

ODOUR CONTROL IN RCF MILLS WITH CLOSED- LOOP ANAEROBIC TECHNOLOGY



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Abstract: In the current environment, all Old Corrugated Containers (OCC) paper mills are forced to operate their mill in Zero Liquid Discharge (ZLD) condition in India which leads to enhance organic and inorganic concentration build up in the mill water. The build-up of organic and inorganic makes chemicals less efficient in the paper mill, there is slime formation, stickiness in various parts of the paper mill, odour in the paper as well as surrounding environment. Similar issues were faced by Sunshine Paptch at their paper mill in Wada and Paques BIOPAQ® ICX was installed to overcome the issues. After implementation of BIOPAQ® ICX, the mill water characteristics has been changed as per their requirement and it is also helping the plant in generating odour free paper. Due to controlled organic and inorganic matter in the water loop the machine runnability improved compared to earlier and chemicals are efficient too. The back water-Soluble Chemical Oxygen Demand (SCOD), Volatile Fatty acids (VFA) and Calcium were 48000 mg/l, 32410 mg/l and 3000 mg/l respectively before BIOPAQ® ICX implementation. Now the back water characteristics of SCOD, VFA and Calcium are 5000 mg/l, 2000 mg/l and 600 mg/l respectively. Since organic matter and inorganic matters are under control in ZLD condition, paper making process has become smoother for Sunshine Paptch. Mill back water is treated by BIOPAQ® ICX followed by aerobic system. Hence, final water is free from organic pollutants and ensures loop water concentration remains same in ZLD condition. After adopting adequate Effluent Treatment Plant (ETP) the odour causing elements like VFA and Sulphide are under control which enables Sunshine to produce food grade paper with ZLD condition.

Key Words: OCC Paper Mill, Zero Liquid Discharge, Slime, Sticky, SCOD, BIOPAQ® ICX, VFA, Calcium, Aerobic System, Effluent Treatment Plant

Introduction: Sunshine Paptch is producing 250 TPD of kraft paper with 20 to 35 BF. For making high grade paper, Sunshine is mixing the imported paper with local paper. Due to such varying sources of raw material, pollution generation from each grade of paper is unknown. As per CPCB norms, OCC mills are mandated for ZLD operation which means they do not have permission to discharge water outside their plants which leads to heavy organic and inorganic pollution accumulation in the water. Over a period, the water becomes heavily polluted or saturated with organic and inorganic matter concentration which creates issue of paper mill operation especially -

- i. Paper mill chemicals becomes less efficient due to higher TDS in the water.
- ii. Odour causing elements like VFA and Sulphide are out of control.
- iii. Formation of sticky and slime affects machine runnability and hence production decreases.

Above addressed issues are common in OCC mills where adequate ETP is not available. The organic and inorganic pollution which is present in wastepaper will ultimately end up with water during paper making process. The organic pollutants like SCOD and VFA will further create issue of odour in the paper and in the surrounding environment. Due to uncontrolled organic matter slime formation in paper machine will be heavy which affects machine run ability and affects paper production rate. To avoid slime formation, it is mandatory to control organic matter concentration in the mill water which means VFA and SCOD must be kept under control. Also, the presence of higher VFA concentration in the mill water dissolves CaCO₃ and forms Ca²⁺ ions.

A higher VFA concentration will generate higher calcium concentration in the water which will further create issue of scaling at neutral pH.

Starch is the major contributor for organic pollution in OCC mill. Since starch is inevitable material for paper making, we cannot stop it. A method to avoid higher concentration of organic matter in mill water is to have adequate Effluent Treatment Plant capacity. With adequate Effluent Treatment Plant, the mill water will get treated in anaerobic followed by aerobic system and clear water can be used for stock preparation as per figure 1.

Materials and methods:

The issue of Sunshine was studied and addressed with adequate Effluent Treatment Plant. The proposed and implemented ETP consists of -

- i. Dissolved Air Flotation
 - ii. Conditioning tank
 - iii. BIOPAQ® ICX
 - iv. Aeration tank
 - v. Secondary clarifier
 - vi. Screw press
- i. Dissolved Air Flotation (DAF): Paper mills operates based on the fibre strength. As mill water consist of fibres which is crucial to recover prior to entering in to the ETP. To recover fibre from machine water, it passed to DAF with flocculant dosing, thus the fibres are recovered and the same is recycled to pulper for further paper making process. The clear water (fibre free) from DAF goes to the conditioning tank.
 - ii. Conditioning tank: After fibre is recovered from DAF, clear water enters the conditioning

tank. In the conditioning tank nutrient like Nitrogen and Phosphorous are dosed and mixed homogenously. This water is then further pumped to BIOPAQ® ICX.

- iii. BIOPAQ® ICX: After the influent is made homogenous it is pumped to BIOPAQ® ICX for further degradation of organic matters. In this stage wastewater SCOD and VFA has reduced considerably to 70% and 90% respectively. Hence, the wastewater is less polluted and further it goes to an aeration tank. BIOPAQ® ICX is an anaerobic reactor where SCOD and VFA get reduced in absence of air. The degraded SCOD and VFA further forms into biogas and granular biomass. The biomass is stored in storage tanks and are transported to other sites for start-up. The generated biogas consists of methane which has higher calorific value. Sunshine is using this biogas into their boiler to save equivalent amount of coal.
- iv. Aeration tank: Anaerobically treated water further goes to aeration tank for next level of

purification. In aeration tank air is introduced by an installed air blower. Here, remaining VFA and SCOD gets removed and water becomes clean. Since this water contains Mixed Liquor Suspended Solids it cannot be used directly into the paper mill. Hence this water is further sent to a secondary clarifier.

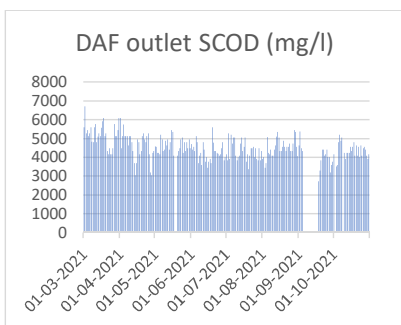
- v. Secondary clarifier: By natural gravity sedimentation Mixed Liquor Suspended Solids from aeration tank get settled in the secondary clarifier and clear water get overflowed from it. This clear water is further pumped to paper mill stock preparation area for pulp making. The settled sludge is pumped to aeration tank to maintain Mixed Liquor Suspended Solids concentration in the aeration tank. The excess sludge is again pumped to a sludge holding tank and pumped to Screw press for dewatering.
- vi. Screw press: Drained sludge from aeration tank has 30 to 40% organic matter and 60 to 70% inorganic matter. These sludge after dewatering is supplied to a local vendor

for tray making. The local vendor utilizes the sludge for making egg trays. The filtrate from the screw press again pumps to the aeration tank.

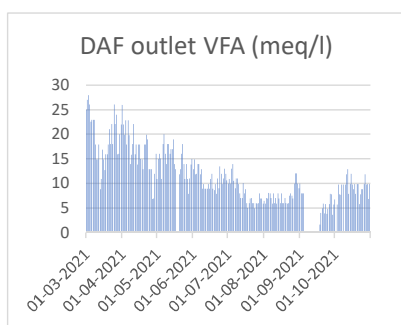
Results and discussion:

The above approach and design of closed loop system has been successfully operating and have resulted in the below benefits -

1. Biocide, PAC and defoamer in paper mill stopped 100%.
2. Mill run ability has been improved and able to make 5% to 10% higher paper production.
3. Paper produced is odour free and certified as food grade due to controlled organic matter in mill water.
4. ETP operational cost is equal to biocide cost. Hence, extra expenses are not required to operate the ETP. Before and after ETP implementation per ton of paper production cost is also same.
5. Paper is free from fungal contamination even after 1 year.



Graph 1



Graph 2

Table 1: Mill water characteristics before and after treatment

S. No.	Parameters	Before BIOPAQ® ICX Feb'2020	After BIOPAQ® ICX Jan'2022
1	pH	6.02	6.7
2	TSS (mg/l)	465	350
3	TDS (mg/l)	22500	8000
4	Calcium (mg/l)	3046	650
5	VFA (meq/l)	463	20
6	Paper odour	Yes	No
7	Sulphate	1250	650
8	SCOD (mg/l)	47400	5200
9	Biogas generation (m3/d)	0	3000 - 3500

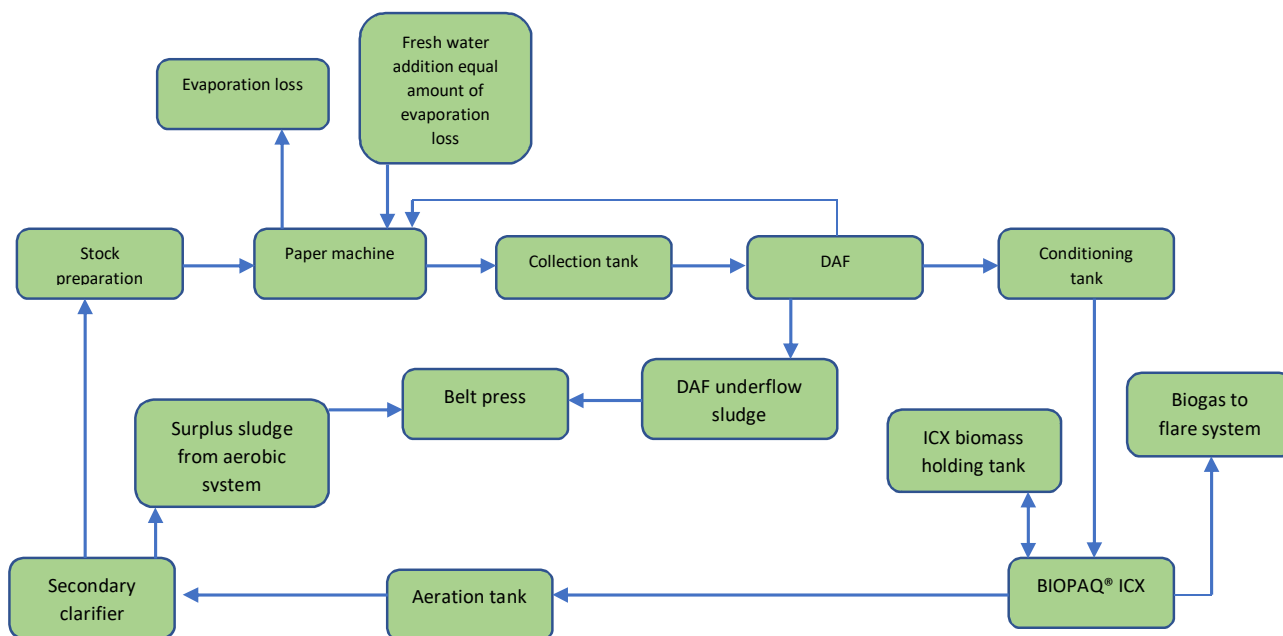


Figure 1: Sunshine mill operation with ETP

Table 1 is indicating that SCOD in the mill water was 47400 mg/l before ETP implementation and after ETP implementation it is maintaining 5200 mg/l. Likely VFA, Calcium, SO4 and other parameters has been changed. Graph 1 and Graph 2 indicates that DAF outlet SCOD and VFA maintains consistently with ZLD operation.

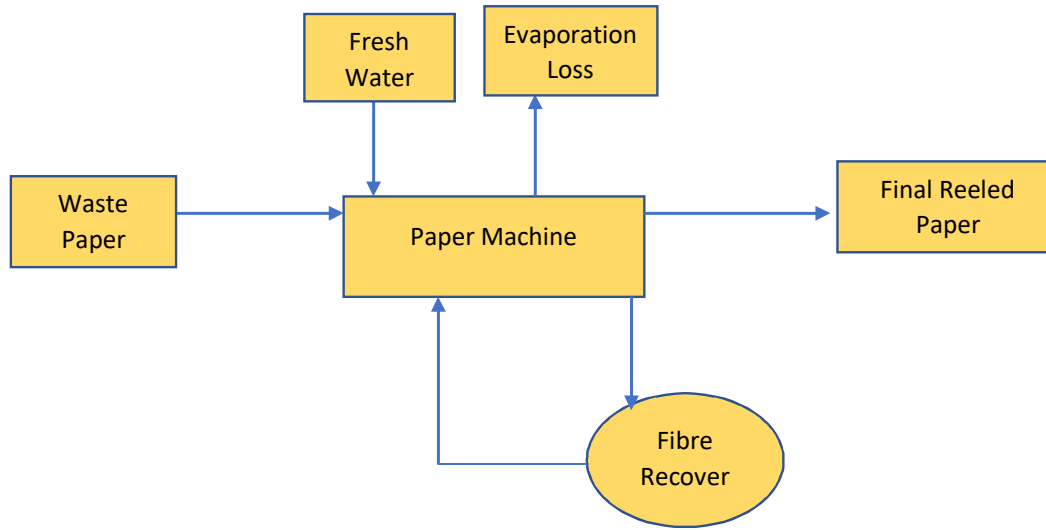


Figure 2: Sunshine mill operation without ETP

Conclusion: Issue faced at Sunshine Paptch is common in all OCC mills which can be addressed and solved with adequate ETP implementation. By implementing adequate ETP, paper mills also can ensure their smooth run ability of machine, production of odour free paper and they can target the packaging market in food, pharma, ecommerce, and many others. The operated ETP also handles organic and inorganic matter excellently. Because of that VFA, SCOD and Calcium are under control with ZLD condition. The

implemented ZLD has been achieved without UF, RO and evaporation system which helps the paper manufacturer to save more Capital and Operational expenditure. ZLD in the OCC paper mill at Sunshine Paptch is thus a proven technology and it is possible for other OCC mills too.

Refer to figure 1 and figure 2 – With an ETP, a paper mill can treat organic matter and recirculate same water back to paper making process without affecting their process which

helps them to avoid usage of more freshwater consumption for paper making. In figure 1 and figure 2 freshwater consumption is limited to evaporation loss which makes paper makers to use metered fresh water. Since freshwater consumption is limited to evaporation loss organic and inorganic matter built up in back water if mill does not adopt adequate ETP. Thus, having an adequate ETP helps paper makers to avoid many problems and makes their paper making a very smooth process.