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Sustainability through Technology Integration by Advance Process Control for Continues Digester and Fiberline Stabilization

Tamil Nadu Newsprint and Papers limited, Unit-2

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About TNPL Unit-2, Trichy

2014 – MEP Phase-1, Board machine Green Field Project

2016 – Board production

2021 – MEP Phase -2, Pulp Mill, Integrated ClO2 plant & Soda Recovery Island

Green Field Project

2022 - Pulp Production

Introduction

Aim:

At Pulp Mill to attain ***Sustainability*** through ***Technology*** by,

- Collecting information
- Compiling
- Interpreting
- Optimizing the process

Tool:

APC ***(Advanced Process Control)*** for Continuous Digester

FSC ***(Fiberline Stabilization Control)*** for Fiberline optimization

APC ***(Advanced Process Control)*** for Continuous Digester

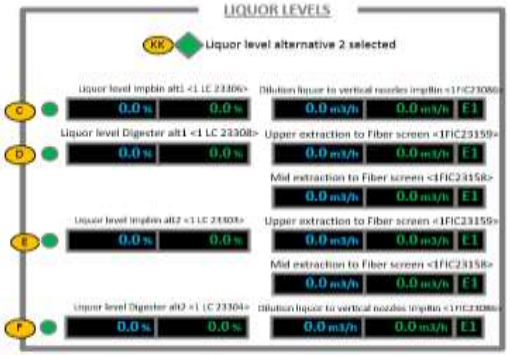
Aims to maintain an even cooking kappa number

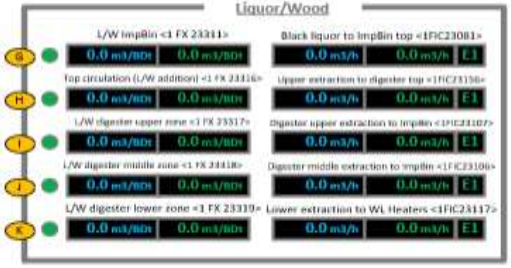
By calculating and coordinating the changes in,

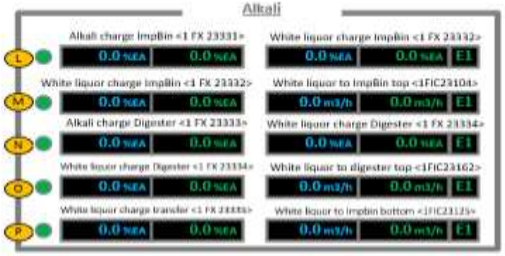
- Cooking temperature
- Chip feed flow
- Blow flow
- White liquor flows
- Other incoming/outgoing flows

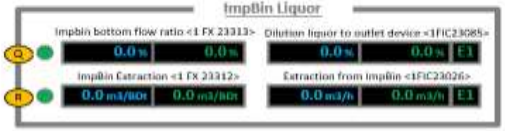
Here APC enables reduced quality variations and higher energy efficiency.

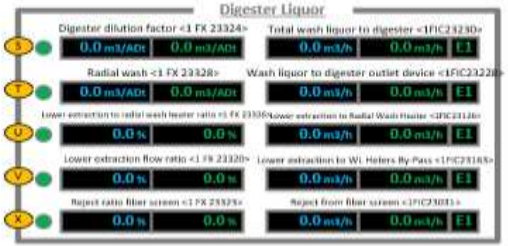
Cooking Plant APC – Overview

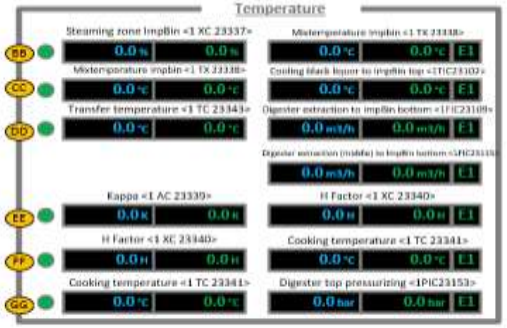


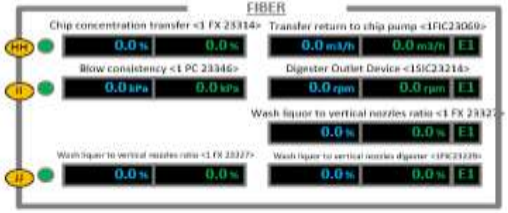




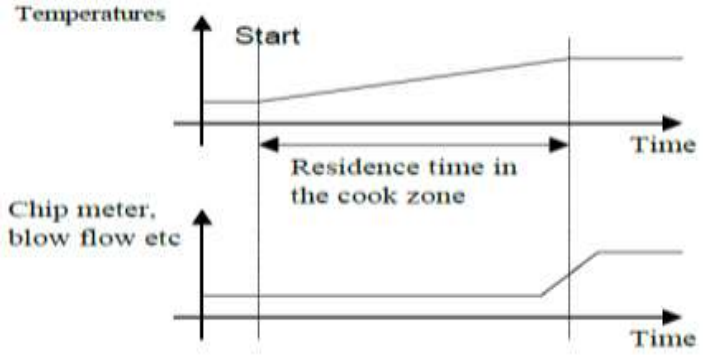




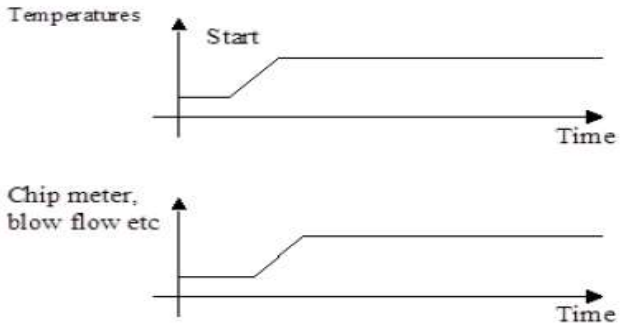




1. Production Rate Control



Normal Production Control



Fast Production Control

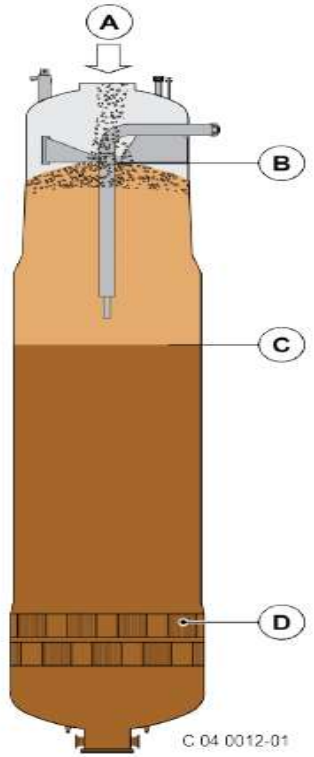
- Aim to attain minimum kappa variation
- A ramp time that corresponds to the residence time of chips in cooking zone
- Calculated Temperatures are first ramped for the production rate change
    - Chip measuring screw speed
    - Blow flow
    - White liquor flows etc. are ramped to their new values

2. **Fiber Production Control**

- Control of the chip volume flow
- Control of the ImpBin chip level
- Control of the digester chip level
- Control of the blow line consistency

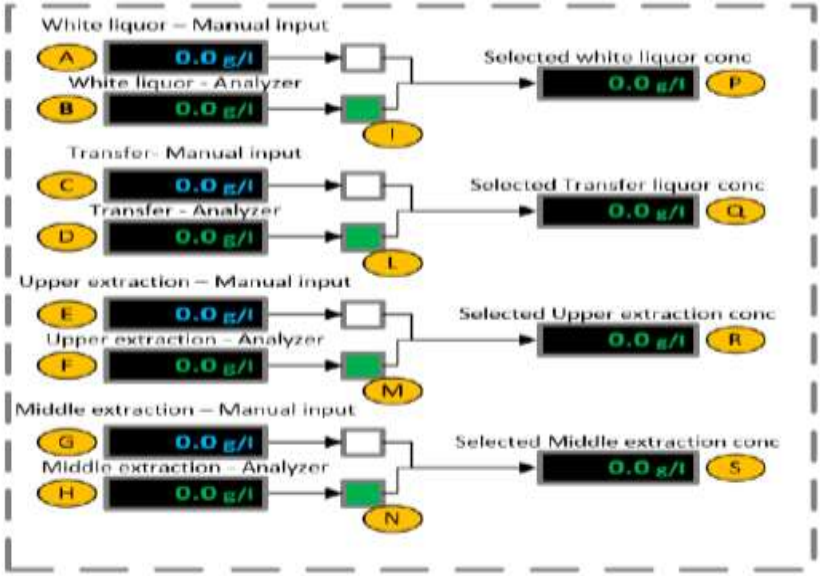
3. **Liquor Balance**

- ImpBin liquor level is controlled by extraction flows out from digester to evaporation
- ImpBin liquor level allows to vary within a range
- Feed forward is calculated from a flow balance over digester vessel
- The extraction flows to evaporation will be more stable



A	Chips
B	Chip level
C	Liquor level
D	Extraction screen

4. Alkali control



- The purpose of the alkali charge controllers is to maintain a constant alkali charge in the digester and in the Impbin
- The alkali charge controllers compensate for variations in black liquor flow and alkali concentrations by adjusting the white liquor charges.

5. **Temperature control**

Rod Temperature
- Controls the Rod temperature

Top mix Temperature
- Heat balancing control

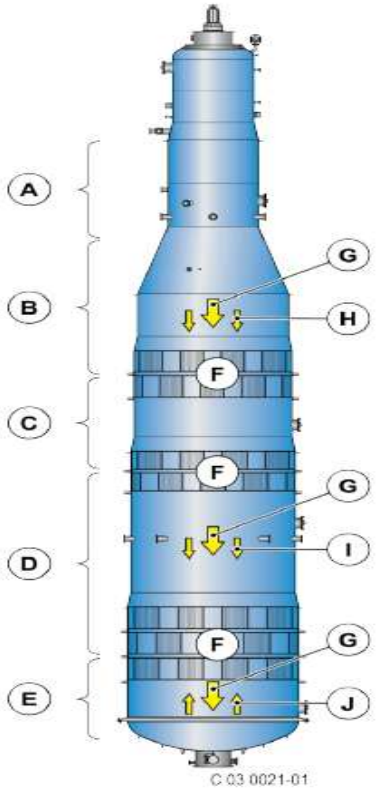
Heat Input to Top
- Black liquor flow temperature controller

H-factor Control

The function of production rate and cooking temperature

A combined effect of retention time in the cook zone

The H-factor control calculates the remote set point for the cooking zone temperature



A	Steam zone
B	Upper cooking zone
C	Middle cooking zone
D	Lower cooking zone
E	Wash zone
F	Extraction screens
G	Chips
H	Cooking liquor
I	Black liquor
J	Wash liquor

FSC ***(Fiberline Stabilization Control)*** for Fiberline

Aims to maintain an even cooking kappa number

By calculating and coordinating the changes in,

- Fiberline production
- Kappa/brightness variations
- ODL kappa reduction
- Wash liquor balance
- Reduce bleaching chemicals

Here FSC enables *sustainability* in production, quality parameters, benchmark chemicals and utility consumptions

FSC - Fiberline

The target of the FSC is to reduce pulp quality variability and to reduce operating costs as follows,

- Desired kappa values
- Desired pulp brightness
- To reduce kappa and brightness variability
- To optimize chemical consumptions

Oxygen delignification stage FSC control to minimize variations in kappa and minimise chemical charges. It depends on,

- Alkali charge
- Oxygen charge
- Residence time
- Temperature
- Incoming kappa values

Analyzer values required for FSC

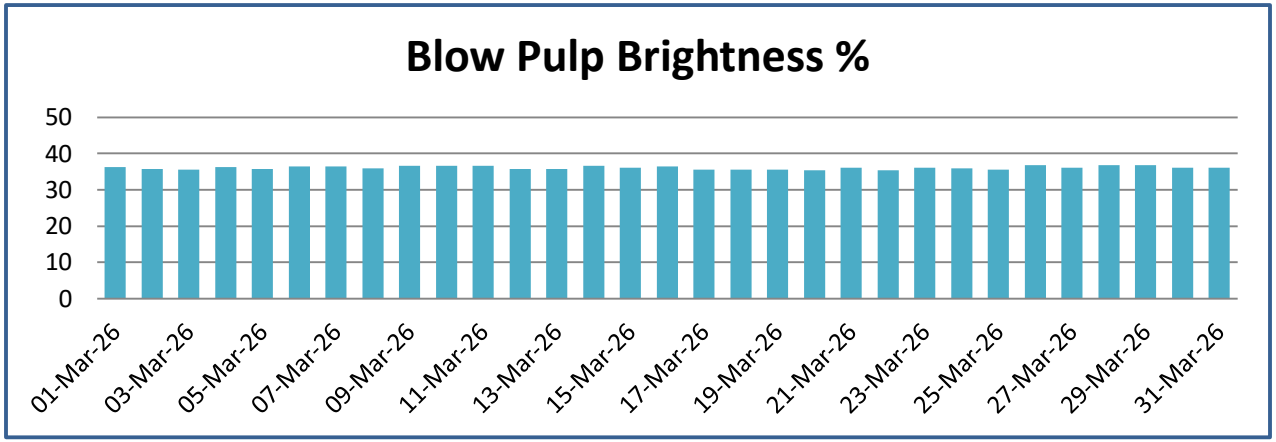
Kappa Analyzer

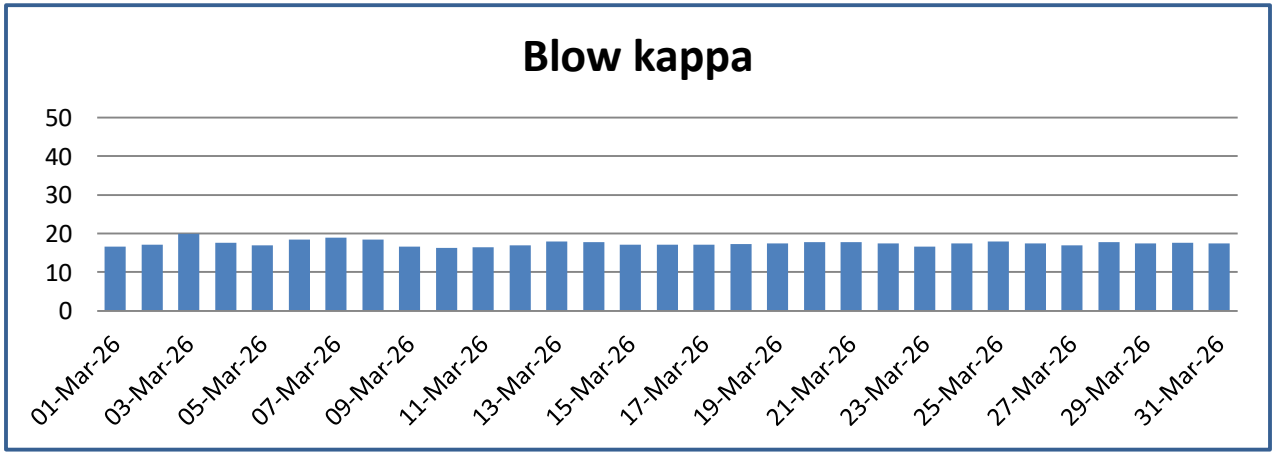
Kappa	ODL IN
Kappa	ODL Out
pH	ODL Out
Kappa	D0 IN
Brightness	D0 IN
pH	D0 Out
Kappa	EP Out
Brightness	EP Out
pH	EP Out
Brightness	D1 out
pH	D1 Out

Results & Discussion

S No	Parameters	UOM	Month Average
1	Bleached pulp production	MT	413.9
2	Blown pulp brightness	%	36.1
3	Blown pulp Kappa	-	17.5
4	WBL RAA	Gpl	11.3

Digester performances for the month of March 2026


Blow Pulp Brightness %
50
40
30
20
10
0
01-Mar-26
03-Mar-26
05-Mar-26
07-Mar-26
09-Mar-26
11-Mar-26
13-Mar-26
15-Mar-26
17-Mar-26
19-Mar-26
21-Mar-26
23-Mar-26
25-Mar-26
27-Mar-26
29-Mar-26
31-Mar-26


Blow kappa
50
40
30
20
10
0
01-Mar-26
03-Mar-26
05-Mar-26
07-Mar-26
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11-Mar-26
13-Mar-26
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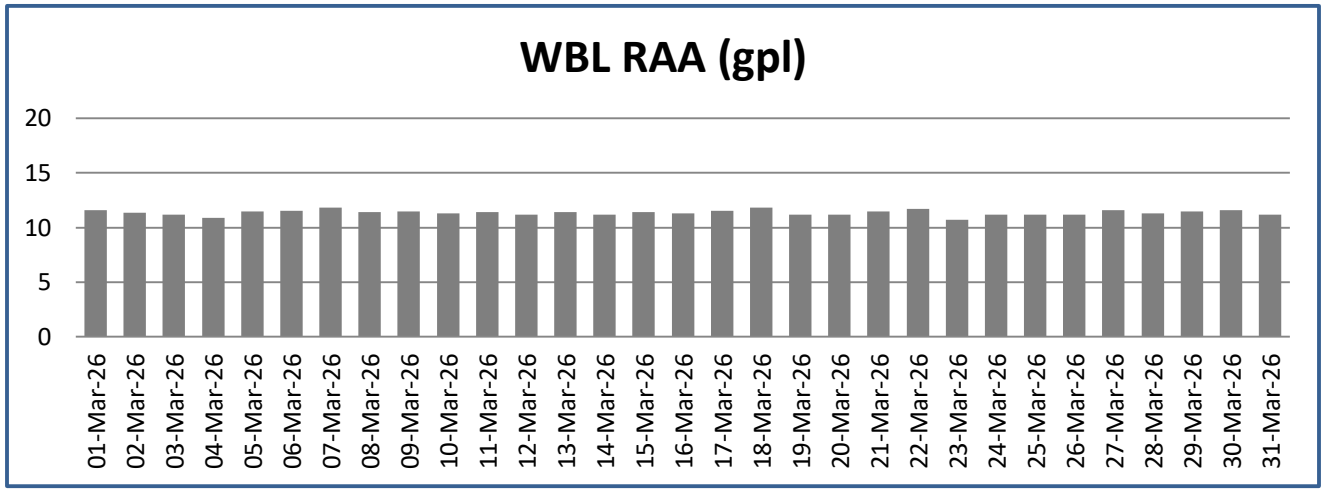
29-Mar-26
31-Mar-26


WBL RAA (gpl)
20
15
10
5
0
01-Mar-26
02-Mar-26
03-Mar-26
04-Mar-26
05-Mar-26
06-Mar-26
07-Mar-26
08-Mar-26
09-Mar-26
10-Mar-26
11-Mar-26
12-Mar-26
13-Mar-26
14-Mar-26
15-Mar-26
16-Mar-26
17-Mar-26
18-Mar-26
19-Mar-26
20-Mar-26
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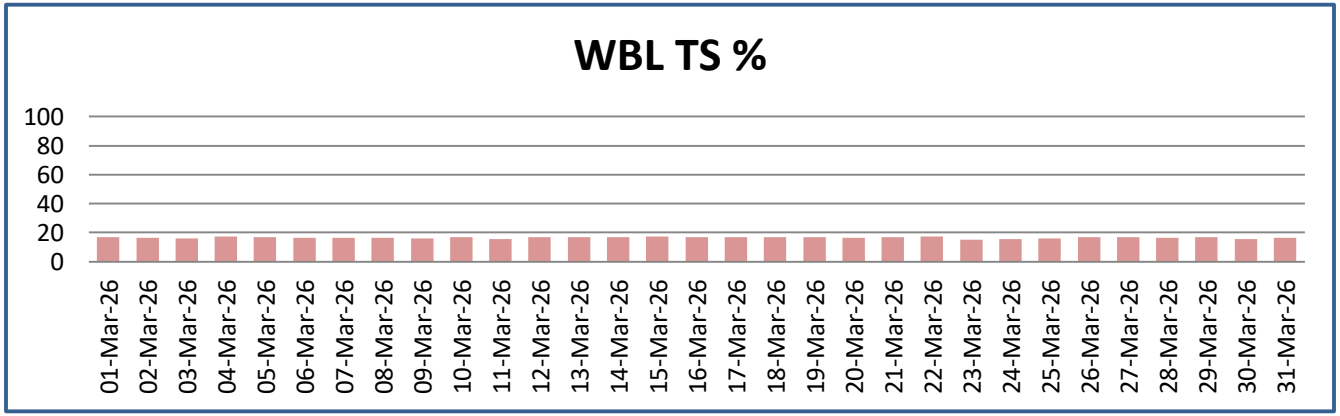
31-Mar-26


WBL TS %
100
80
60
40
20
0
01-Mar-26
02-Mar-26
03-Mar-26
04-Mar-26
05-Mar-26
06-Mar-26
07-Mar-26
08-Mar-26
09-Mar-26
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11-Mar-26
12-Mar-26
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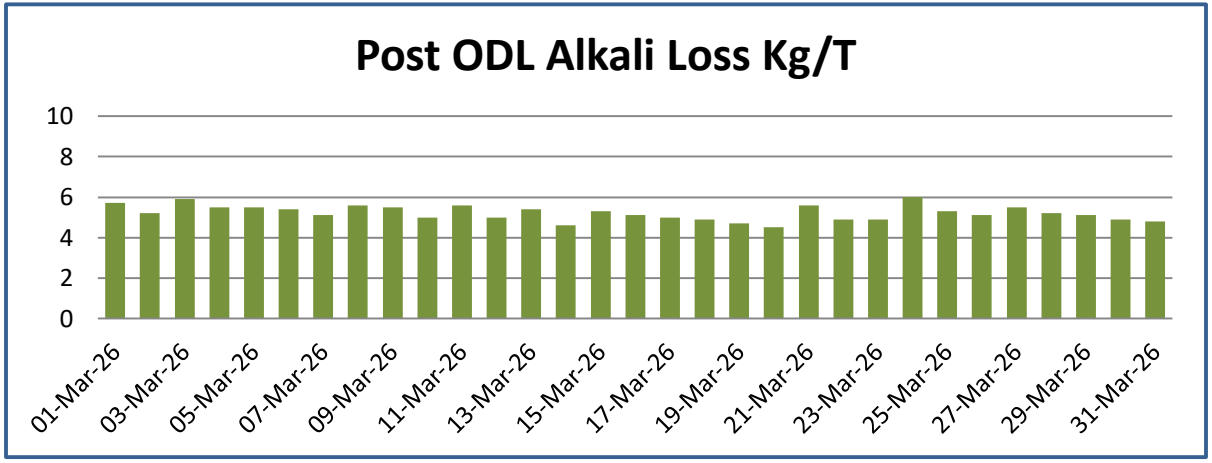
Post ODL Alkali Loss Kg/T
10
8
6
4
2
0
01-Mar-26
03-Mar-26
05-Mar-26
07-Mar-26
09-Mar-26
11-Mar-26
13-Mar-26
15-Mar-26
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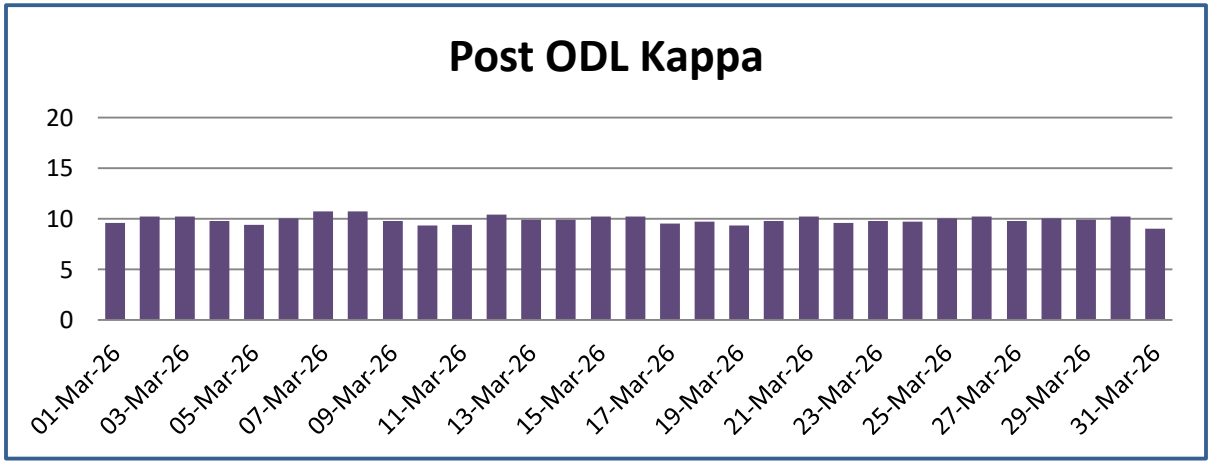
29-Mar-26
31-Mar-26


Post ODL Kappa
20
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10
5
0
01-Mar-26
03-Mar-26
05-Mar-26
07-Mar-26
09-Mar-26
11-Mar-26
13-Mar-26
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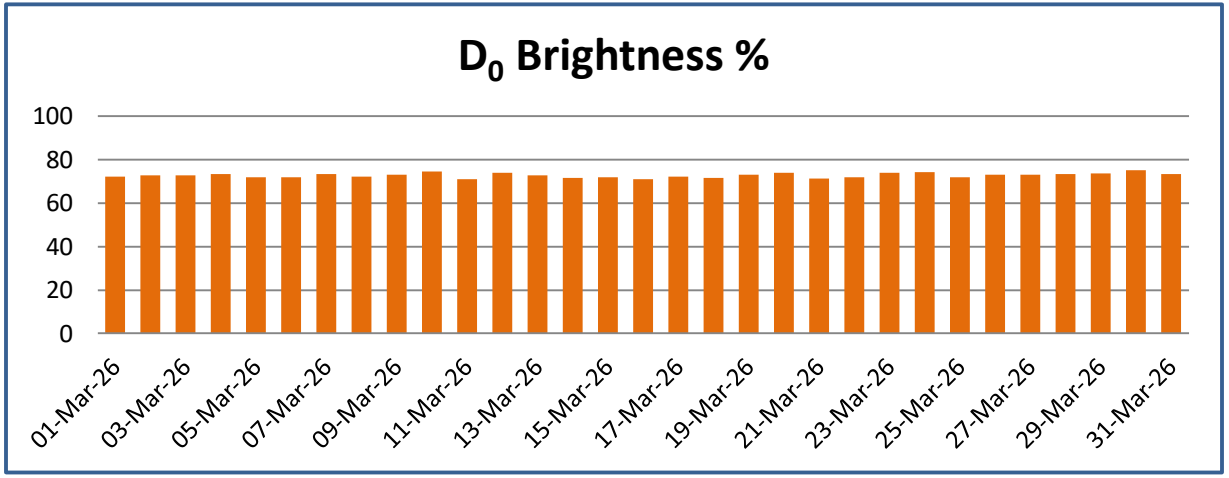
27-Mar-26
29-Mar-26
31-Mar-26


D_0 Brightness %
100
80
60
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20
0
01-Mar-26
03-Mar-26
05-Mar-26
07-Mar-26
09-Mar-26
11-Mar-26
13-Mar-26
15-Mar-26
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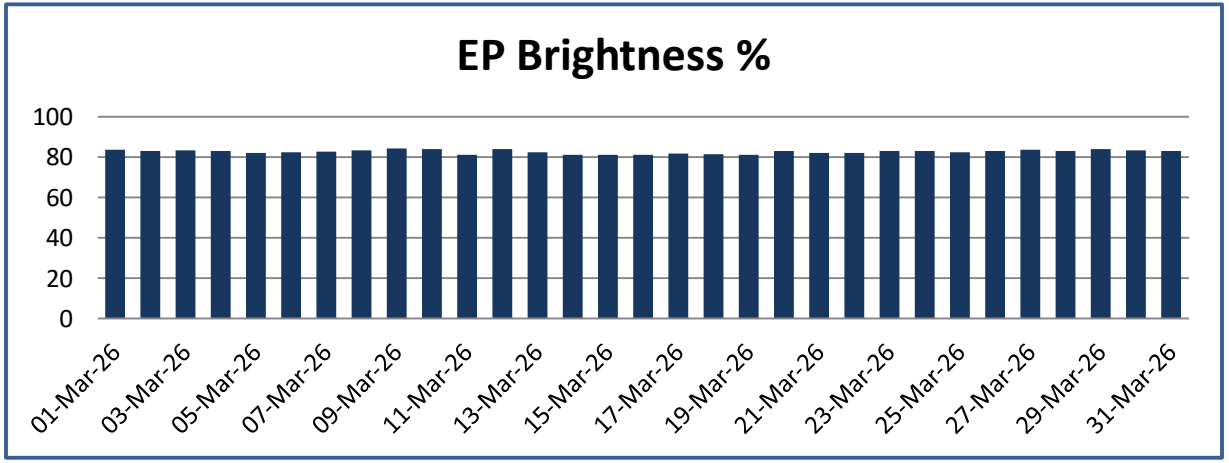
27-Mar-26
29-Mar-26
31-Mar-26


EP Brightness %
100
80
60
40
20
0
01-Mar-26
03-Mar-26
05-Mar-26
07-Mar-26
09-Mar-26
11-Mar-26
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15-Mar-26
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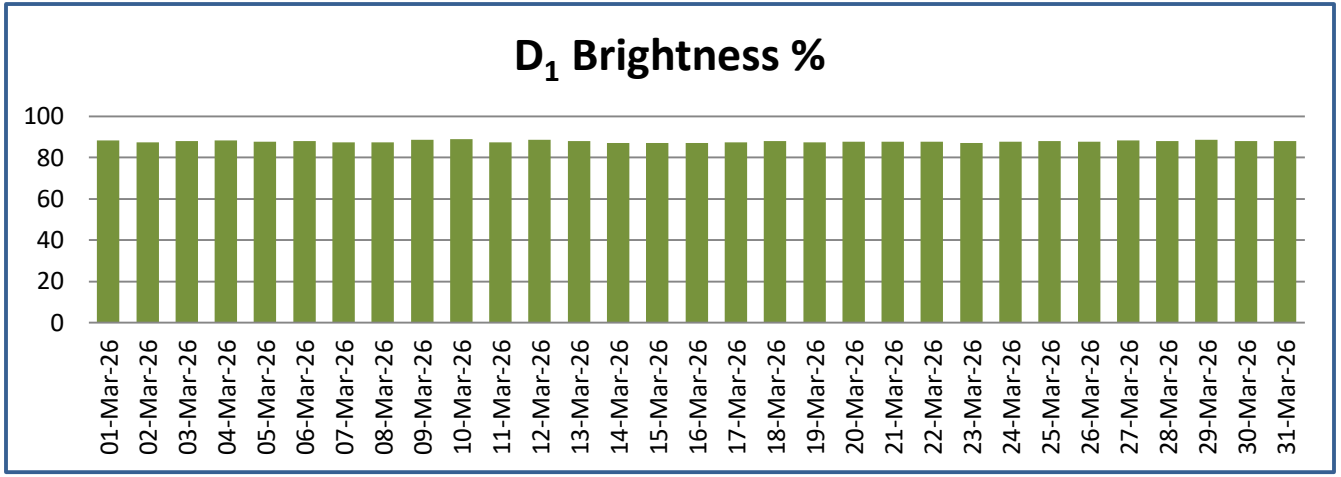
31-Mar-26


D1 Brightness %
100
80
60
40
20
0
01-Mar-26
02-Mar-26
03-Mar-26
04-Mar-26
05-Mar-26
06-Mar-26
07-Mar-26
08-Mar-26
09-Mar-26
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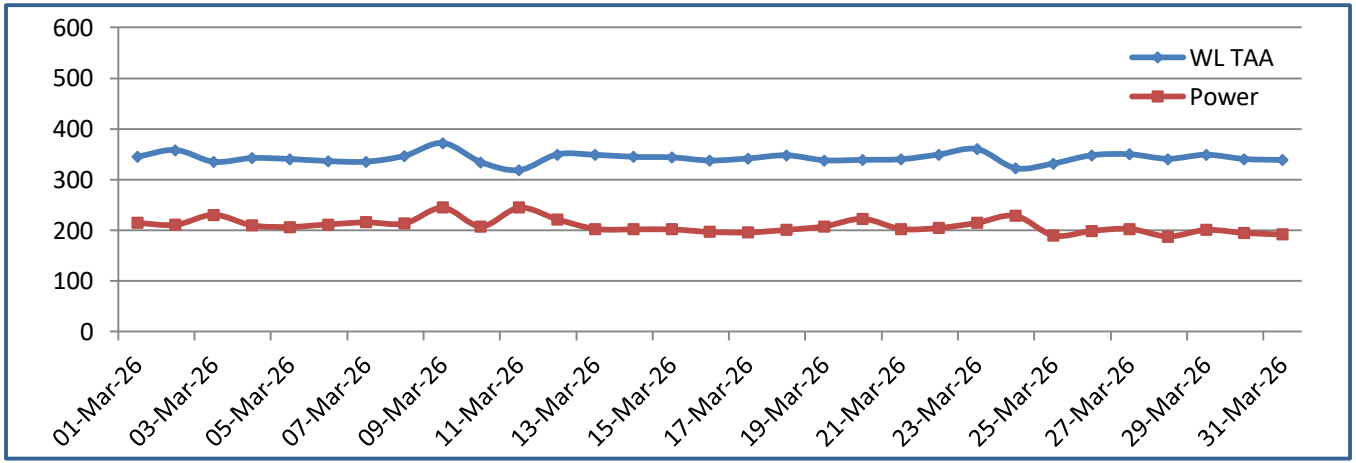
600
500
400
300
200
100
0
WL TAA
Power
01-Mar-26
03-Mar-26
05-Mar-26
07-Mar-26
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11-Mar-26
13-Mar-26
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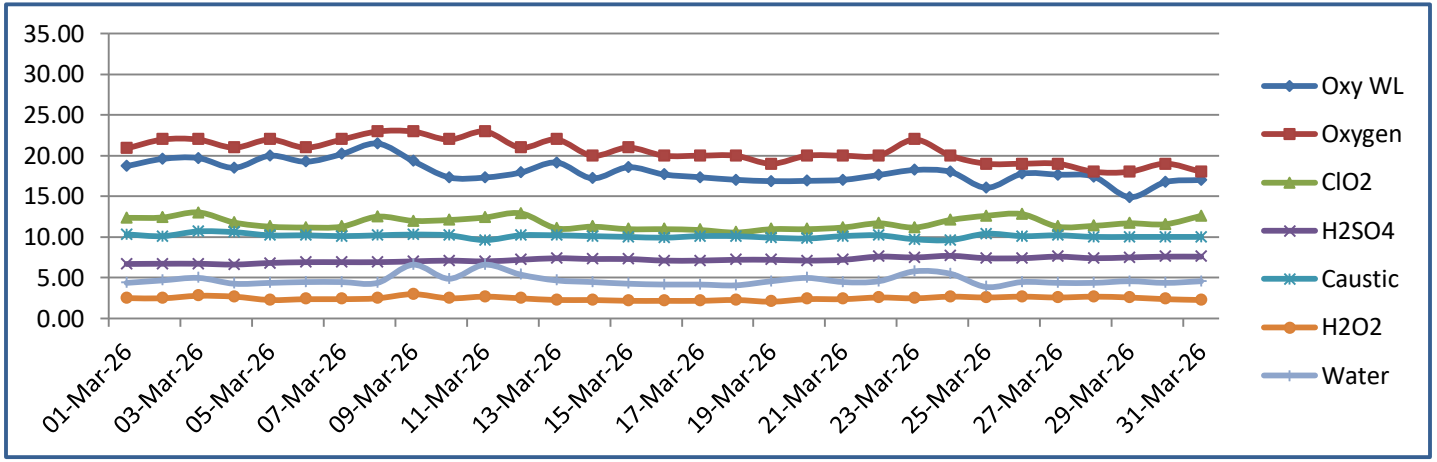
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01-Mar-26
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07-Mar-26
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13-Mar-26
15-Mar-26
17-Mar-26
19-Mar-26
21-Mar-26
23-Mar-26
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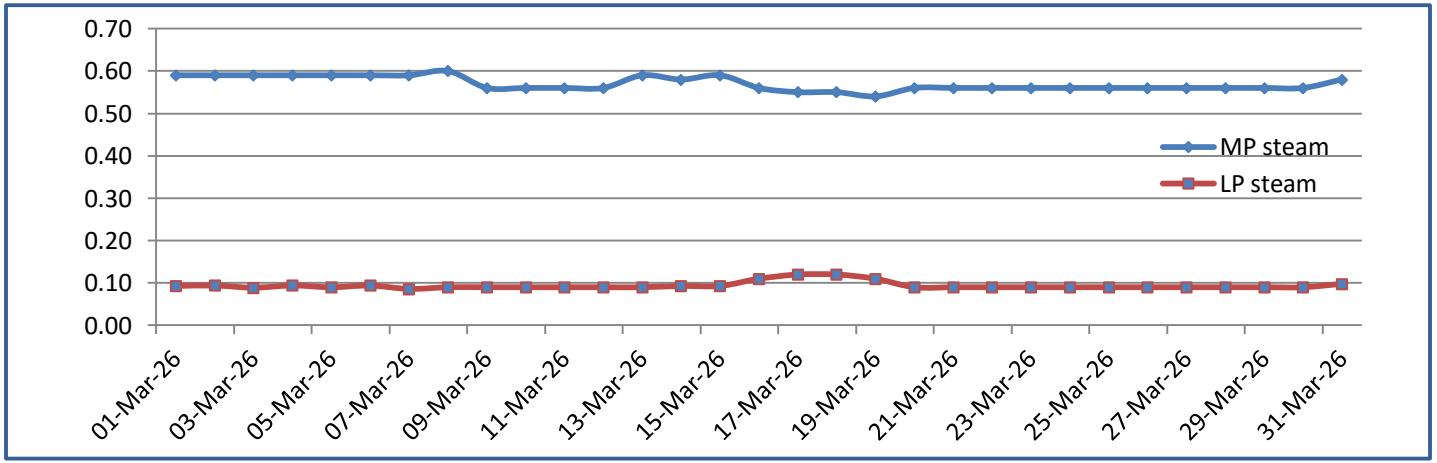
29-Mar-26
31-Mar-26
Oxy WL
Oxygen
ClO2
H2SO4
Caustic
H2O2
Water


0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
01-Mar-26
03-Mar-26
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07-Mar-26
09-Mar-26
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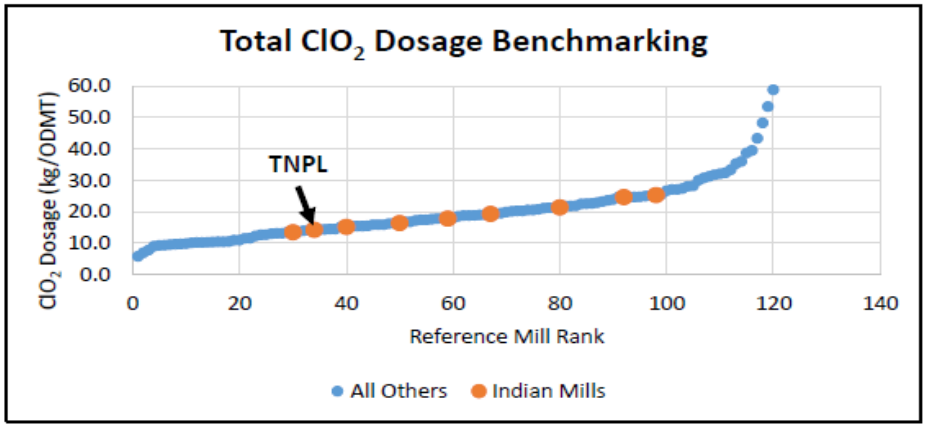
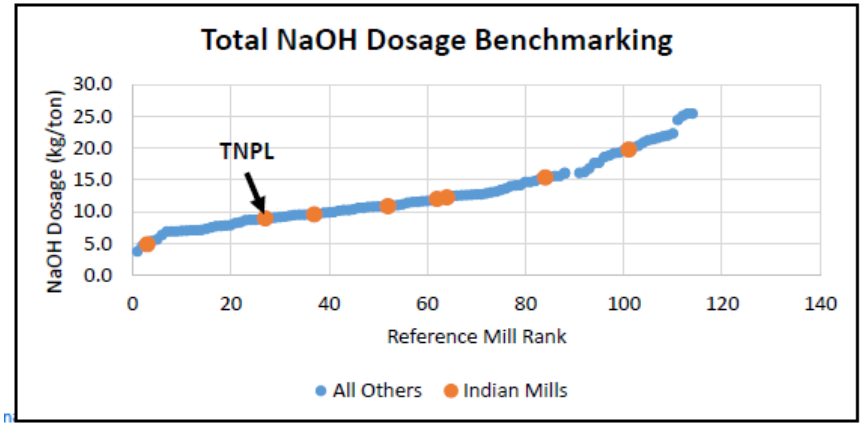
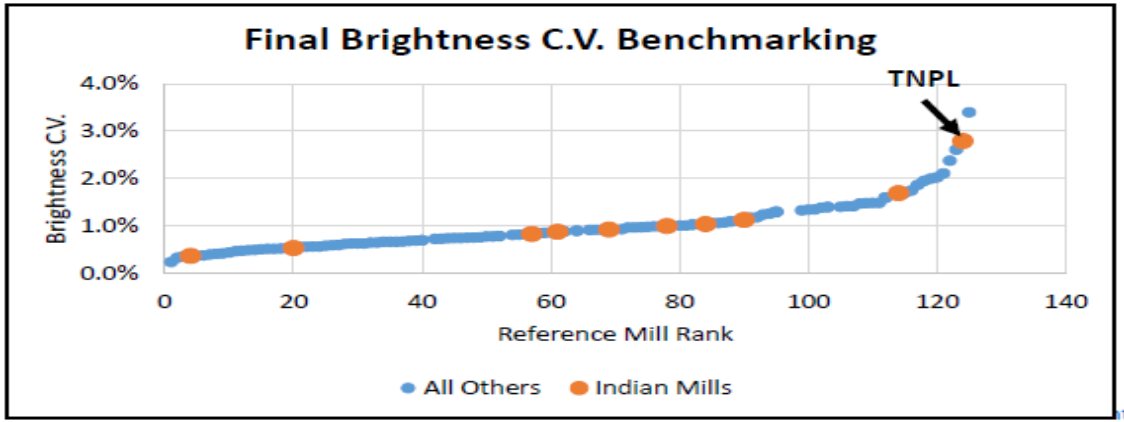
25-Mar-26
27-Mar-26
29-Mar-26
31-Mar-26
MP steam
LP steam

Comparisons with other mills (Source: BTG)







Conclusion

This APC & FSC aims to maintain even cooking kappa, optimised fiberline process parameters and chemical consumptions

APC & FSC is well proven as shown in the results and discussion

It is recorded that a very good sustainability in maintaining the process parameters, quality and chemicals consumptions.

By adopting APC for continuous cooking and FSC for fiberline stages the best sustainable results and better hold on process operation can be achieved cost effectively.

Building a Sustainable Future..

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Thank You

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R. Kandhavel, DGM- Instrumentation

N. Vasantharajan, Manager-Pulp