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INNOVATION IN EFFLUENT COLOUR REDUCTION AND GENERATION OF VERMI COMPOST FROM LIGNIN SLUDGE

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Abstract:

Studies were conducted to reduce the final effluent colour and COD. Conducted several lab scale trials with enzyme treatment, ozone oxidation, nano filtration, carbon adsorption and chemical treatment. Finally, team found positive results from chemical treatment with different combination of FeCl3, Poly, lime, Alum and PAC. Study continued for cost optimization and concluded combination of PAC, Lime and Poly are best suitable for plant requirement.

Next question is sludge handling. Burning in CFBC Boiler is not economical due to high Moisture & the process was not Environment friendly. Team has conducted several trails to produce Vermi compost with lignin sludge and cow dung. Concluded to scale up with 10 % Cow Dung & 90 % Lignin sludge. Observed lignin sludge conversion as Vermicompost in 45 - 50 Days.

Introduction

In Pulp indutry major challenge is effluent generation and treatment. Effluent is brownish tinge in colour due to residual lignin. Several technologies are emerged to reduce the effluent generation and treat in pulp industry and succeeded. Still pulp indutries have black mark on highest water consumption and effluent generation & quality. Team has taken voluntary approach towards effluent colour reduction trials and convincing the management on mill sustainability.

Mill is generating effluents from mainly three sources Digester chips wash, bleach effluent and recovery effluent. In primary clarifier mill effluent is treated to remove suspended solids. Treated and untreated PreHydrolysate liquor from biogas plant will also combine with effluent and treated in aerobic lagoons followed by aerobic treatment and secondary clarifier.

Final effluent parameters achieved:

SN	Parameter	Unit	KSPCB Norms	Result
1	COD	ppm	< 250	230
2	BOD	ppm	< 30	26
3	TSS	ppm	<100	85
4	Inlet/Outlet Colour	PtCo	-	900

With earlier treatment methodology plant meeting the environment norms. However, team reveals that,

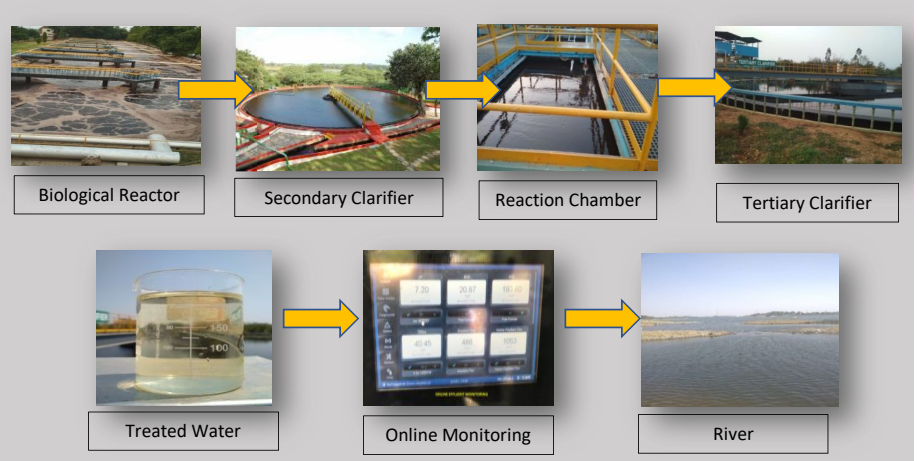
1. Colour of the treated effluent was an aesthetic issue
2. Industry was forced to stop production every year for 13 days during Mylar Jatra (festival) – leading to financial loss
3. Difficult to run the plant with treated Colour effluent discharge during lean / no flow – long term sustainability issue
4. Continuous pressure from society and statutory body – in a long run, image of the industry could be at stake

While handling and removal of Effluent colour, team faced several challenges. Trials conducted with combination of different chemicals.

1. FeCl3 + Lime + Poly
2. Alum + Lime + Poly
3. HCl + Lime + Poly
4. PAC +Lime + Poly

Results are encouraging with PAC, Lime and Poly. Trials continued with different Ratios, finally concluded with 140:20:0.5 Ratio.

Cross functional team has developed inhouse design of equipment and requirements for trial implementation at plant scale. Effluent treated as shown in below process.



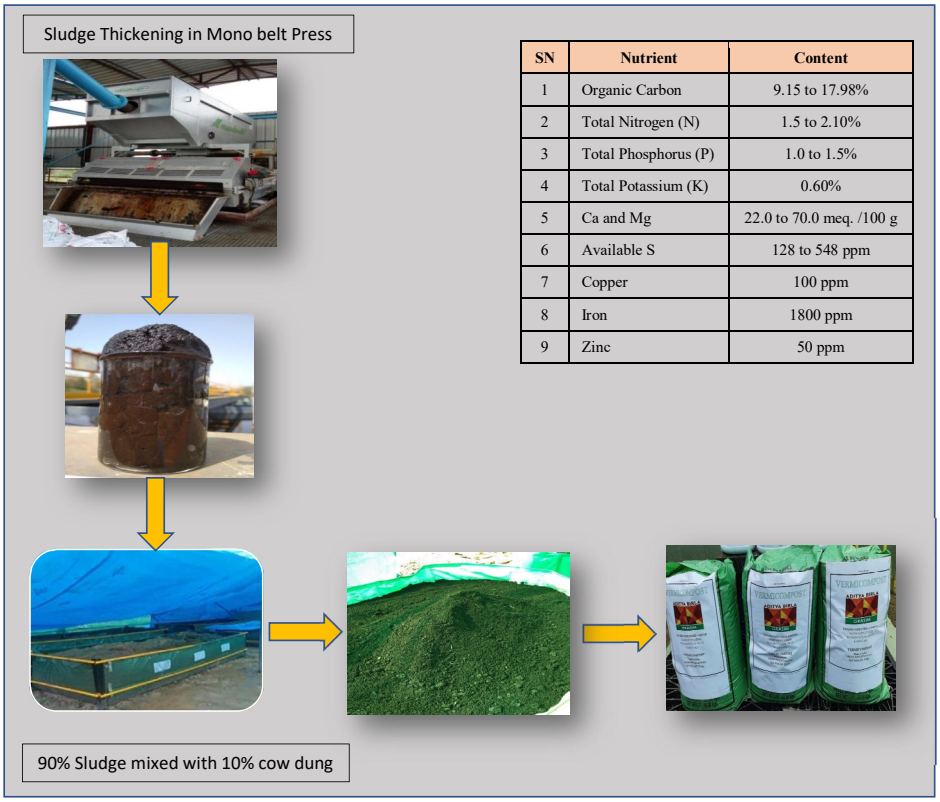
Every day from Tertiary clarifier 25 – 30 tons of as such sludge is generated at 12% solids (3.0 TPD on dry basis), which is not Economically feasible to dry with equipment due to High moisture content i.e. >88%. Burning in CFBC Boiler is not economical due to high Moisture & the process was not Environment friendly.

Team has conducted several trails to produce Vermi compost with lignin sludge and cow dung. Concluded to scale up with 10 % Cow Dung & 90 % Lignin sludge.

The team decided to Scale up in phase manner as per pilot trial & following recipe was implemented in phase-1 with 20 beds (size: 4x 16x3ft.)

- The Generated lignin sludge is natural dried up to 50-60% moisture.
- Dried Lignin Sludge to be dumped in Vermicomposting Bed with quantity 3-4 tons per bed.
- 200 kg of Cow dung will be added.
- 50 Kg of Earthworms will be added for each bed and water will be Sprayed for every alternate Days.
- Vermicompost will be ready in 60 - 75 Days.

Vermi Compost preparation process is as under:



SN	Nutrient	Content
1	Organic Carbon	9.15 to 17.98%
2	Total Nitrogen (N)	1.5 to 2.10%
3	Total Phosphorus (P)	1.0 to 1.5%
4	Total Potassium (K)	0.60%
5	Ca and Mg	22.0 to 70.0 meq. /100 g
6	Available S	128 to 548 ppm
7	Copper	100 ppm
8	Iron	1800 ppm
9	Zinc	50 ppm

Learnings from trials:

- Liquid PAC can be used i.p.o powdered to optimize the cost.
- More the worms, lesser is the period and weekly once mixing of beds for speedy process
- Earth worms are very active @ around 50 % bed moisture and under the shade.

Benefits:

1. Continuous running of Pulp Plant during Mylar Jatra, one of the major milestones, which led to planning of annual maintenance as per mill requirement.
2. Downstream River water quality improved & Industry Image improved.
3. Vermicompost is an Eco-Friendly natural Organic Fertilizer and Free from chemical inputs and promotes better root growth and Nutrient absorption.
4. Improves the water retention capacity of the soil because of its high organic matter content and improves the nutrient status of Soil, both macro and micro nutrients.

Way Forward:

Marketing of the Vermi Compost and increasing the manufacturing capacity to 3.0 TPD.

Results:

SN	Parameter	Unit	KSPCB Norms	Before TC	After TC		
					FY22	FY23	FY24
1	COD	ppm	< 250	230	164	162	153
2	BOD	ppm	< 30	26	17	18	20
3	TSS	ppm	<100	85	52	42	45
4	Inlet/Outlet Colour	PtCo	-	900	247	293	250
5	Cost of Tertiary treatment	Rs/TP	-	-	391	378	416
6	Vermi Compost generation	Tons	-	-	13.68	56.82	96.01
7	Revenue from Vermi Compost	Rs. Lakhs	-	-	0.55	2.69	5.76