
بسم الله الرحمن الرحيم

Ramzan Sugar Mills Limited, Chiniot

Presented By:

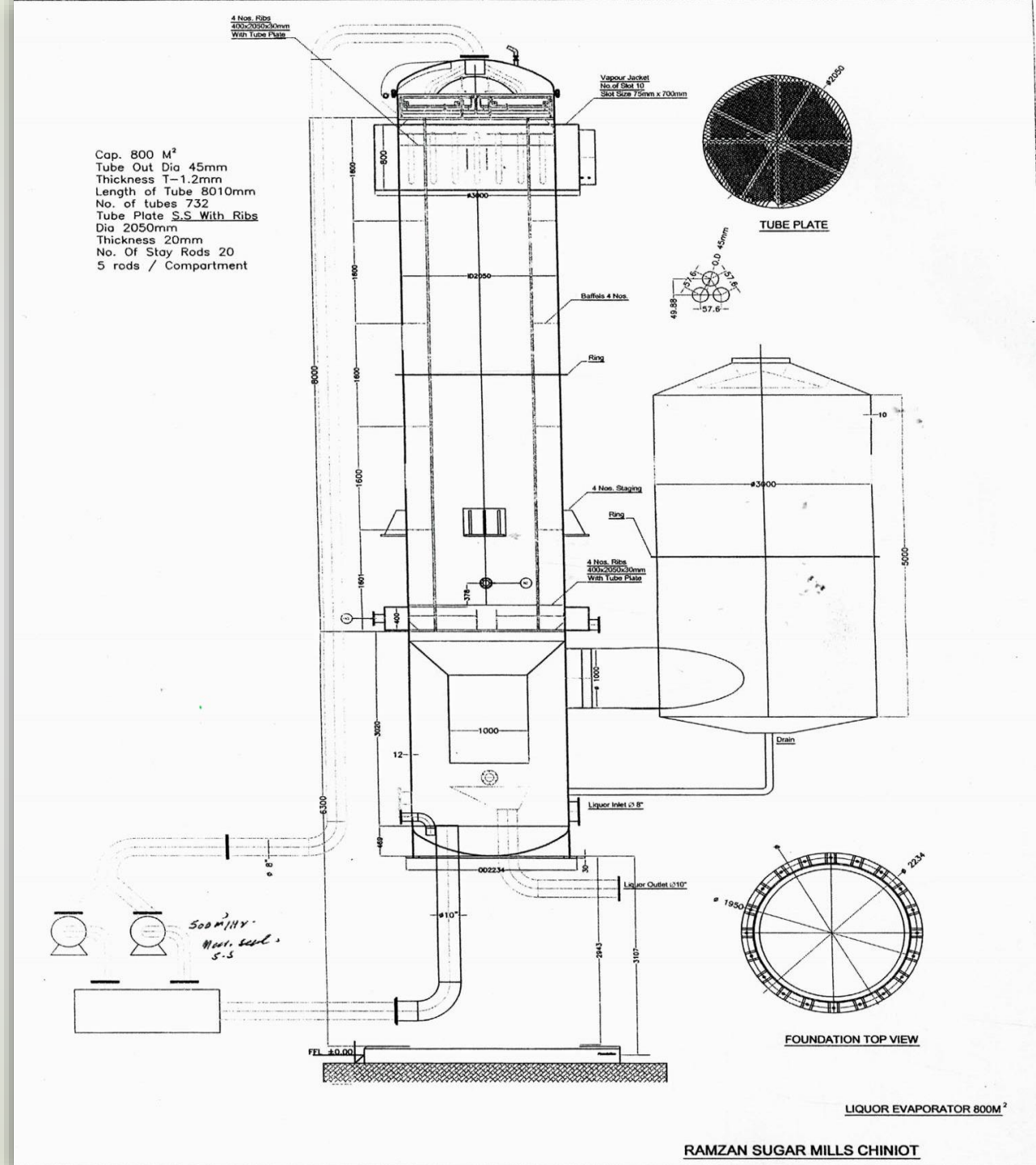
. PROJECT DIRECTOR

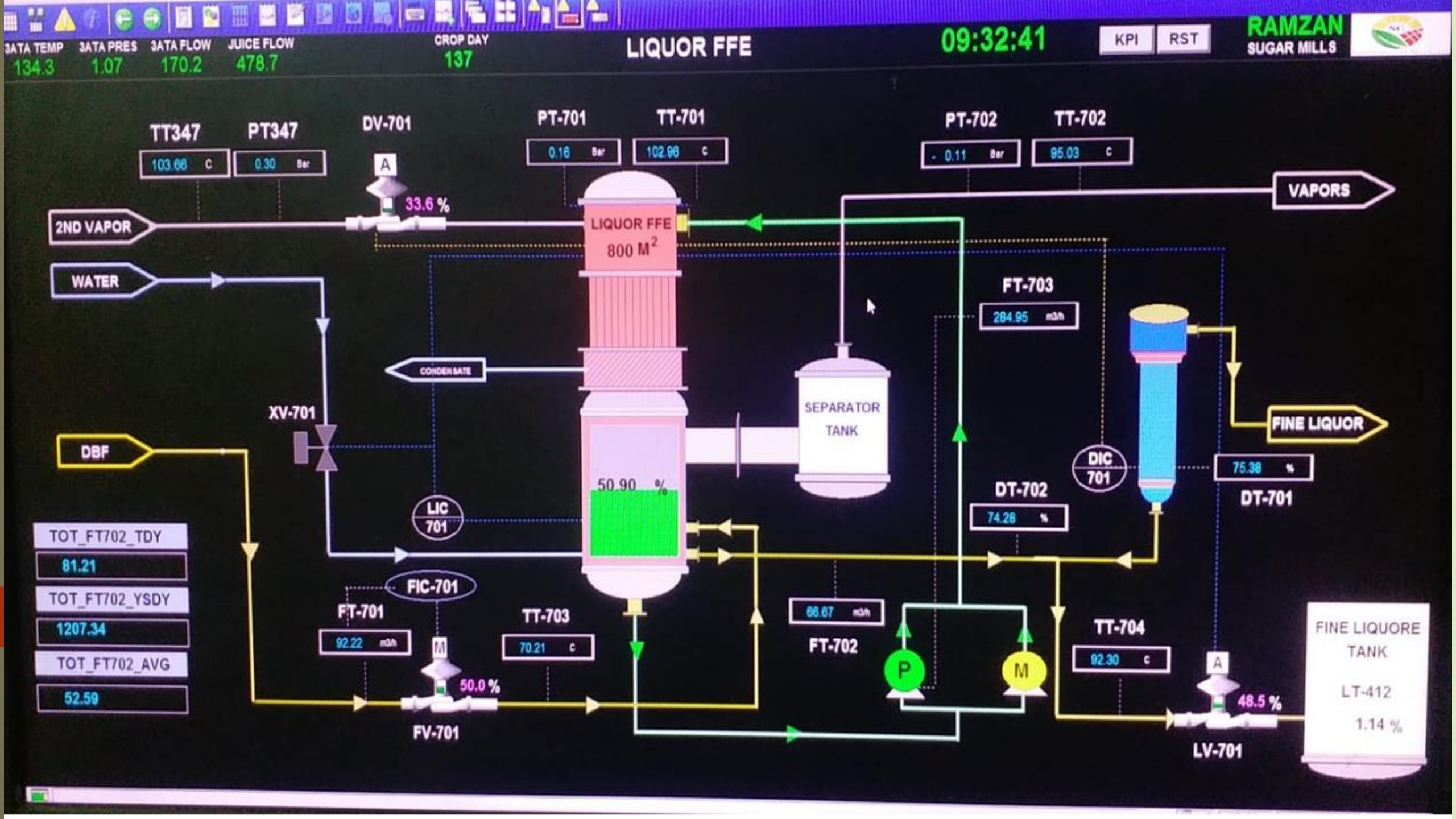
. DGM (PRODUCTION)

. TECHNICAL DIRECTOR

Title:

Liquor Evaporator (FFE 800M²)




3ATA TEMP
134.3
3ATA PRES
1.07
3ATA FLOW
170.2
JUICE FLOW
478.7
CROP DAY
137
LIQUOR FFE
09:32:41
KPI
RST
RAMZAN
SUGAR MILLS
TT347
103.66 C
PT347
0.30 Bar
DV-701
A
33.6 %
PT-701
0.16 Bar
TT-701
102.96 C
PT-702
- 0.11 Bar
TT-702
95.03 C
VAPORS
2ND VAPOR
WATER
LIQUOR FFE
800 M2
FT-703
284.95 m3/h
CONDENSATE
SEPARATOR TANK
XV-701
DBF
50.90 %
DIC 701
FINE LIQUOR
75.38 %
DT-701
DT-702
74.28 %
LIC 701
TOT_FT702_TDY
81.21
TOT_FT702_YSDY
1207.34
TOT_FT702_AVG
52.59
FIC-701
FT-701
92.22 m3/h
M
50.0 %
FV-701
TT-703
70.21 C
66.67 m3/h
FT-702
P
M
TT-704
92.30 C
A
48.5 %
LV-701
FINE LIQUORE TANK
LT-412
1.14 %

Introduction

- One of major cost for operating of sugar plant is energy. Efficient Energy Management System leads to reduce energy consumption as well as equipment & technological improvement coupled with process design, operation and behavioral changes among the staff to get true energy efficiency.
- In Ramzan Sugar Mill, during crushing season (2020-21), steam % cane remained 38-45%,at different low& high crushing rates with average steam % cane = 42.65%.

(with Power Plant option, Less energy is available to process house due to non availability of steam condensate, De-superheating of steam and utilization of flash, cause higher steam % cane 3.5% minimum, as compare to conventional Sugar Mills operation).

- To make the plant more energy efficient, along with crushing capacity enhancement some more steps are taken to reduce steam %cane less than 40% on average basis. We achieved 38.85% average at end of crushing season 2021-22. (3.8% reduction)
- Categorizes the heat losses in to the three groups:

1. Using the heat over again.
2. Preventing the escape of heat.
3. Reducing the work to be done.

- One of them installed Falling Film Evaporator of 800M^2 to concentrate the Fine liquor from 65° to 75° Brix. FFE are mostly used in sugar refineries around the globe to concentrate liquor with no sugar loss.

- Liquor Falling Film Evaporator (FFE) are mostly used in sugar refineries/cane sugar plants in most part of the world to get concentrated Liquor from 60° to 75° Brix, with minimum retention time (2-5 Sec max), along with low temp. difference and very less colour formation against in Robert Evaporators, which has retention time approximate 6 minutes.

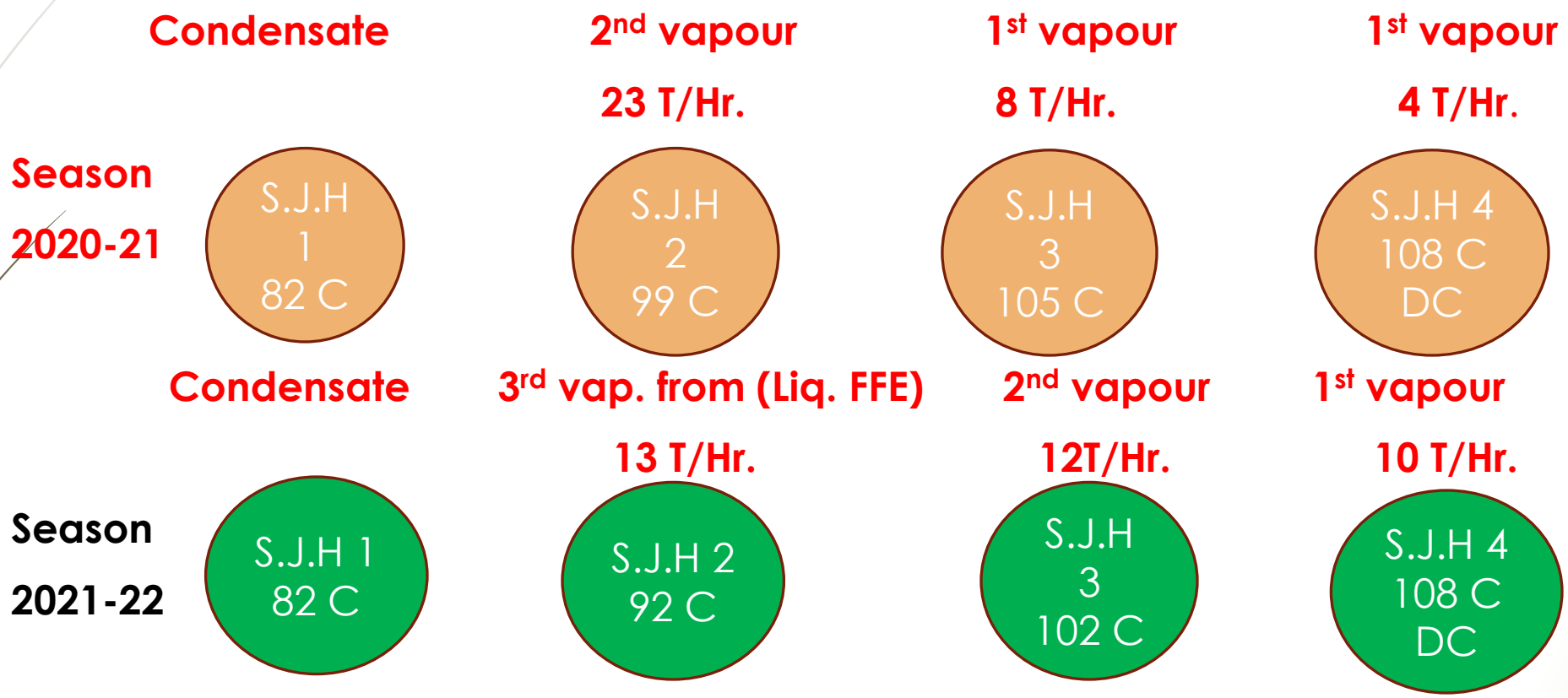
- Some are given below:-
- Ettihad Sugar Refinery, 3000T/D,Iraq.
- Angren Shakar Refinery, 900T/D, Uzbekistan.
- Al Khaleej Sugar,2400T/D, Dubai.
- Durrah Sugar Refinery,2500T/D, Saudia Arabia.
- Tienen Refinery, Belgium.
- Aarberg Factory, Switzerland.
- India has two Sugar Refinery in Gujrat of 3000 & 2000T/D.
- Reference: PETER REIN, Page No 526, edition year 2007
- IPRO, also recommended liquor concentrator (FFE), double effect with vapour inlet temperature 106-107C

Advantages

- Steam Economy achieved (1.5% on Cane) @ Liquor flow 97 tons/hr. from 65 Brix to 75 Brix by 2nd Vapor.
- Reduction in Injection water at Refine Pans.
- Reduces Boiling Time of R1 Massecuite.
- Reduces Equipment use (Refine Pan).
- Less Color formation due to Reduced Boiling Time in pan.
- Less Dust formation due to Liquor temperature about 91-92°C.
- Less water consumption at refine pans, approx.50%.
- Extra condensate available 13 Ton/Hr.

Steam Saving

2nd vapour used at liquor FFE (107°C) and liquor FFE out vapour (Temperature 96-97°C) used for 2nd stage of secondary juice heating.



1: 2nd vapour saving = 11 Ton/Hr.

2: 1st vapour saving = 01 Ton/Hr.

- Less 2nd Vapors are used at Refine Pan due to enhanced Liquor brix 75, @13 T/Hr. This also helped to increase the vapor pressure.
- Overall Steam saving is 1.5% on cane by liquor FFE.
- It contributed in saving of Rs. 0.54 million /day, @ bagasse rate Rs.4500/Ton approx.

Injection Water Saving

- Less Injection and Spray water Load
- vapor : water = 1:70
- Approx. 910 T/H at each side.
- Reduces Power Load 115 KWH on aggregate.
- Rs.60,000/day saving @ Rs.22/Kwh.

Boiling Time Saving

- Boiling time reduce at refine pans due to higher liquor brix.
- Approx. 20% Time saving per day.
- Which enhanced boiling capacity at refine pans.
- Increase efficiency of Refine side.

Equipment Saving

- Same capacity achieved at refine pans with less equipment in operation.
- Minimum two extra strike per shift.

Less Color Produced

- Color transfer from Liquor to Massecuite is 5-10% of Mother liquor during pan boiling due to extra boiling time at 65 Brix.

(Ref: https://www.sugarprocesstech.com/refined-sugar-massecuite boiling/)

- In this case Less color transfer during pan boiling, due to less strike time (reduce 25-30 minute per strike) @ 75 Brix of Liquor.

Contribution of Liquor FFE for Color Formation/Sugar Degradation

- The reducing sugar of fine liquor before entering into FFE and after leaving the FFE are analysis in lab and found undetectable difference. (Method GS 2/3/9-S (2011) knight & Allen EDTA Method).
- The preferred method of liquor concentration in the world is the falling-film evaporator, which inherently has a short retention time leading to negligible sugar losses". As sugar degradation / colour formation in conventional liquor concentration is much more due to higher retention time.

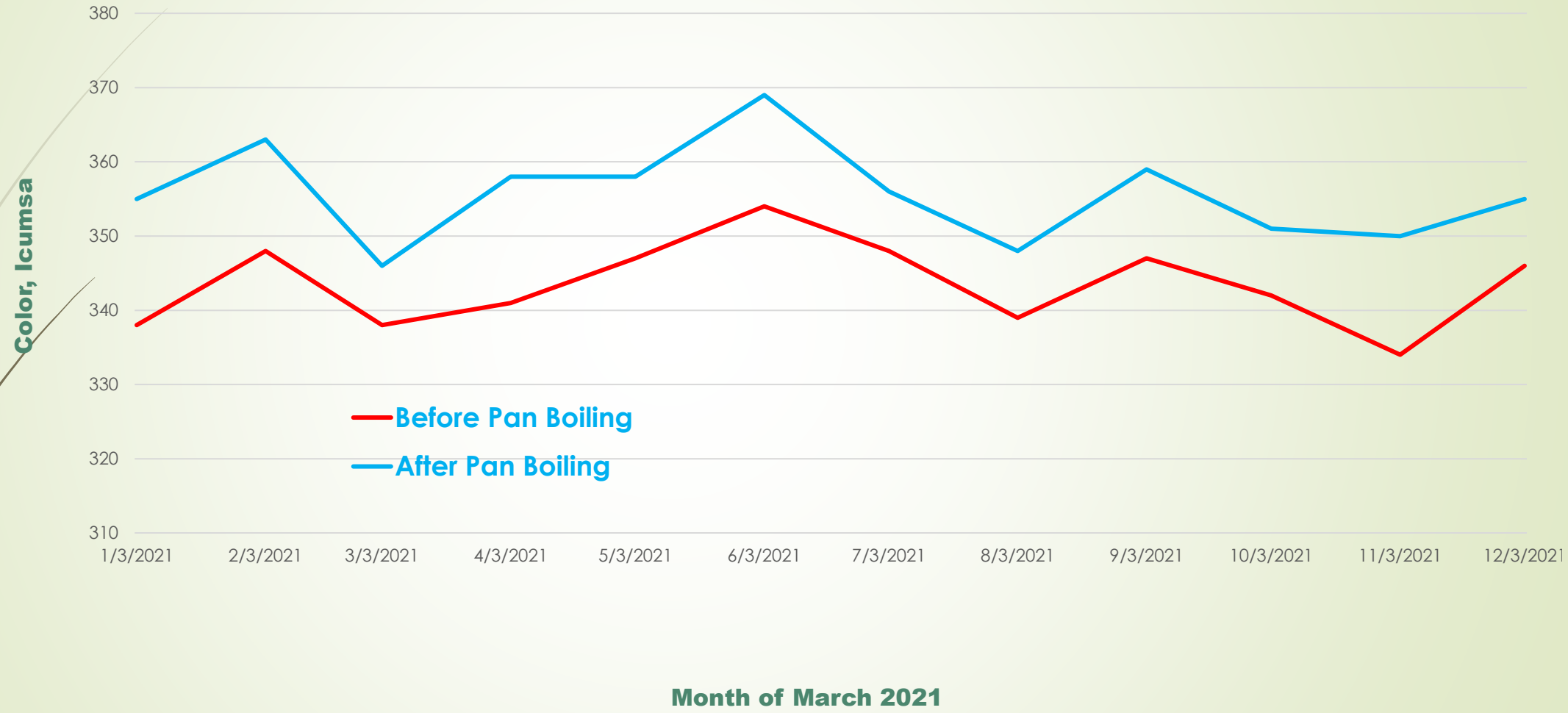
- The Supporting Information is available on the ACS Publications website at DOI: 10.1021/acs.iecr.7b02178. Detailed analysis of membrane-concentration data.

Color Formation Data

- Cane Crushing Season 2020-21
- Fine Liquor concentration from 65 to 75 brix during boiling in Refine pan Colour Increased 4~5%.

S.#	Month	Unit	Before Pan Boiling Avg. Colour at 65 Brix	During Pan Boiling Avg. Colour at 75 Brix
1.	December, 2020	Icumsa	359	371
2.	January, 2021	Icumsa	349	362
3.	February, 2021	Icumsa	346	363
4.	March, 2021	Icumsa	343	357

Color Formation During Pan Boiling
Season 2020-21



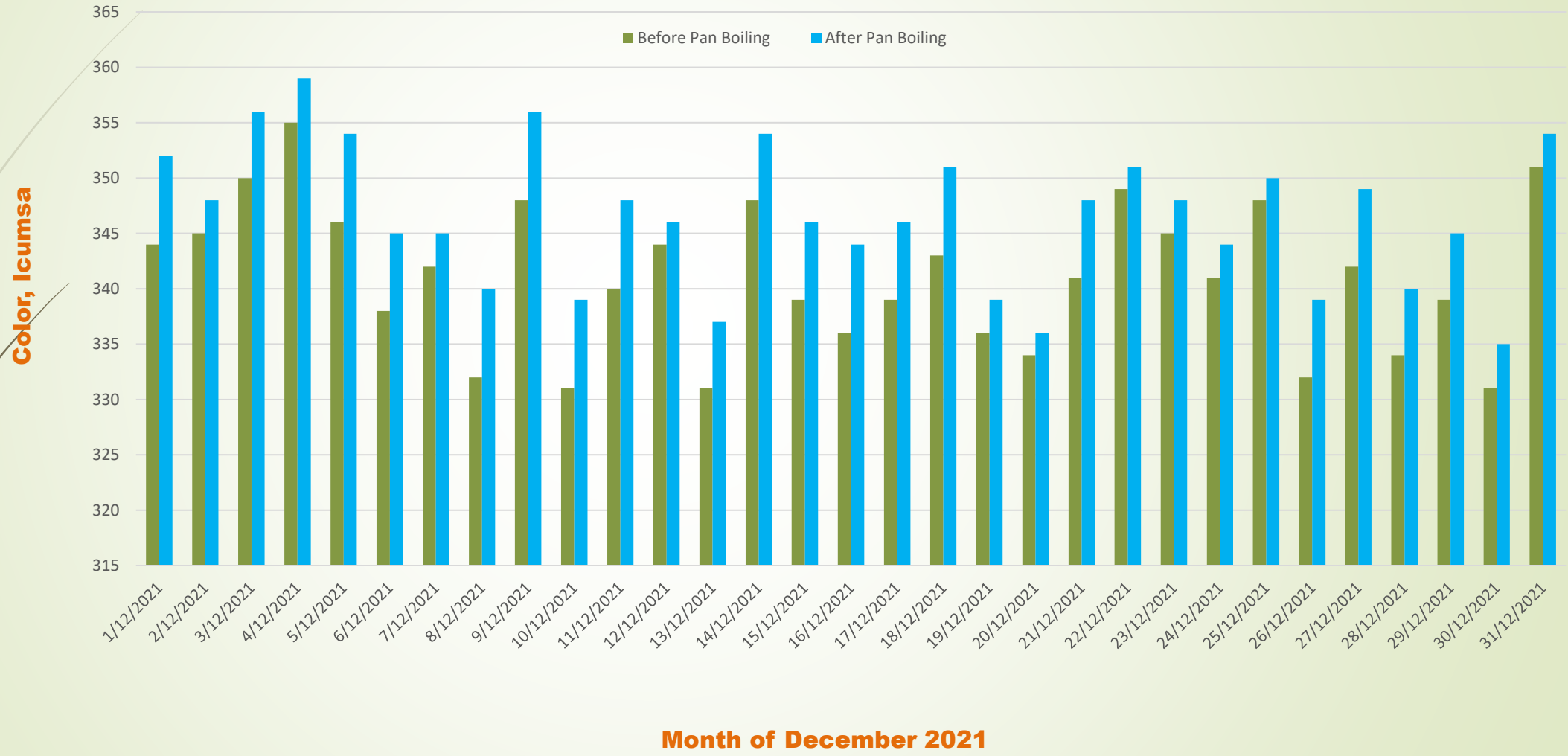
Color Formation During Pan Boiling
Season 2020-21

Color Formation Data

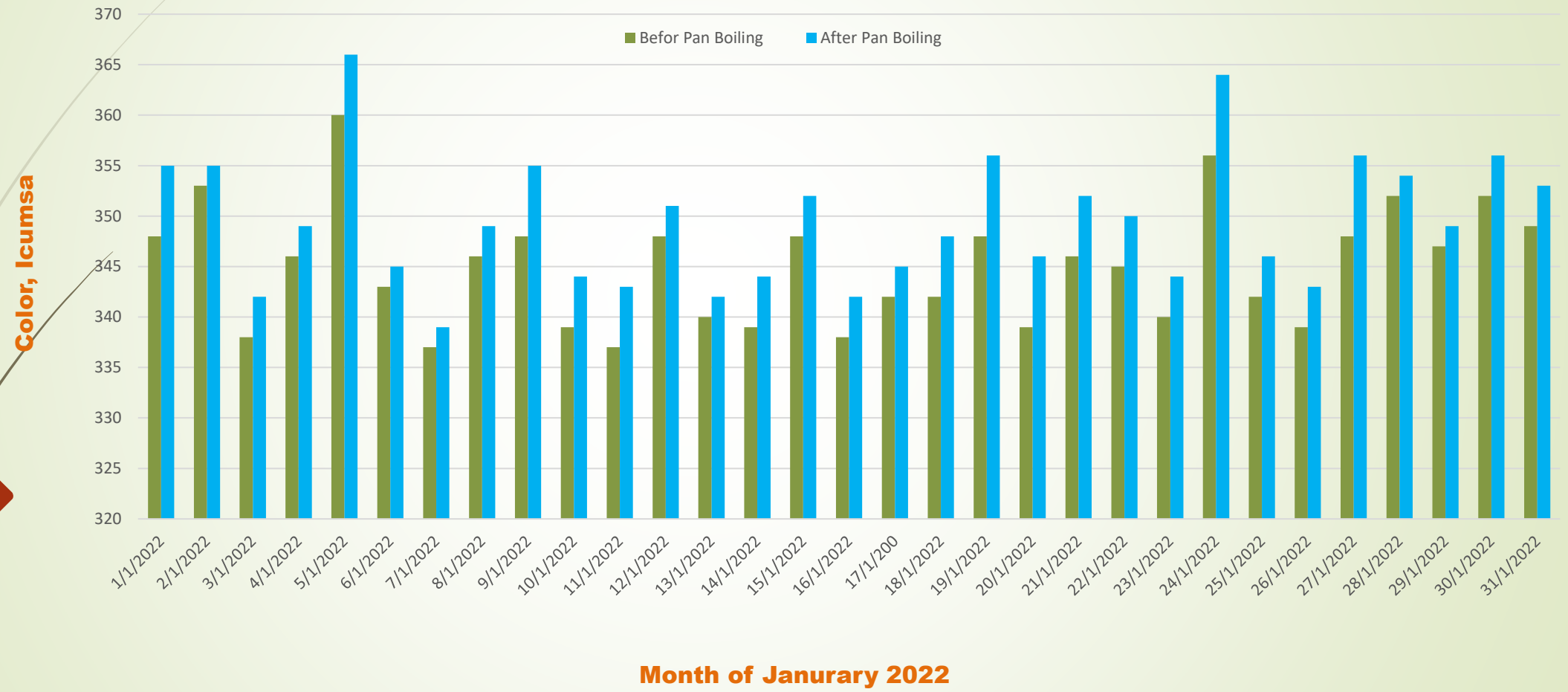
- Cane Crushing Season 2021-22
- Fine Liquor concentration from 65 to 75 brix in FFE
- Colour increase 1.4~1.5%

S.#	Month	Unit	Before FFE Avg. Colour at 65 Brix	After FFE Avg. Colour at 75 Brix
1.	December, 2021	Icumsa	350	354
2.	January, 2022	Icumsa	347	352
3.	February, 2022	Icumsa	345	350
4.	March, 2022	Icumsa	342	348

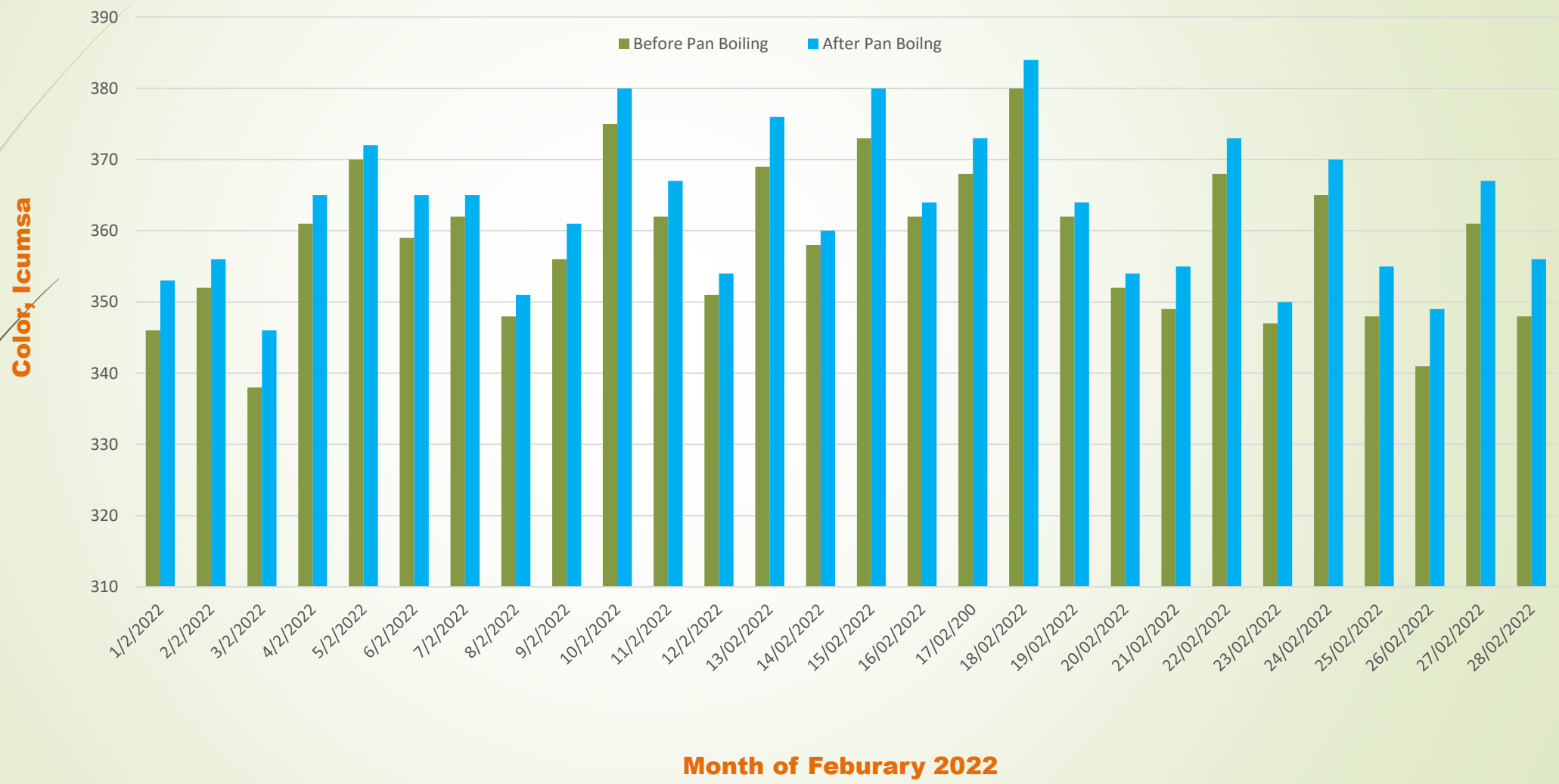
Color Formation During Pan Boiling
Season 2021-22



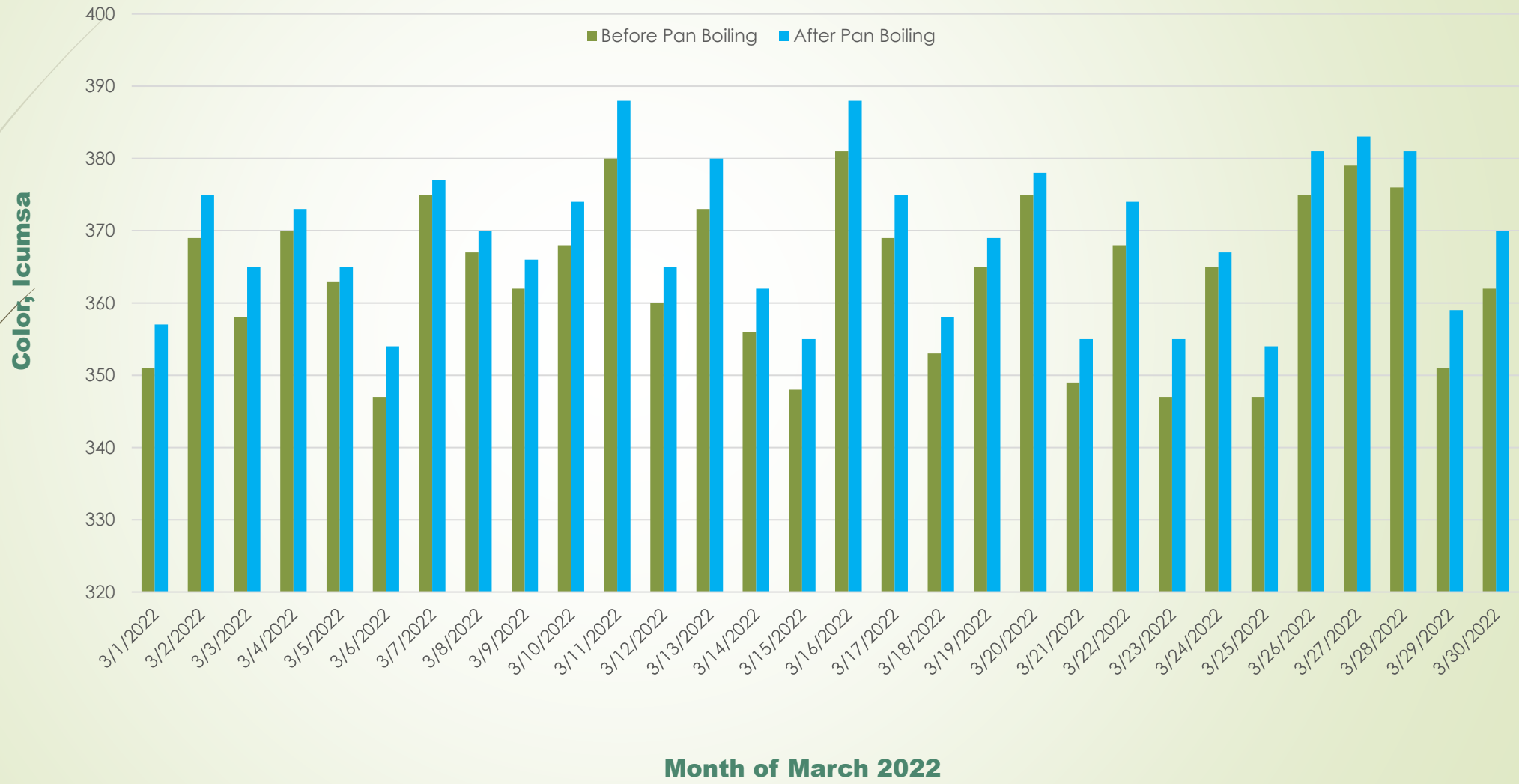
Color Formation During Pan Boiling
Season 2021-22



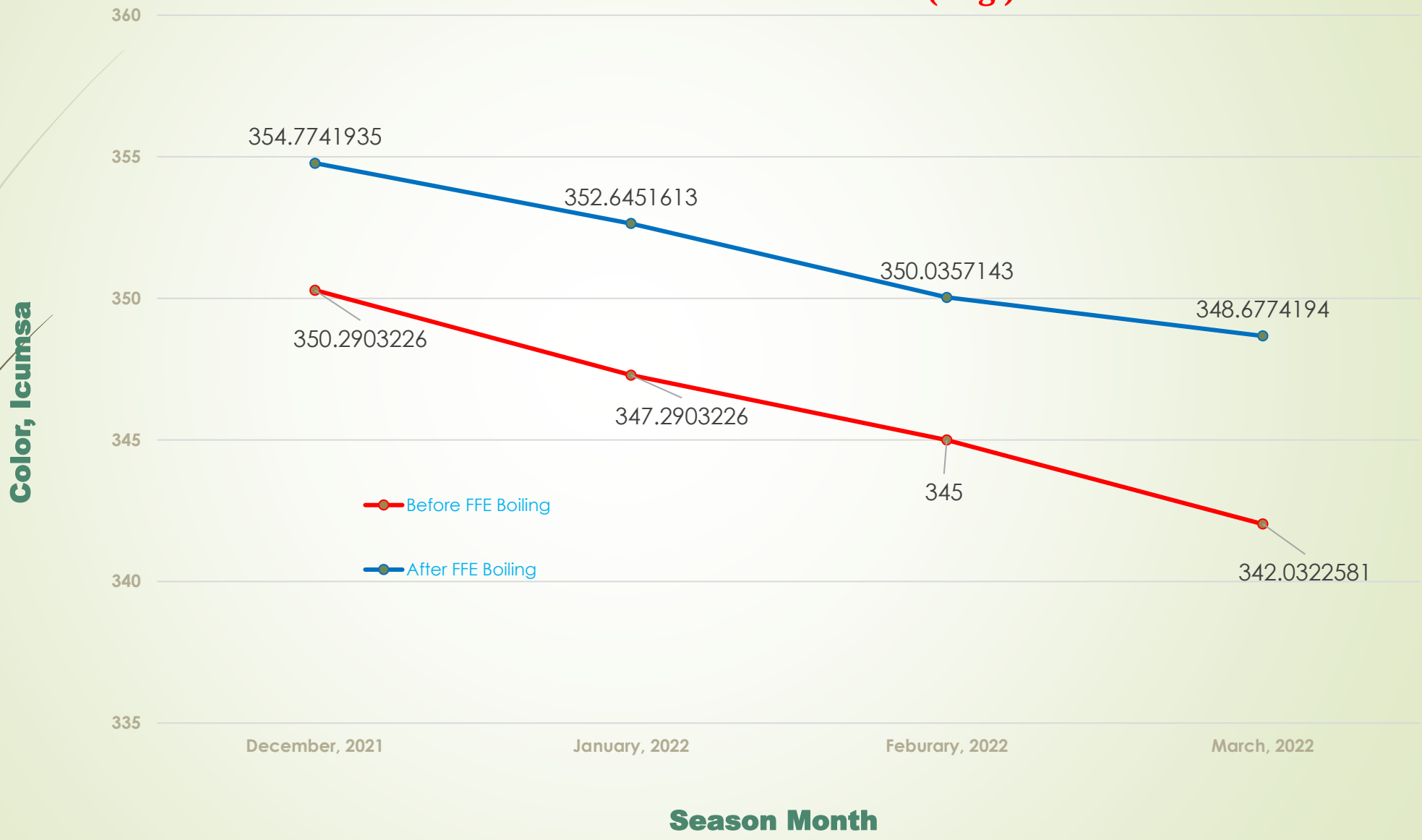
Color Formation During Pan Boiling
Season 2021-22



Color Formation During Pan Boiling
Season 2021-22



Color Formation During FFE Boiling
Season 2021-22
Season Colour Increase 1.5% (Avg.)



Financial Saving

. Season Duration=130 days.

S.#	Description	Unit	Amount	Remarks
1.	Total saving in terms of steam economy	Million	70.2	(16000TCD x 1.5% x 4500Rs/T x 130 days) / 2 x 100
2.	Total saving in terms of power economy	Million	7.8	
3.	Total Amount saved in season	Million	77.8	

Electric power saving will be utilized at FFE Pumps etc. Then net saving is 70.2 Million per season.

Pay Back Period

. Cane Crushing Season = 130days.

S.#	Description	Unit	Value	Remarks
1.	Cost of Installation of Liquor FFE system	Rs. Million	35.0	
2.	Benefit from installation of Liquor FFE system	Rs. Million	70.2	
3.	Pay back period (within one season)	Days	65	

Discussions

- Falling Film Evaporator for Liquor concentration covered up its cost within season.
- No disadvantage regarding significant Color formation and sugar loss, during concentration process is reported in literatures/ graph.

- **Many Sugar refineries around US, Europe, Australia, Middle East and India are using same technique to concentrate the fine liquor for energy efficient refineries.**

Acknowledgment

- I am very thankful to Mr. Sajjad Anwar Sb (D.H.) for willingness in the project and give me a great support and encouragement.
- I also thankful to the RSML staff for their valuable contribution.

Thank you !

IPRO
Braunschweig, Germany

Maximize Cogeneration - Benchmarks