polymer preparation tank discharges into a stock solution tank from where it is pumped to the decanters using VFD controlled screw pump (1 opr + 1 st.by). Solids cake from the first stage decanters is mixed with hot water and the resulting slurry is pumped to the second stage decanters.

SUGARDEC 400 DECANTERS AT LOKMANGAL MAULI INDUSTRIES LTD.

The pol% pressmud achieved at Lokmangal mauli is 1.5. However, owing to high suspended solids concentration in the muddy juice, the feed to first stage decanters was maintained at 10-11 cum/hr to each decanter at a pH of 7.0 to 7.3 by addition of milk of lime. This ensured excellent clarity of the first stage centrate. Thus, separation efficiency of more than 90% was achieved at this site and that too without any dilution of the muddy juice with hot water.

	Sugar Mud Decanter Mass Balance		**15-02-2014**		
	Customer : Lokmanagl Mauli Ind. Ltd.	**2 X Sugar Dec-400**			**2 X Sugar Dec-400**
Muddy	**Total m3 / hr**	21.00	**Feed 2**	**Second Stage**	
Juice	Suspended Solids %	8.70%		Dilution Water	20000
	Suspended Solids (kg / hr)	1827		Net Water in Cake (kg/hr)	6108
	Dissolved Solids %	14.50%		Dissolved solids in cake (kg / hr)	986
	Dissolved Solids (kg / hr)	3045		Suspended D.S. in cake (kg / hr)	1774
	Water (kg / hr)	18128		Total Feed to 2nd Decanter (m3/hr)	28.87
	Dissolved concentration in water	15.88		Suspended Solids %	6.14%
	Total Solids in Feed %	23.20%		Suspended Solids (kg / hr)	1774
				Dissolved Solids %	3.41%
Poly	Addition kg/t dry basis	0.75		Dissolved Solids (kg / hr)	985.82
	Concentration	0.05%		Water (kg / hr)	26108
	Addition rate m3/hr	2.74		Dissolved concentration in water	3.64%
	Polyelectrolyte consumption Kg/hr	1.40		Total Solids in Feed %	9.56%
Feed + Poly	Total m3 / hr	23.74	**Poly 2**	Addition kg/t dry basis	0.55
	Suspended Solids %	7.70%		Concentration	0.05%
	Suspended Solids (kg / hr)	1828		Addition rate m3/hr	1.951
	Dissolved Solids %	12.83%		Polyelectrolyte consumption Kg/hr	0.98
	Dissolved Solids (kg / hr)	3045	**Feed 2+ Poly**	Total m3 / hr	31.0

	Water (kg / hr)	18867		Suspended Solids %	5.76%
	Dissolved concentration in water	13.90%		Suspended Solids (kg / hr)	1774
	Total Solids in Feed %	20.53%		Dissolved Solids %	3.2%
				Dissolved Solids (kg / hr)	986
Reslurry	Suspended Solids Recovery Rate	97.00%		Water (kg / hr)	28058
Cake	Suspended D.S. in cake (kg / hr)	1773.5		Dissolved concentration in water	3.39%
	Suspended dry solids in cake (%)	20.00%		Total Solids in Feed %	8.96%
	Total cake (kg / hr)	8868			
	Net liquid in cake (kg /hr)	7094	**Waste Cake**	Suspended Solids Recovery Rate	96%
	Dissolved solids in cake (kg / hr)	986		Suspended D.S. in cake (kg / hr)	1704
	Net water in cake (kg / hr)	6108		Suspended dry solids in cake (%)	23.00%
	Total D.S. in cake (kg / hr)	1439		Total cake (kg / hr)	7407
	Total D.S. in cake (%)	28.00%		Net liquid in cake (kg /hr)	5703
				Dissolved solids in cake (kg / hr)	193.58
				Net water in cake (kg / hr)	5509
Sugar Juice	Suspended solids (kg / hr)	55		Total D.S. in cake (kg / hr)	1897
Filtrate	Water and T.D.S. (kg / hr)	14818		Total D.S. in cake (%)	30.00%
	Dissolved solids centrate (kg / hr)	2059		Dissolved solids in Cake (%)	2.61%
	Total effluent (kg / hr)	14873		Dissolved solids loss from feed %	6.36%
	Dissolved solids in centrate (%)	13.85%		Pol in cake	1.43%
	Suspended Solids centrate (%)	0.37%	**Imbibition**	Suspended solids (kg / hr)	71
	Total Solids in centrate (%)	14.21%		Water and T.D.S. (kg / hr)	23341
				Dissolved solids imbition (kg / hr)	792

				Total effluent (kg / hr)	23412
				Dissolved solids in imbibition (%)	3.38%
				Suspended Solids imbibition (%)	0.30%
				Total Solids in imbibition (%)	3.69%

Performance with Rotary Vacuum Drum Filter System

Basis: 5000 TCD sugar mill

Requirement: 2 nos. 14' dia x 24' long

Performance parameters of RVDF system in general:

Muddy juice feed flow rate: 20 to 25 m^3/hr @ 8-12% w/w suspended solids (each)

Mud solids retention: 70%-75% (average)

Mud cake solids: 15 to 18% w/w

Bagacillo in cake: 8 to 10% w/w

Cake moisture: 72 to 77% w/w

Sugar content in mud cake: 2.5 to 4% pol

Suspended solids in filtrate: 1.2-1.5% w/w

Filter Cake % cane: 3.3 - 3.6%

ROTARY VACUUM DRUM FILTER - 2 NOS. 14' DIA X 24' LONG

Various operating expenses considering 210 days' operation:

Consumed power:

Vacuum pumps	2 nos.	110 KW
Drum drive	2 nos.	15 KW
Agitator drive	2 nos.	8.0 KW
Filtrate pumps	2 nos.	37 KW
Hot water pump	1 no.	5.5 KW
Feed (mud) mixer	1 no.	15 KW
Bagacillo blower	1 no.	22 KW
Mud pump	1 no.	22 KW
Wash water pump	1 no.	5.5 KW

Total consumed energy: 240 KWH

Considering INR 5/unit of power, cost is INR 60 Lakh per season

Bagacillo required for filtration: 7 kgs per ton of cane (minimum)

Polyelectrolyte consumption: Not required

Wash water consumption: 200 m^3/day @ 4% on cane

Cost towards wash water evaporation considering 1% steam equivalent to 0.5% bagasse

Approximate maintenance cost: INR 20 Lakh per season

Sugar loss @ 0.06% cane: INR 150 Lakh per season

Area required for installation: approximately 2,800 sq. ft.

Considering 2 Drum Filters with associated auxiliaries such as vacuum pumps, moisture traps, filtrate receivers, etc.

Performance with Alfa Laval Decanter Centrifuge System

Basis: 5000 TCD sugar mill

Requirement : 4 nos. SugarDec 400 Decanters – two for 1st stage and two for 2nd stage We also recommend one swing/standby decanter.

Performance parameters of Decanter system in general:

Muddy juice feed flow rate: 25 m^3/hr @ 4-5% w/w suspended solids (each)

Mud solids retention: @ 95%

Mud cake solids: 25 to 30% w/w

Bagacillo in cake: NIL

Cake moisture: 70 to 72% w/w

Sugar content in mud cake: 0.8 to 1.5% pol (average 1.2)

Suspended solids in filtrate: Less than 0.4% w/w

Reject cake % cane: 1.8-2.1%

DECANTERS - 5 NOS. SUGARDEC 400 (CONSIDERING ONE SWING/STANDBY)

Various operating expenses considering 210 days' operation:

Consumed power:

Decanter main drive	4 nos.	96 KW
Hot water pump	1 no.	5.5 KW
First stage feed (mud) mixer	1 no.	15 KW
Mud pump	1 no.	15 KW
First stage centrate pump	1 no.	15 KW
Second stage mud agitator	1 no.	15 KW
Second stage mud pump	1 no.	15 KW
Second stage centrate pump	NIL (by gravity)	
Dilution water pump	1 no.	5.5 KW
Agitator for polyelectrolyte preparation	1 no.	2.2 KW
Polyelectrolyte dosing pump	5 nos.	7.5 KW

Total consumed energy : 192 KWH

Considering INR 5/unit of power, cost is INR 48 Lakh per season

Cost of bagacillo : NIL

Polyelectrolyte consumption : 50 kgs/day

Cost of polyelectrolyte per kg : INR 300/-

Re-slurry water consumption : 300 m^3/day @ 6% on cane

Cost NIL as imbibition water is used.

Approximate maintenance cost: INR 20 Lakh per season (after initial 2 years)

Sugar loss @ 0.03% cane: INR 75 Lakh per season

Area required for installation: approximately 1,500 sq. ft. for 5 nos. SugarDec 400 Decanters.

Cost–economics: ALFA LAVAL Decanters v/s Rotary Vacuum Drum Filters

Basis: 5000 TCD Sugar Mill with 210 days' operation per year

Bagasse savings: 7 kg per Ton of cane crushed

Total bagasse savings in one crushing season: 7350 MT

Saved bagasse is used for power generation

1 MT bagasse generates 2.6 MT steam

Therefore, 7350 MT bagasse will generate 19,110 MT steam

1 MW power generation requires 5.5 MT steam.

Therefore, total power generation with 7350 MT bagasse = 3,475 MW or 3,475,000 KW

Selling price of power to local electricity board is INR 4.79/unit

Therefore, revenue earned by selling 3,475,000 units is INR 166 Lakh

Considering 1% steam equivalent to 0.5% bagasse, cost towards evaporation of wash water works out to INR 100 lakh per season

Sugar recovery is double that of drum filter, so INR 75 lakh saved per season

Wash water consumption: 200 m^3/day @ 4% on cane.

Considering Rs. 50/m^3, cost of wash water is INR 20 lakh per season

Savings in consumed power: INR 12 lakh per season

Cost towards polyelectrolyte water works out to INR 31.5 lakh per season

Maintenance expenses in the first few years are negligible but after the first few years this could be considered to be INR 20 lakh per season

NETT GAIN with Alfa Laval Decanter Technology: INR 3.20 Crores per season

COST/SEASON ↓	ROTARY VACUUM DRUM FILTER	ALFA LAVAL DECANTER	SAVINGS/SEASON WITH DECANTER
Operating costs	345.0	100.0	245.0
Sugar loss	150.0	75.0	75.00
Total costs	495.0	175.0	320.0

Note : All figures are in Lakh INR

Differential Capital cost required for Alfa Laval Decanter system compared to RVDF system is less than the annual savings with the Decanter system.

Therefore, payback period with Alfa Laval Decanters is one sugar season!

CONCLUSIONS

On the basis of the operating data collected from our Decanter installations in various sugar mills, we can state with authority that the Alfa Laval

SugarDec decanter centrifuges provide a more profitable and technically and environmentally superior solution for muddy juice dewatering as compared to conventional Rotary Vacuum Drum Filters.

The advantages/benefits of using Alfa Laval Decanters can be summarized as follows:

- Saving of bagasse which is not required as in the case of drum filters (as filtration aid) and can be used for power production instead.
- Higher recovery of sugar due to lower sugar losses in solids cake.
- Savings in operating power consumption.
- Wash water is not present in the clarified juice discharged from first stage decanters and therefore reduces the load on evaporation.
- Superior juice quality (centrate) as compared to filtrate from drum filters.
- Lesser space requirement.
- Simplified continuous operation.
- Lower inversion losses due to very short residence time.
- No bacterial contamination and no environmental pollution as mixing of bagasse is completely eliminated.
- System can be kept clean as decanters and piping can be flushed with hot water.
- Totally closed system – leakage & splash-free.
- Decanters can handle lower consistency mud unlike drum filters.

All the above benefits amount to a shorter payback period of less than 1 sugar season.

With further work we expect to prove conclusively the financial advantage of back drive automation that is incorporated in our **SugarDec-400** decanter model and fully justify its inclusion by reducing the payback period further, with lower sugar loss.

ADDITIONAL BENEFIT:

In sugar mills which also operate sugar refineries, the same Alfa Laval decanters can also be used for sugar scum de-sweetening, thereby generating additional revenue and reducing the payback period even further.

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SGDM 400, Sugar Dec 400 and Sugar Dec-405 are brand names of Alfa Laval Decanters.