

# Wastewater and waste disposal management solution through innovative solutions like sludge pre-Treatment, TSS control by IoT and Polymer mixing Technology to improve dryness of Sludge



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## ABSTRACT

*In order to preserve the resource for next generation and to meet the constrained rules and regulations to meet the environment norms, Paper Industries are looking for the Innovative solutions to handle wastewater and solid waste disposal. Nalco has several innovative new technologies, which are aligned with key sustainability drivers in terms maintaining environment and initiate RRR approach (Reuse, Reduce and Recycle).*

## Introduction

Paper production requires huge amount of water and chemicals and wastewater generation is, also, quite high. Wastewater characteristics from a paper mill vary widely depending on the type of mill, raw materials, pulping process, chemicals used etc. Contaminants include TSS, Color, BOD, COD, Halogenated Compounds, Sulphur based compounds etc.

Typical treatment scheme involves, Preliminary, Primary, Secondary & Tertiary treatment.

Conventional treatment involves use of commodity chemicals like Alum, PAC, Iron based Coagulant and a Polymeric Flocculant which generates huge amount of solids waste. Treatment with Polymeric Coagulant & Flocculant based chemistry generates, at least 40-60 % lesser solids waste. It also minimizes the need for any secondary pH adjustment prior to the Secondary treatment. Polymeric Coagulants have been found to be more effective for the reduction of apparent & true color. Also, processes like Adsorption, Chemical Coagulation, Advance Oxidation (AOP), Membrane filtration, Bio-augmentation products/enzymes is used now a days. Uses of Bio-augmentation products have been found to be more effective in the Secondary treatment, particularly for an upset recovery condition.

One wastewater treatment trend gaining attention is anaerobic digestion. While this process has high capital costs, it doesn't require oxygen (like aerobic treatment does), ultimately resulting in significant energy savings over time. Anaerobic systems also generate less sludge for the amount of BOD removed compared to the high quantities created from aerobic treatment. This treatment approach generates biogas, which can be used to harness energy onsite, greatly reducing sludge disposal costs.

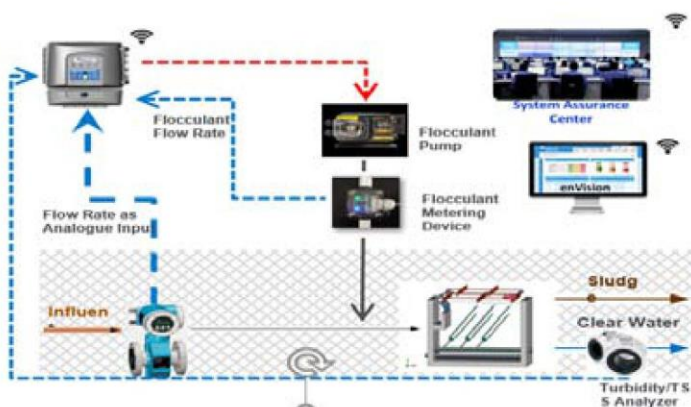
Attention has also been given to advanced or tertiary treatment, where, approaches such as adsorption, UV disinfection, coagulation/precipitation, membrane filtration, de-chlorination, and chemical oxidation are being incorporated at pulp and paper mills to support this process.

Nalco Provides innovative technology to implement IoT concept in monitoring TSS, TDS and Flow in wastewater treatment in 24\*7 basis. Polymer mixing Technology to improve dryness of sludge and Sludge pre-treatment to re-use sludge back into paper machine.

## Technology for wastewater Monitoring and controlling of TSS

### Working Mechanism

- Flow Rate-Based Product (Flocculant) Dosing Set-Point Control
- Verified Product Dosage in ppm
- Operations Visibility
- Process KPIs (Turbidity/TSS)
- Override/manual operation with High Turbidity/TSS Alert



- Easy to Install & Operate
- Ability to adjust product ppm directly
- Advantages of IoT concept in ETP DAF/Clarifier
- Product dosage Setpoint control based on Inlet Flow rate
- Actual, real time measurement & chemical dosage visibility (ppm calculation)
- Multiple Flow rate & chemical dosage Control with one Controller.
- Inlet Flow rate and Chemical flow rate.
- No Water sample or Probe. All data through Inputs from external sensors.
- Ability to control pH.
- Ability to take Turbidity/TSS value and Generate Alarm.
- 24x7 Monitoring by System Assurance Center, data visibility at Web Platform & Scheduled Reports

#### Polymer/Sludge Mixing Technology to improve Sludge Dryness

- Good distribution of polymer in incoming sludge by powerful mixing
- Up to 5 % higher cake dry solids



#### Measurable Results-With Polymer/Sludge Mixing Technology

Plant: Paper Mill

Background: Sludge dewatering application

Situation: Customer was looking for ways to reduce the total cost of operation and meet company sustainability goals.

Application: New Polymer Mixing Technology Program

eROI:

~ Increase of 6 pct pts in sludge solids reduce sludge generation by 5,500 tons/yr.

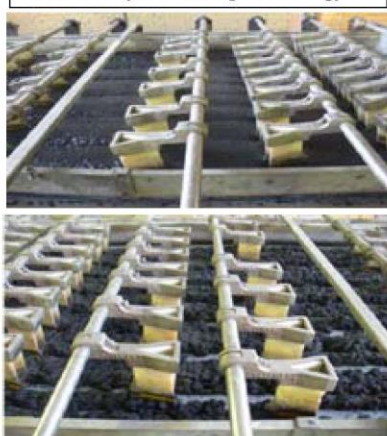
~ Reduced fuel gas use for sludge incineration by 330,000 m3 and reduced CO2 emissions by almost 700,000 tons.

~ Reduction of 17M gallons of polymer make down water

~ Estimated Annual Savings:

~ Overall reduction in the Total Cost of Operation (TCO) of over \$509,00 per year

Without Polymer Mixing Technology



With Polymer Mixing Technology

#### Sludge Pre-Treatment Program

##### Reuse to process

Sludge from primary settling tank are mainly composed of fiber fines and ash fillers, which are the major raw materials of papermaking. It would be valuable if sludge could be reused back to papermaking process and retained on the paper sheet, from which sludge treatment cost drops and fiber raw materials are saved.

Waste → Sludge Pre-Treatment → Raw Materials

##### Microbial control

Purpose: to control bacteria, especially harmful bacteria

High-efficiency microbial control with new micro-bio control product with dosage of 100~300ppm to sludge flow rate

##### Sludge pretreatment

Purpose: Make sludge easier to retain

Sludge pretreatment with newly formulated product with dosage of 0.08~0.15 kg/ton of paper

Sludge addition concentration: 3-4%, the lower concentration, the more uniform mixing

#### Commercial application-Case Study#1

##### Background

grade: 100-140gsm corrugated medium

production: 700 ton/day

Machine A: 350 ton/day

Machine B: 350 ton/day

Sludge: primary clarifier

**Challenges:** The customer was suffering low retention of recycled sludge, which caused increasing COD in wastewater. They had to replacing process water with fresh water every 30 days to ensure qualified wastewater discharge.

**Solution:** Sludge Pre-Treatment

**Results:** Sludge retention improvement

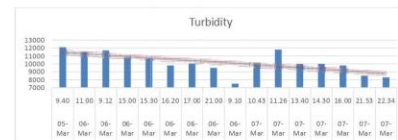
Ash% increase

Fiber saving

Cleaner system

TCO reduction

Machine	Ash% before trial	Ash% in trial	Ash% increase
A	13.95	14.80	0.85
B	13.15	14.00	0.85



#### Commercial application Case Study#2

##### Background

grade: 80-90gsm liner board

production: 450 ton/day

Machine A: 250 ton/day

Machine B: 200 ton/day

Sludge: bio tank & primary clarifier

**Challenges** COD of wastewater kept increasing due to the reuse of sludge in process. the customer had to replace process water with fresh water every 30 days to ensure qualified discharge.

**Solution:** Sludge Pre-Treatment

**Results:** Sludge retention improvement

COD reduction

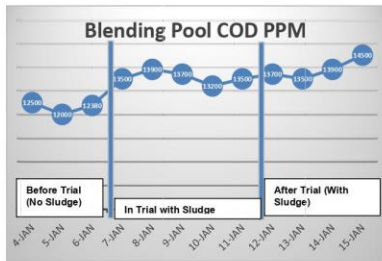
Fiber saving

TCO reduction



Wastewater & Waste Disposal Management Solution through innovative solutions like sludge pre-treatment, TSS control by IoT and Polymer mixing Technology to improve dryness of Sludge

Machine	Ash% before trial	Ash% in trial	Ash% increase
A	17.87	18.58	0.71
B	16.02	16.76	0.74



Plastic Waste Management

The most of the mill adapted option is burnout the plastics in cement kiln with high temperature (>1100OC) and residence time in cement Industries

- Reduction in overall emission of greenhouse gases.

- Promotion to the concept of circular economy
- Utilisation of waste, which otherwise was a serious concern, as thermal substitute, replacing an almost equivalent amount of coal.
- Specialty designed boiler with operational range of more than 1100OC to burn the plastic without negative impact to environment.

Reduction in pollution benefited society as a whole

The shredded plastic waste is added to the aggregate. ... The plastic waste coated aggregate is mixed with hot bitumen and the resulting mix is used for road construction.

CONCLUSION

Considering current stringent environment norms, considering water scarcity and to meet the carbon foot print, Paper Industries are looking for

the innovative solutions to improve the Waster water treatment plant efficiency enhancement.

The technologies presented above not only provide On line monitoring and control in Waste water treatment plant, they provide avenues for water and Energy water conservations.

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