



# **Opportunities for Enhanced Productivity and Quality in Indian paper mills approaching Zero liquid discharge- UNIDO's intervention**

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**Efficient Collection & Processing of Recovered paper for Achieving Improved Yield and Quality**

**30<sup>th</sup> -31th October 2023**

**Kings Villa , Muzaffarnagar, UP, India**



# Overview of the Indian paper industry

22 MTPA  
production

4% of  
global  
production

Ranked  
5th

6-7%  
market  
growth  
rate

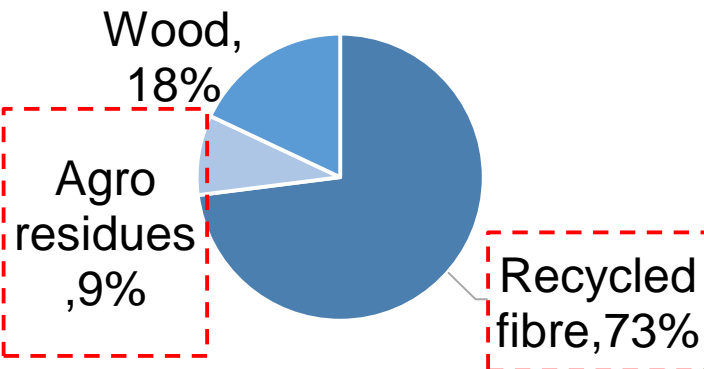
~650,000  
direct  
jobs

High no.  
of  
MSMEs



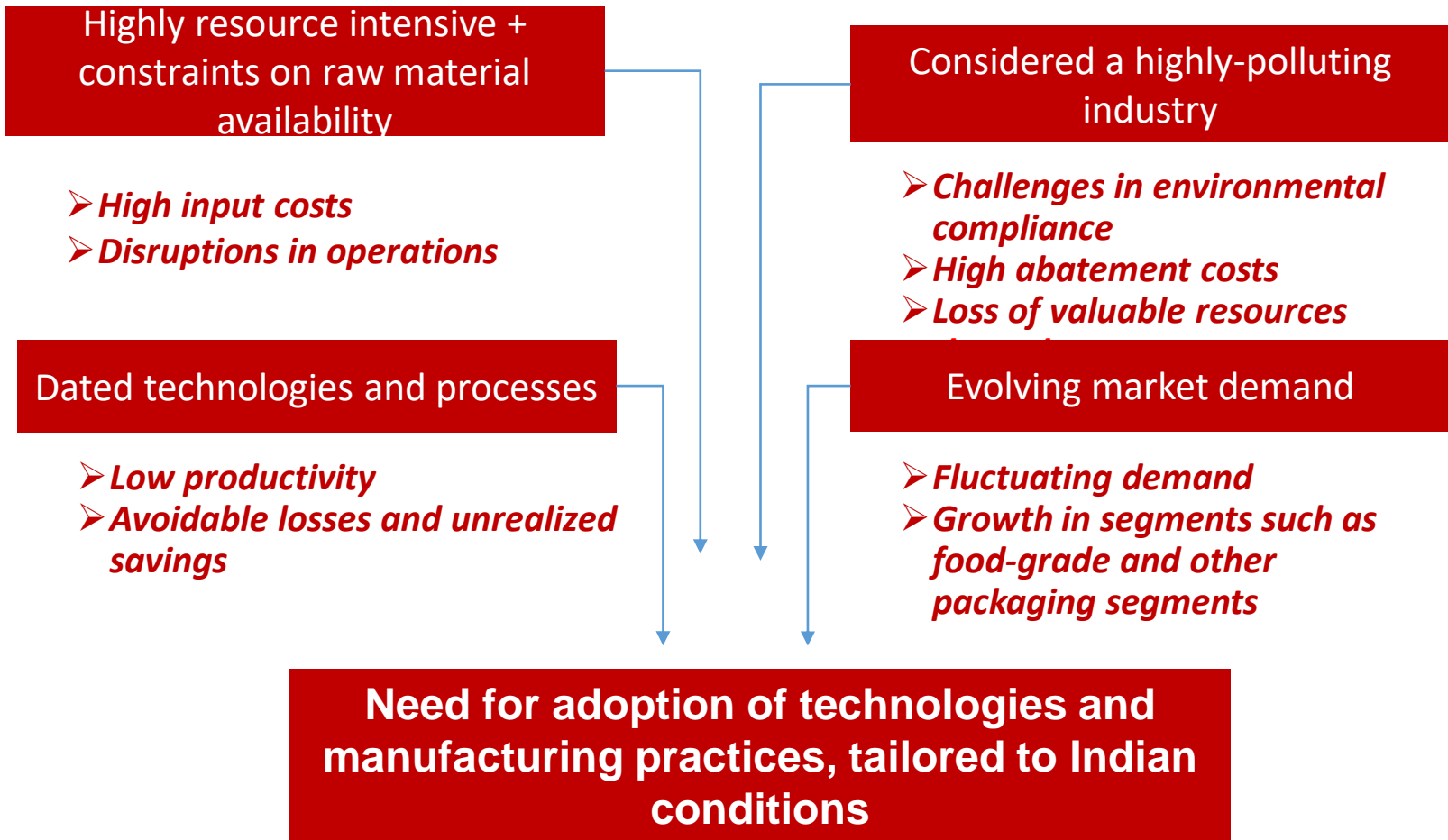
*Agro residue*

## RAW MATERIAL USAGE



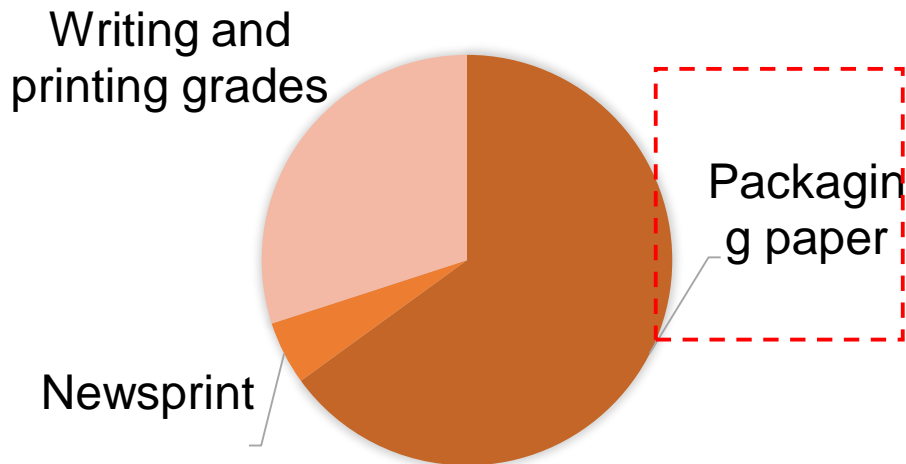
*Waste paper*

# Key challenges of the Indian paper industry



# Specific challenges for the packaging sector

## PRODUCT SHARE



**Paper-based materials account for ~40% of food grade packaging**

- **Significant growth in the paper-based packaging segment:**
  - **Growth in e-commerce, F&B industry, FMCG and pharma sector**
  - **Ban on single-use plastic in India**
- **Apart from general production challenges, closed water loops in RCF-based paper mills can result in microbial build-up, affecting product quality and performance, especially for food grade packaging**
- **Need for adoption of suitable water management practices and technologies**

# UNIDO Paper project (Phase II)

*“Firm-level demonstration of technologies and productivity enhancement for the pulp and paper industry” (2019-2023)*

**Demonstration of innovative technologies**



**Demonstration of best production practices**

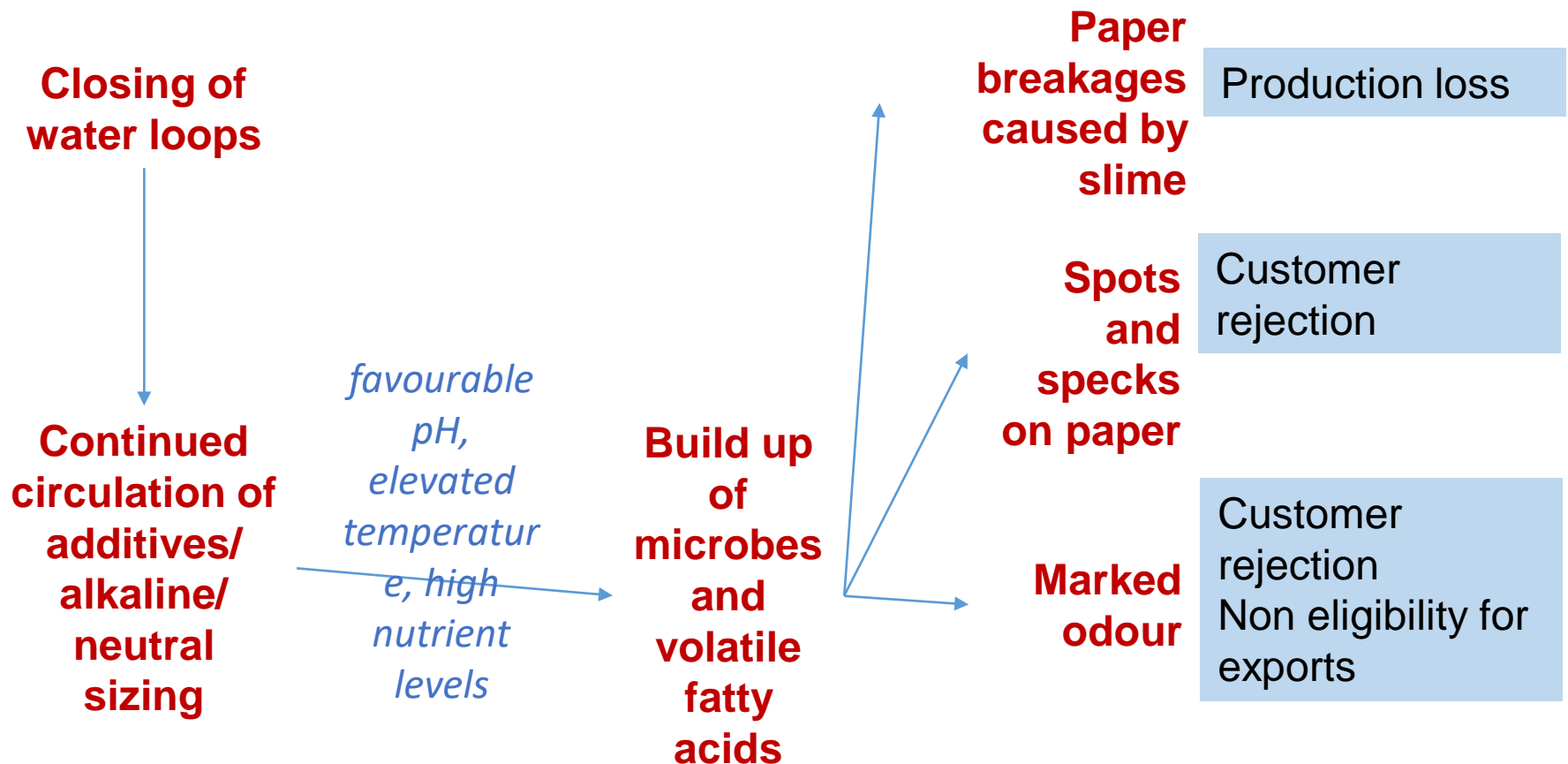


- Optimization of technical processes
- Workplace and quality management tools



- **Energy efficiency: Black liquor heat treatment**
- **Wastewater treatment: Membrane filtration, Application of ClO<sub>2</sub>**

# Application of ClO<sub>2</sub>: challenge to be addressed



## Advantages of ClO<sub>2</sub>

**ClO<sub>2</sub> is a broad-spectrum, effective oxidant, biocide, and disinfectant**

**Immediate at-source application**

**Faster microbial killing rate**

**Ability to penetrate the polysaccharides barrier (EPS) in aged bacteria**

**Low concentrations required for treatment**

**Leaves negligible traces in process water**

**Odourless and biodegradable**

➤ **Can pass through crevices**

➤ **Effective over a wide pH range**

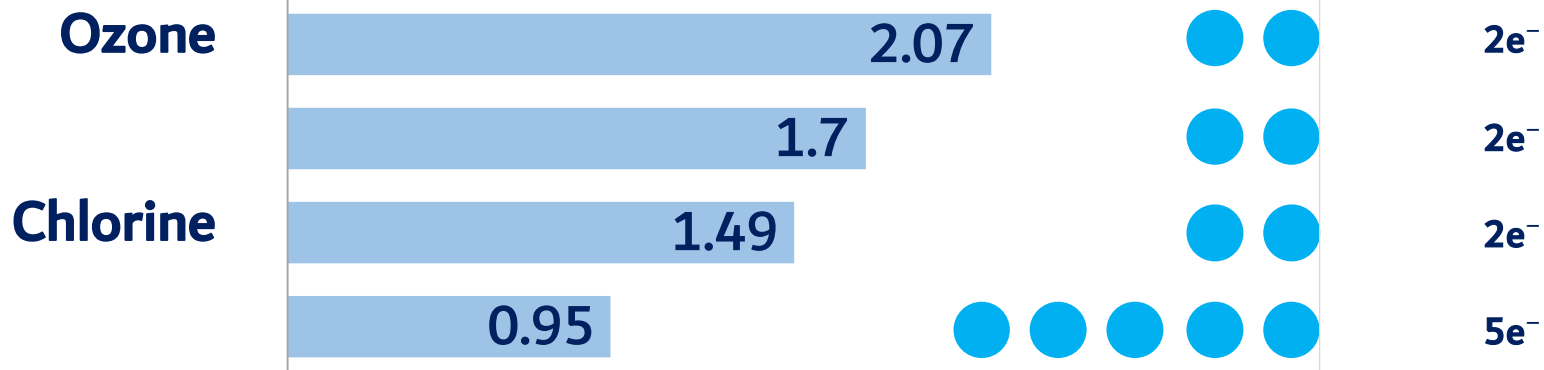
➤ **Cost effective**

**Higher oxidising capacity**

# Advantage of ClO<sub>2</sub>

**OXIDATION  
STRENGTH**

**OXIDATION  
CAPACITY**



**Less Oxidation Strength,  
less corrosive;**

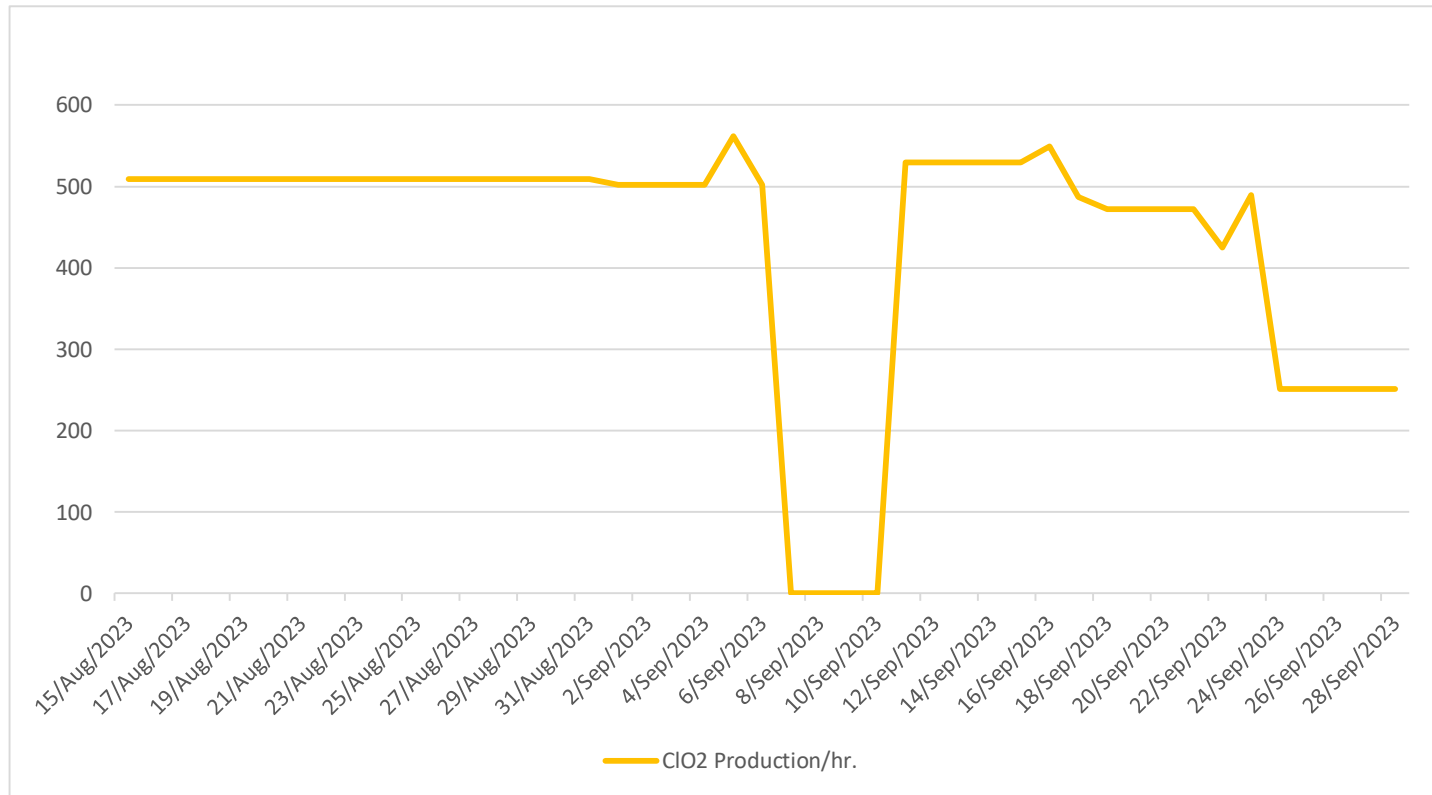
**more oxidation capacity,  
less chemical qty required**



# ClO2 system for Odour Control



# ClO<sub>2</sub> Production/hr. Aug & Sep 2023



# Estimation of Total Baceterial count (TBC) – Bactaslyde



07<sup>th</sup> July 2023,  
11:30 AM

Bactaslyde:  $10^8$



07<sup>th</sup> July 2023,  
06:12 PM

Bactaslyde:  $10^8$



27<sup>th</sup> July 2023,  
02:39 PM

Bactaslyde:  $10^7$



21<sup>st</sup> Aug 2023,  
12:45 PM

Bactaslyde:  $10^5$



26<sup>th</sup> Sep 2023,  
01:08 PM

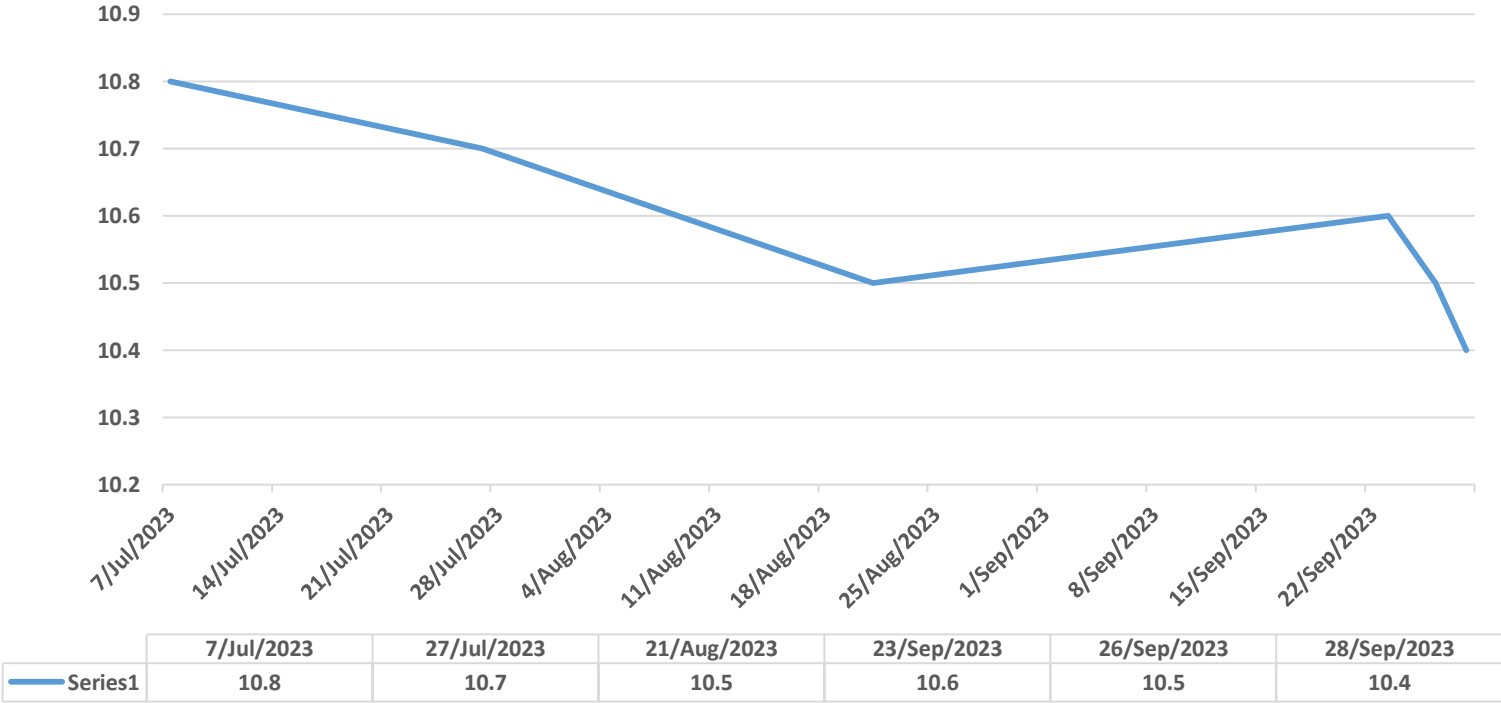
Bactaslyde:  $10^5$



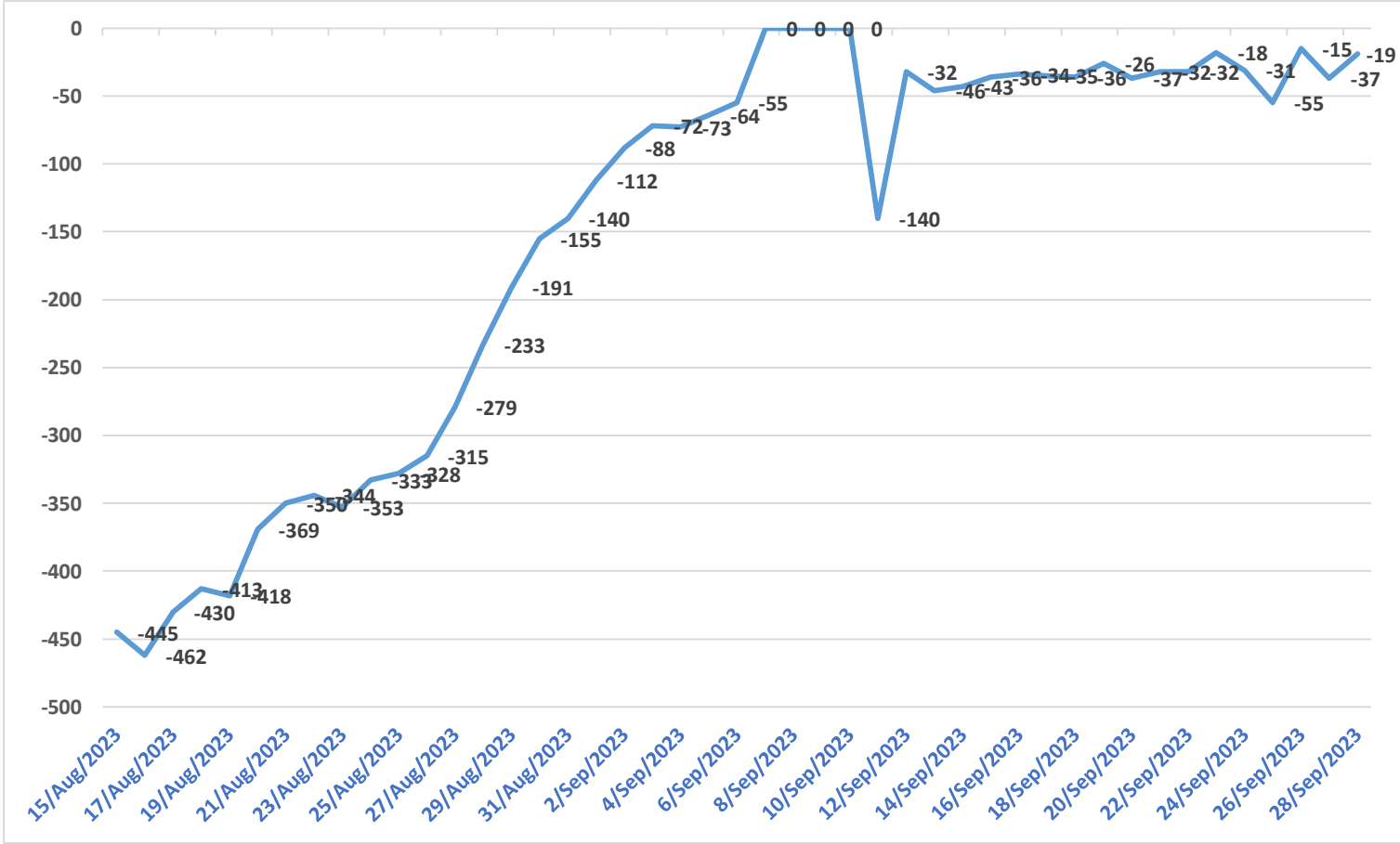
28<sup>th</sup> Sep 2023.  
02:35 PM

Bactaslyde:  $10^4$

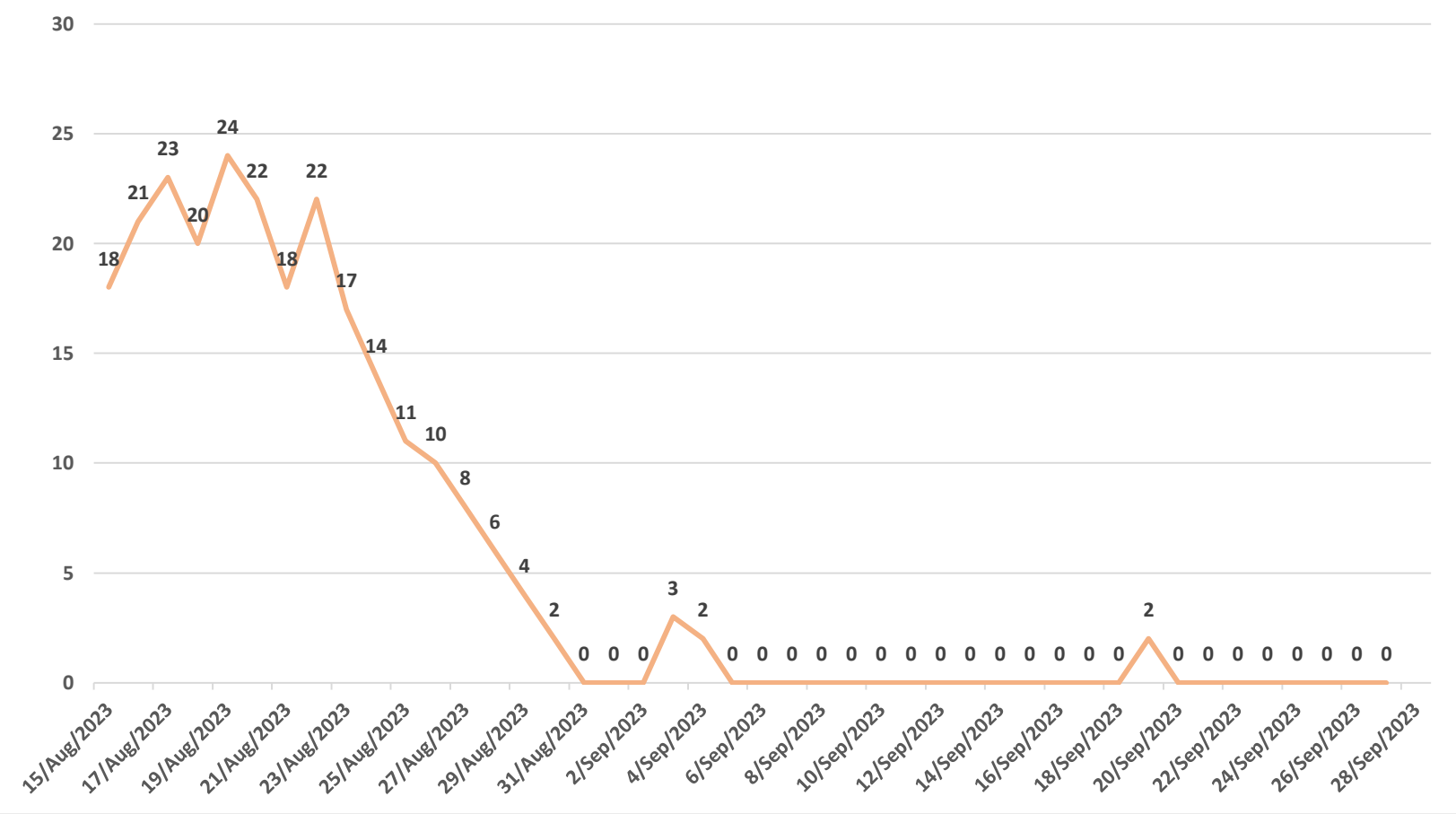
# Total Bacterial Count in internal process water



# Trends in ORP during CLO2 treatment period August - Sep 2023



# Trends in Paper machine Breaks/day period August - Sep 2023



# Capex and Opex ( ROI) - Implementation of ClO2 treatment in RCF based paper mills producing packaging grades of paper in Muzaffarnagar:

1. Operational costs (energy, chemicals ) : INR 21 /- tonne of paper
2. Benefits accrued due to enhanced productivity, Reduced paper breaks, more draw , productivity enhanced / day ( 4-5%, Around 7 tons/day @INR 5000 i.e. INR 35000/- per day
3. Capital Cost : INR 6, 00,000/-
4. Return-on-investment( ROI) : Less than one month

# Conclusion

- Control of microbial contamination and odour ,reduced paper machine breaks and down time
- Enhanced productivity, competitiveness and overall process efficiency
- Improved the quality of paper by reducing defects such as specks, spots, and holes in the sheet, reduced sheet breaks and subsequent production and finishing losses.
- Very effective sporicide in food grade paper, it is appropriate to use this versatile disinfectant in food grade paper applications
- Technology demonstration in Indian paper mill approaching toward ZLD could enhance productivity, sustainability and competitiveness of the Indian paper industry by reducing input costs, consistency in production and improved higher product quality thereby, increased acceptability both in domestic and export markets.



# Acknowledgement

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UNITED NATIONS  
INDUSTRIAL DEVELOPMENT ORGANIZATION



**SUSTAINABLE DEVELOPMENT GOAL 9**  
INDUSTRY, INNOVATION AND INFRASTRUCTURE

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# Thank You

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*Future From Waste....*

