GRAVITY FLOW SCREENING OF HOT RAW JUICE TO BOOST UP PERFORMANCE AND CAPACITY OF DECANTER STATION

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ABSTRACT

We once again would like to express our grateful thanks to sugar industry for selecting and successfully implementing the most modern Decanter Technology for muddy juice treatment. Application of decanter technology indeed has been a major technical breakthrough of the 21st century contributed by Indian sugar industry and is highly commendable. Truly India has emerged as a world leader by introducing application of this modern technology for all other factories in the world to follow.

Simple gravity flow screening of Hot Raw Juice is successfully implemented using well proven Rotary Juice Screening technology. It is interesting to note that by separating 99.0% fibre solids from raw juice prior to juice reaction vessel the solid loading on existing decanter has been considerably reduced. Thus capacity and/or efficiency of existing Decanter station is further improved together with forever financial gains by generating additional electrical energy using the bagasse separated at Hot Rotary Juice Screen.

INTRODUCTION

Data collected over a period last 15 years revealed that higher quantities of cane fibre and of more fine nature are entering into process house due to dust like formation of fibre particles at cane preparatory devices. Rotary Juice Screen generally of 500 micron mm wedge bar opening provided at milling station was found to be inadequate and the escaped excessive quantities of fine cane fibres are finding its way to raw juice causing serious problems at all subsequent processing stages.

Stage-wise juice screening by 'gravity flow' operation, all by using Rotary Juice Screen, initially of cold raw juice in two stages at milling station followed by hot raw juice screening was carried out. First stage screen has 500 micron opening, second stage having 350 micron opening and third final stage hot raw juice screen with 120 micron opening. Fibre content of juice was analyzed at each stage using ICUMSA Method GS7-13 (1994) and 'fibre balance' study was conducted. This is a novel concept successfully introduced first time ever in the sugar industry.

Average results of fibre content analysis are as under depending upon particle size distribution of fibre solids.

1)	Unscreened raw juice	:	11000 PPM
2)	First stage screened raw juice	:	2000 PPM
3)	Second stage screened raw juice	:	700 PPM
4)	Third stage screened hot raw juice	:	80 PPM
	Net cane fibre removal	:	99%.

Highest 99% cane fibre removal from raw juice has resulted into multiple advantages like e.g. colour reduction of clear juice by 15 to 20%, clear juice turbidity reduction by 50%, reduction of fibre solid loading on juice clarifier by 95% (from 2000 ppm to 80 ppm), no carryover of fine cane fibre was observed in clear juice, no inclusion of fine cane fibre in sugar crystal etc. and many such more at subsequent processing stations allowing improved performance at each unit operation.

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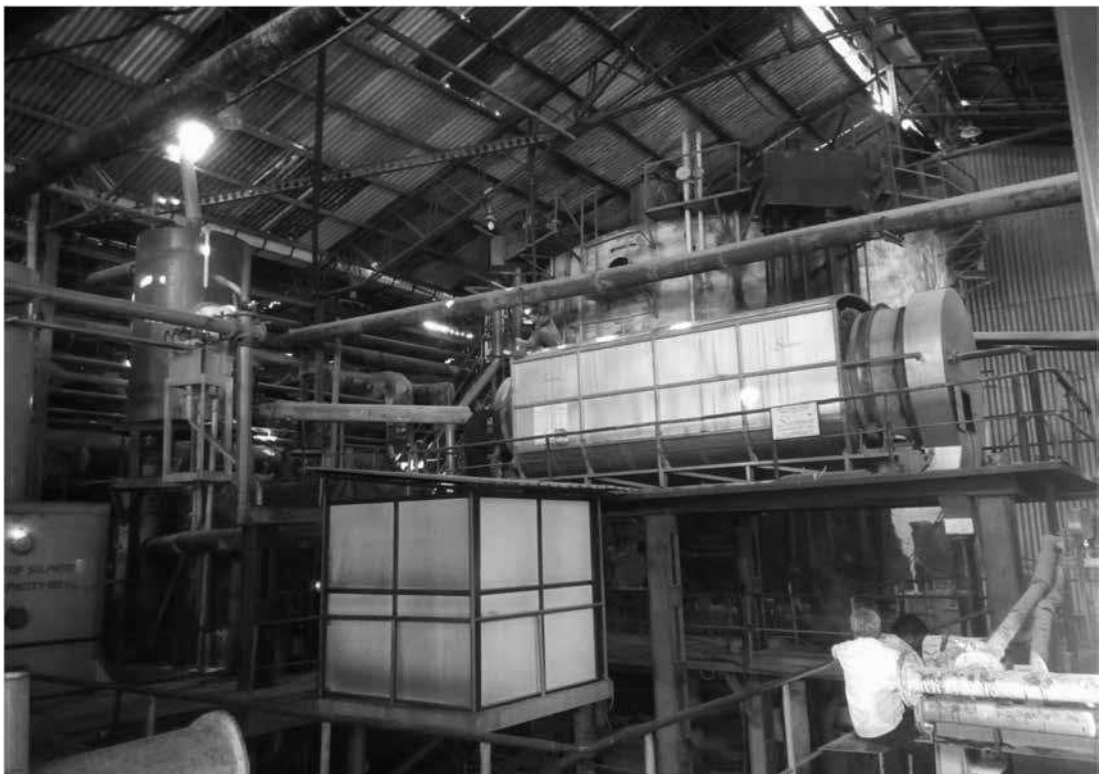
The capacity and performance of decanter machine is normally judged and dictated more particularly by the 'insoluble solids' it has to handle and also simultaneously although to a lesser extent, by the 'liquid' loading.

Once the importance of this fundamental principle of decanter application was well understood full plant scale study was taken up on how effectively to reduce the 'insoluble solids' contents of decanter feed i.e. juice clarifier underflow muddy juice.

A yearlong 'in-house' as well as 'on field' rigorous trials and testing undertaken during two crushing seasons it is concluded that the most appropriate stage for pre-screening of raw juice in the juice clarification stream is just prior to juice reaction vessel which in turn will reduce fibre solid content of juice clarifier underflow muddy juice.

Description of Equipment – "Hot Raw Juice" – Rotary Juice Screen

Cylindrical rotary drum fabricated in stainless steel construction and is fitted with rim located on either end for mounting the entire drum on trunnions. The screening area comprises of cylindrical shape screen drum having filtering media of 120 micron opening supported by perforated screen in stainless steel to form a rigid cylindrical shape rotary screen which forms an integral part of the rotating drum. Towards the driven end of the drum the driving sprocket is rigidly fixed on output shaft of gearbox and connected to driven sprocket mounted on rotating drum to transmit the power through heavy-duty chain arrangement. Thrust roller fitted at the non-drive end absorbs the lateral thrust developed by inclined rotating drum. The motor is suitably covered to protect the same from splashing of juice. The entire assembly of the drum along with its trunnions is mounted on rugged Mild Steel fabricated frame for installing the equipment in the clarification house. Spray nozzles are fitted on piped header located inside the screen drum to cover the entire length of screen.



Installation of Hot Raw Juice Screening System

Unique feature of totally closed and insulated Rotary Juice Screen

In a normal milling plant the feed juice temperature is much below 35 – 40OC and hence the total Rotary juice screen assembly is of "open" feature, i.e. top and discharge end drums are open to atmosphere.

However, considering the temperature of hot raw juice at 70-80^{O}C, it is essentially provided with a unique feature of "totally enclosed" arrangement to avoid heat losses and to prevent subsequent reduction in temperature of screened hot raw juice.

In order to prevent escaping of vapours the Rotary Screen is provided with totally closed bolted top cover and totally enclosed feed and discharge end drums. In addition to totally closed construction of Rotary Screen it is essential to provide lagging/insulation followed by aluminum cladding to totally closed assembly of Rotary Screen to avoid heat loss.

Totally closed Rotary Screen for hot raw juice screening

Operation of – "Hot Raw Juice" – Rotary Juice Screen

The Rotary Screen for hot raw juice screening is located near juice sulphiter (Juice Reaction Vessel). The hot raw juice from SO_2 absorption tower is delivered to juice inlet pipe of rotary screen and screened hot raw juice outlet of the screen is delivered to juice sulphiter (Juice Reaction Vessel) **by gravity**. The bagasse discharged from the screen is delivered to a receiving tank by gravity and is pumped to mills in a slurry form.

Advantages of "Hot Raw Juice" – Rotary Juice Screen

1. Increase in the decanter machine capacity and decrease in Pol % Reject cake raw juice and also lesser Reject Cake % cane.
2. With decanter installation this situation is much favourable because considerable reduction of insoluble solids fibre content in the muddy juice will effectively reduce solid loading on decanter.

3. No contamination of sugar crystal due to fine fibre.
4. Reduction in hot raw juice colour by 2000 to 3000 IU was achieved because some colloidal colouring matter gets precipitated after heating the Raw Juice at its natural iso-electric pH of 4.5-5.5 and which then gets adhered to the bagacillo discharged from Rotary Juice Screen.
5. Due to totally closed and insulated hot surface – no heat loss due to radiation or by self evaporation.
6. In addition to cost effective benefits there are other multifold advantages due to reduction in bagasse entering into process house, reduction in new colour forming compounds, reduction of floating particles in clear juice. As well as other mechanical advantages like preventing chocking at pumps, juice heater headers, tubes and PHE etc.

CONCLUSION

In addition to other multiple advantages the main advantages influencing decanter operation is that the muddy juice % cane is effectively been reduced to 4 to 5% cane and with subsequent reduction in Decanter project cost it works out that the payback period of decanter station will get further reduced.

ACKNOWLEDGEMENT

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REFERENCE

Screening of hot mixed juice using Rotary Screen to achieve total bagacillo separation efficiency more than 95% by Subodh Vinayak Joshi – 45th Annual Convention of SISSTA - 2015.