# Simple Rotary Juice Screen Technology To Remove Fine Fibres From Mixed Juice

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**Abstract:**
At milling tandem to remove fibre from unscreened juice rotary juice screen having 500 micron opening is used. Now a day this single stage rotary screen is not found adequate as quantity of fine fibres are increasing because of very fine cane preparation. We have collected data w.r.t. fine fibres in screened juice and found that further screening of the screened juice is now necessary to avoid problems like chocking of juice pumps, juice heaters, fine particles in clear juice and sometimes fibre contamination of sugar crystal.

For sugar industry stage wize operation is required to achieve maximum results, for example to achieve maximum sugar extraction milling tandem consist of 4 to 6 mills and another example is of pan boiling where A, B and C massecuite pan boiling takes place. In the similar lines to minimize the problem of higher quantity of fine bagacillo particles in screened juice now it is important that the juice screening is to be carried out in two stages i.e. initially “coarse separation” by using rotary screen having 500 micron opening followed by “fine separation” by using rotary screen having 350 micron.

After successful implementation of this two stage screening system at mill house we have developed a new technology of screening hot juice by using rotary screen having 150 micron opening which is now well tested and established in a few sugar factories in Maharashtra. A proven technology of rotary juice screening is used after first stage juice heating.

The results are quite satisfactory resulting into not only maximum possible fibre reduction but also reduction in juice colour and sugar colour. This technology is also helpful to produce sugar meeting norms given by bulk consumers like Pepsi, Coca Cola and other.

This paper gives introduction of this newly born simple but effective system* and also the installation details, operational details, data collected at various sites and advantages of hot raw juice screening system.

**Keywords:**
Unscreened mixed juice, screened mixed juice, rotary juice screen, fibre, ppm

**Methods:**
Following internationally accepted ICUMSA methods are used for analysis of all intermediate products and final product, sugar.

a) Fibre content of juice - ICUMSA GS7-13 (1994)
b) Colour of juice - ICUMSA GS1/3-7
c) Turbidity of juice - ICUMSA GS7-21 (1994)
d) Colour of white sugar - ICUMSA GS 2/3 – 9 and 10
e) Beverage floc test of sugar - ICUMSA GS 2/3 – 40
f) Conductivity ash of sugar - ICUMSA GS 2/3/9 – 17
g) Sediment content of sugar - ICUMSA GS 2/3/9 – 19
h) Sulphur Dioxide content of sugar - ICUMSA GS 2/1/7/9 – 33

*Global patent pending for ‘equipment’ and ‘process’

**Introduction:**
To improve the mill extraction we need to increase the preparation index (PI) of prepared cane. This higher PI results into dust formation resulting very fine fibre particles in unscreened juice. These fine particles escapes through the opening of rotary juice screen of 500 micron.

Following data was collected within last 17 years

| Period | Average Fibre content in screened mixed juice | |
|---|---|---|
| | gram / kg | % |
| 2000 - 2004 | 1.4 | 0.14 |
| 2005 - 2009 | 1.6 | 0.16 |
| 2010 - 2015 | 1.8 | 0.18 |
| 2010 - 2018 | 2.0 | 0.20 |

1 g / kg = 0.1 % ≈ 1 g/ltr

Above results indicates increasing trend of fine fibre in screened juice.

The above values clearly indicate the journey of cane preparation towards very fine powdered dust like cane preparation and increasing fibre particles in screened mix juice. These particles look irritating when it observe in clear juice. This trend was very rarely observed in earlier times but now a day it is observed in almost every factory. So it is very important to reduce fibre particles in screened mix juice without disturbing the journey of higher mill extraction.

To separate this fine particles further screening of mixed (raw) juice is carried out initially at mill house using 350 micron opening rotary screen as a second stage screen. After this second stage screen around 50% of residual fine fibres are removed say from 0.2% to 0.1%. Much fine fibres having size less than 350 microns cannot be separated at mill house because lesser opening than 350 microns creates frequent chocking problem, very high wash water requirement and huge screening area requirement.

Hence to reduce this very fibre a well proven - simple – gravity flow – rotary juice screen is installed to screen the mixed juice after primary heating say around 70 to 75 deg.C. Screening at this temperature helped to enhance screening efficiency and to reduce chocking problem. Much finer opening screen is used to achieve maximum possible fibre reduction from juice entering process house.

**Equipment details:**
At milling tandem as the juice temperature is ambient the rotary screens are of open type of construction. As hot juice screen is installed after primary heating and hence to avoid temperature drop across the screen the screen is of totally closed type of construction. Feed end, discharge end, juice collection trough and top of the screen are closed to avoid temperature drop. Insulation and cladding to juice pipes and stationary parts of rotary screen helps to minimise the temperature drop.

The screen is made from working screen in stainless steel construction having 150 micron opening supported with backing screen also of stainless steel construction. Feed and discharge end drum and other juice contact parts like feed pipe, distributor, juice collection trough etc are also of stainless steel construction. Other non wetted parts are of mild steel construction. The screen drums alongwith drive and discharge end drums are supported on 4 nos. rollers which are mounted on heavy duty base frame. Power is transmitted through chain – sprocket arrangement. Spray nozzles are fitted on piped header located inside the screen drum to cover the entire length of screen. Periodic screen washing by clear juice and hot water is carried out automatically by a timer operated pump.

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**Location details:**
The Rotary Screen for hot juice screening is located near juice sulphiter. The hot raw juice from $SO_2$ absorption tower is connected to juice inlet pipe of rotary screen by gravity and screened hot raw juice outlet of the screen is connected to juice sulphiter by gravity. Thus re-pumping of juice is totally eliminated. The fine fibres discharged from the screen is delivered to slurry tank by gravity and is pumped to mills/mud mixer of vacuum filter in a slurry form.

Figure no. 1 : - **Process flow diagram**

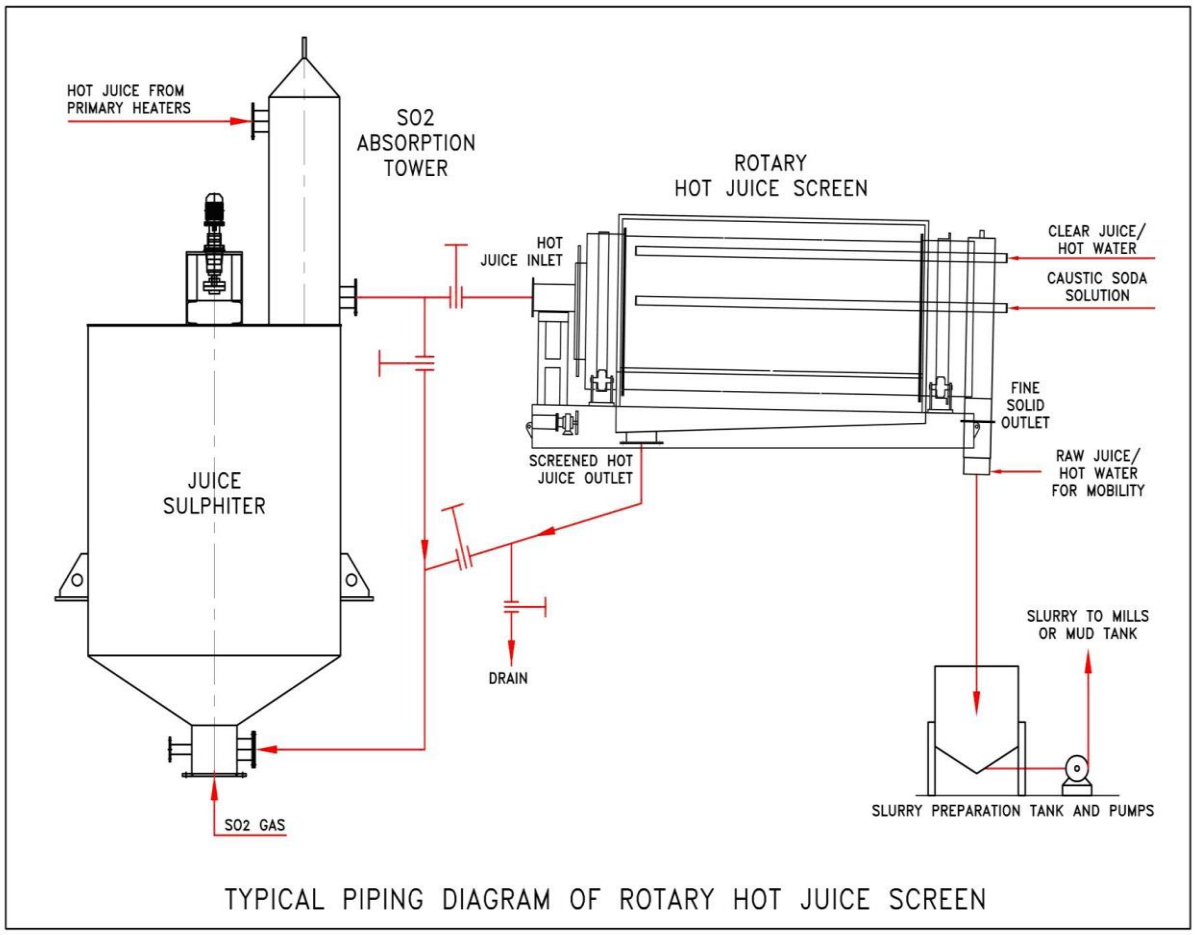

Figure no. 2 **Installation of Rotary Screen for hot raw juice screening**

**Data collection at various installations:**

**Cost economics by selling more bagasse saved by using Totally Closed Rotary Juice Screen having much finer opening for hot raw juice:**

| **Base** | | |
|---|---|---|
| 1. | Total Annual cane crushing | 10 Lac tons |
| 2. | Bagasse sell rate | Rs. 2500/- per ton |
| **As per actual data collected at one of the installations** | | |
| 1. | Residual fibre content in screened mixed juice at 1st stage Rotary Juice Screen having 500 micron opening. | 0.2% (~ 2 g/l) screened mixed juice on oven dry basis |
| 2. | Residual fibre content in screened hot raw juice at Rotary juice Screen having much finer opening. | 0.035 % (~ 0.35 g/l) screened mixed juice on oven dry basis |
| 3. | The reduction in residual fibre content in screened mixed juice | 0.165 % screened mixed juice on oven dry basis |
| 4. | For the sake of simplicity of calculations let us consider | 100 |

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| | | |
|---|---|---|
| | screened mixed Juice % cane | |
| 5. | Hence the reduction in fibre content in screened mixed juice % cane | 0.165% cane on oven dry basis |
| 6. | Let us consider fibre % mill bagasse | 50% |
| 7. | Therefore additional mill bagasse % cane | 0.33 % cane |
| 8. | Quantity of additional mill bagasse | = 0.33 x 10,00,000 / 100<br>= 3300 Ton |
| 9. | Additional revenue by selling saved bagasse | = 3300 x 2500<br>= Rs. 92,40,000. |
| | **FOREVER NET FINANCIAL GAIN PER SEASON** | **Rs. 82.50 Lacs** |
| | **FINANCIAL GAIN PER TON CANE CRUSHED** | **Rs. 8.25** |

**Advantages of "Hot Raw Juice" – Rotary Juice Screen:**

1. Reduction of Clear Juice colour by 1500 – 2000 IU.
2. Reduction of Clear Juice turbidity and improvement in transmittance.
3. Additional separation of 0.15 to 0.165% cane dry fibre.
4. Lowest ever fibre in screened hot raw juice 200 – 300 ppm (Aprox. 0.2 to 0.3 g/l)
5. The white sugar produced has always tested negative to the beverage floc test.
6. The Sedimentation test for white sugar has shown average value of 30 mg/kg; much below prescribed values by bulk consumers like soft drink manufacturers.
7. Reduced solid and colour loading on subsequent process of juice, syrup and melt clarification.
8. No fibre contamination of sugar crystal.
9. Other mechanical advantages like no chocking at PHE.
10. Increase in capacity of existing clarifier and vacuum filter / Decanter capacity due to reduced solid loading.
11. And most importantly, improvement in sugar colour by 5 - 10 IU in adverse condition (10 – 20 IU in favourable situation)

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**Conclusion:**
Total fibre separation from unscreened mixed juice to screened hot raw juice is achieved more than 95 %. This fibre reduction helped to reduce suspended solid loading of clarification house and improve the overall performance and also will help to improve the keeping quality of sugar.

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