Best Methodologies Being Followed In Waste Treatment System In BGPPL, Kamalapuram To Emerge As An ECO- Friendly Mill

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ABSTRACT

Eco friendly activities are required to balance/maintain the eco system and protect from global warming. Legislation has forced the industries to safe guard global natural systems. Through improved techniques achieved the targets for water conservation by recycling and reusing to the maximum extent of treated effluent usage. The color of combined effluent was reduced by ferrous chloride treatment economically. Installed waterfalls system and reduced the level of inlet temperature, increased the aeration and reduced pollution load. Disposed of fly ash generated in the Coal fired Boilers for manufacturing of bricks which is used for Building construction. Saw dust generated in the chipper house is utilized in multi fuel boilers. Disposing of ETP sludge as filter cake to card board/egg tray manufacturing Industries. Existing system improvement to blow heat recovery for incineration of Non Condensable Gases (NCG) is carried out and continual improvement through Integrated Management System. To conserve our forest, the mill through its wholly owned subsidiary BILT TREE TECH Ltd is arranging saplings to farmers under its farm forestry activity and inturn through these plantations is meeting its wood requirement.

INTRODUCTION

BGPPL Unit: Kamalapuram is one of the best unit in South India for manufacturings Dissolving Grade pulp with annual capacity of 98000 TPA, supplying to textile industries. This Unit is located in Kamalapuram of Warangal in Andhra Pradesh. This Unit has latest state of the art of equipments and entire plant is controlled through DCS (Distributed Control System). Unit was awarded "Three Green Leaves" by Centre for Science and Environment, New Delhi for Green rating project and has been placed in the 5th position out of 29 Units participated. Unit has major customers including Grasim Nagda, who manufactures Viscose Staple and Viscose Filament yarns.

LITERATURE REVIEW

Water is unique because water is the only common substance that exists in three forms (ice, water, steam) at normal temperatures. It absorbs more heat for a given temperature rise than any other common inorganic substance.

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Water expands 1600 times as it evaporates at atmospheric pressure to form steam. The water conservation could be made successful only by augmentation of the demand with treated effluent. The reduction of wastewater flow rates from all the sources results directly from the reduction in water consumption (1).

Colour interferes with aquatic life by limiting light transmittance. The major contribution to the colour is alkaline-stage waste. All industrial effluents are colored and turbid which impart colour to the receiving waters. The pulp mill effluent contains lignin material and other organic materials in dissolved forms. They are highly resistant to biological attack. Color not only is aesthetically unacceptable but also inhibits the natural process of photosynthesis in streams due to absorbance of sunlight. This leads to chain of adverse effects on the aquatic ecosystem, as the growth of primary consumers as well as secondary and tertiary consumers is adversely affected. Fresh waste water is usually a light brownish grey colour, but, as the travel time increases in the collection system and more anaerobic conditions develop the colour of waste water changes sequentially from grey to dark grey and ultimately black which is described as septic. About 75% of the dissolved organic material, 60% of the COD load, 40 to 50% of the organically bound chlorines, and 80% of the color-imparting substances of bleach plant effluents are reportedly contributed by extraction-stage effluents. Therefore, a treatment method that can degrade, dechlorinate, and decolorize extraction-stage effluent can tackle most of the environmental pollution problems associated with bleach plant effluents. The different approaches can be taken to alleviate the problem of effluent colour. Process modifications to control generation of highly colored components: The nature and composition of the effluent, degree of treatment required, operating costs and efficiency of treatment plants are some factors to be considered when deciding on the type of treatment needed for effluent colour reduction. End-of Pipe treatment methods: Some of the End-of-pipe methods are chemical treatment, Massive lime treatment, Polymers, Carbon adsorption, Ozonization, Membrane Process, Irradiation process, MyCOR process etc (2).

Industrial waste water secondary treatment using Activated Sludge techniques has gained increased acceptance in the paper industry. The most versatile biological oxidation method for treating industrial waste is Activated Sludge Process in which

industrial waste is continuously exposed and subjected to biological degradation carried out by the microbial flocs suspended in the reaction tank into which oxygen is introduced by mechanical means. The advantages of ASP are to produce high quality effluent with relatively small areas. The disadvantages are sensitive to shock loads of toxic and organic substances. Careful attention for control of volume and concentration of return sludge. High cost of operation and maintenance. The pulp and paper industry is the second largest industrial water consumer in Europe with a usage of 35 m^3/ton paper and a production of 85.2 Million tons/year. Its effluents cause considerable damage to the receiving waters if discharged untreated since they have a high biochemical oxygen demand (BOD), chemical oxygen demand (COD) and contain chlorinated compounds, suspended solids (mainly fibers), fatty acids, lignin, and sulphur compounds. Environmental legislation has affected the pulp and paper industry. Bio degradable organics which are measured in terms of BOD and COD composed principally of proteins, carbohydrates and fats. If these are discharged untreated to the environment, their biological stabilization can lead to the depletion of natural oxygen resources and to the development of septic conditions. The most widely used parameter of organic pollution applied to waste water is BOD_5. The COD of waste water is, in general, higher than the BOD because more compounds can be chemically oxidized than can be biologically oxidized (3).

The ultimate disposal of the solid & sludge and concentrated contaminants removed by treatment has been and continues to be one of the most difficult and expensive problems. The treatment and disposal of sludge has become one of the most significant challenges for the environment. Presently 75% of power generated in the country is from coal fired boilers. Fly ash is the most abundant of all the residues produced during combustion of coal used for power generation. Efforts are being made to increase the use of fly ash in every possible way. The problems with fly ash are not limited to its disposal which requires large quantities of land, water and energy. But its fine particle, if not managed properly, by virtue of their weightlessness, can become airborne and it also causes serious environmental hazards. Most of the power plants in India are following wet disposal with unlined ash pond which is responsible for subsurface and groundwater contamination (4). The TRS compounds along with vapours of methanol, turpentine etc are collectively called as non condensable gases (NCG's). All components of NCG are considered explosive in concentration range of 1- 45 % (by volume). NCG emissions can be grouped into two categories: Low Volume & High Concentration (LVHC) and High Volume & Low Concentration (HVLC). The ever increasing demand for wood based raw material along with declining resources has made the pulp and paper industries to search for few avenues in order to bridge the gap. Nearly 80 percent of wood in developing countries is consumed for fuel, whereas the developed countries use approximately the same amount for industrial uses. Improved planting stock and innovative agro techniques and other cultural practices have become a main stay in improving the socio economic conditions of the farmer and creating healthier environment. There are several push and pull factors beginning with resources to returns (5).

TABLE 1

WATER CONSERVATION

S.No	Reduction point	Volume in m3/day
1	By Sheduled time to colony & village	1200
2	Sand filter back wash water	1200
3	Chipper house log washing & spray water	2200
4	Plantation inside the mill premises	900
5	Gardening, Coal yard spray, Boiler ash quenching & other cleaning	1300

RESULTS & DISCUSSION

WATER CONSERVATION STEPS

PHOTO 1

USING OF TREATED WATER FOR WOODEN LOG WASHING IN CHIPPER HOUSE

Following control measures were taken for water conservation and the details are given in Table -1. Instead of round the clock pumping of drinking water to colony and village, only pumping of water within the scheduled time of around 12hrs/day is being followed and with this around 1200m^3/day of water is saved apart from energy conservation. Replaced all existing water taps inside the mill and colony with push type pipe to avoid water leakages and wastages. Recycling of WTP sand filter backwash water in to clariflocculator instead of draining in which around 1200 m^3 is being saved daily by constructing RCC water tank of capacity 1800 m^3. In wood yard for log washing, treated water spray system (pumps, storage tanks and pipe line arrangements) are arranged and by that around 2200m^3/day of fresh water is saved (Photo 1). Before feeding of wooden logs into chipper, treated water is being sprayed. Treated water is used for gardening and cleaning & wetting of the RCC roads inside the mill campus. In table feed conveyor of chipper No 1, 2 & 3, treated water is being used for removal of sand and dust. For farm forestry plantation activities of Eucalyptus varieties inside the factory premises treated water pumping system from ETP is arranged and by that around 900m^3/day of fresh water is saved. Treated water was used in power boiler area for ash quenching. E(p) back water is used in C/D washer repulper for pulp dilution. C/D washer sprays are carried out with D-stage back water in place of hot water for two numbers of spray headers. SO_2 plant surface cooler return water is being used and re-circulated in bleach Hot water tank. Rectifier transformer cooling water is sent to cooling tower. Reuse of mud filter vacuum pumps sealing water and lime kiln support rollers cooling water by processing through small cooling towers. Regular awareness training programmes are being conducted regarding water conservation. Subscribing Journals like Everything About Water, Water Digest, Everything About Environment, Environmental Pollution control and etc.

COLOR REDUCTION USING FERROUS CHLORIDE

Color reduction by chemical treatment of combined effluent by using ferrous Chloride was started in Feb '2008. Initial laboratory experiments were conducted using ferrous chloride and

TABLE 2

LAB TRIAL - EFFECT OF FERROUS CHLORIDE (OPTIMIZED DOSAGE 800 mg/l)

Combined effluent						
Tests	Sample	1	2	3	4	Avg
pH	Blank	9.4	9.6	9.7	9.4	9.5
	Treated	6.8	7.0	7.1	6.8	6.9
Colour (Pt.Co)	Blank	6250	6400	5950	5640	6060
	Treated	2272	2272	2604	2450	2400
	Reduction%	64.0	65.0	56.0	57.0	60.0
Total Suspended Solids (ppm)	Blank	660	580	540	680	615
	Treated	264	218	195	264	235
	Reduction%	60.0	62.0	64.0	61.0	62.0
Chemical Oxygen Demand (ppm)	Blank	1440	1580	1580	1480	1520
	Treated	628	764	762	692	712
	Reduction%	56.0	52.0	52.0	53.0	53.0

TABLE 2a

LAB TRIAL - EFFECT OF PAC (OPTIMIZED DOSAGE 500 mg/l)

Combined effluent						
Tests	Sample	1	2	3	4	Avg
pH	Blank	9.4	9.6	9.7	9.4	9.5
	Treated	7.2	7.1	7.0	6.9	7.1
Colour (Pt.Co)	Blank	6250	6400	5950	5640	6060
	Treated	4200	4400	3900	3850	4088
	Reduction%	33.0	31.0	34.0	32.0	33.0
Total Suspended Solids (ppm)	Blank	660	580	540	680	615
	Treated	440	400	380	420	410
	Reduction%	33.0	31.0	30.0	38.0	33.0
Chemical Oxygen Demand (ppm)	Blank	1440	1580	1580	1480	1520
	Treated	1100	1150	1185	1120	1139
	Reduction%	24.0	27.0	25.0	24.0	25.0

TABLE 3

PLANT TRIAL - EFFECT OF FERROUS CHLORIDE & PAC TREATMENT IN COMBINED EFFLUENT

Tests	Sample	PAC 300 mg/l	Ferrous chloride 630 mg/l
pH	Blank Treated	9.4 7.1	9.6 7.2
Colour (Pt.Co)	Blank Treated Reduction%	3079 2469 20.0	2955 1655 44.0
Total Suspended Solids (ppm)	Blank Treated Reduction%	403 238 41.0	358 186 48.0
Chemical Oxygen Demand (ppm)	Blank Treated Reduction%	1020 749 26.0	1042 609 42.0

PAC separately. Results from table 2 & 2a indicats that significant reduction in color levels by using ferrous chloride in comparison to PAC. Color reduction of 60% and 33%, COD reduction of 62% and 33% and TSS reduction of 53% and 25% were observed for ferrous chloride and PAC respectively. Looking in to above results, plant trial was conducted using ferrous chloride and PAC separately. Results from Table 3 inferred that effective reduction in color by using ferrous chloride. Apart from color, reduction in total suspended solids & COD was also observed. Color reduction of 44% and 20%, suspended solids reduction of 47% and 41%, COD reduction of 41% and 27% were observed for ferrous chloride and PAC respectively. Ferrous chloride readily undergoes hydrolysis to ferric hydroxide at pH above 2.3 in a gelatinous form and absorbs any precipitate formed by the coagulative action of the electrolyte and collects them and separates easily.

Color in pulp& paper effluent generally exists as negatively charged colloidal particles due to which removal can occur by coagulation with the aid of trivalent or divalent salts such as Ca, Fe, or Al or by addition of cationic type organic polymer. Treatment of negatively charged particles begins with neutralizing the charge to allow particles to bond onto larger and larger particle structures until removal by sedimentation can be achieved. The first part of the process, the charge neutralization is called flocculation. The disadvantages of these systems are necessity to maintain absolute pH control and problems encountered in sludge handling. Color removal technology using ferrous chloride is being followed in Tamil Nadu, Kerala & Karnataka by the major pulp & paper Industries.

WATER FALLS SYSTEM IN ACTIVATED SLUDGE PROCESS

Waterfalls system (15 feet above the ASP surface level) was arranged (Photo 2) before the activated sludge process. Due to there is an improvement in aeration and reduction in temperature was observed around 3 to 5°C from the inlet temperature and in-turn increases the biological activity in ASP then reduction of BOD, COD and suspended solid levels were observed after secondary clarification. As per APPCB

PHOTO 2

WATER FALL SYSTEM IN ACITIVATED SLUDGE PROCESS FOR TEMPERATURE REDUCTION

effluent discharge temperature should be around 35 to 36°C for effective biological action. The temperature of waste water is commonly higher than that of the fresh water stream because of addition of warm water from industrial activities. Optimum temperature for best biological activity is in the range of 30 - 35°C. At present the influent temp is about 42 to 45°C, due to which the biological activity is slightly disturbing to achieve the required BOD levels. To bring the temperature around 35 - 38°C effluent Waterfalls system was installed. There was increase in dissolved oxygen level in ASP and getting significant BOD & COD reduction in the discharge effluent. R&D study is being carried out for the injection of direct oxygen for increasing the dissolved oxygen in ASP.

DISPOSAL OF SOLID WASTES GENERATED

Identified areas for Solid waste dumping in mill premises are marked as individual areas for the wastes and sludge generated. Fly Ash and Cinder Ash generated from power house is being supplied to Brick Industries. We are encouraging country brick industries to use fly ash and are disposing 100% fly ash for brick manufacturing and road works. Saw Dust generated from chipper house & saw mill is being utilized in Power Generation Plant. 24 tons/day of Sawdust & 8 tons/day of Wood bark/yard waste are used in our existing sawdust boiler. By using saw dust and wood bark material, around 13 Tons/day of coal consumption is being saved. Around 15 - 20 MT /day of ETP Sludge (filter cake is being sold to pollution control board authorized Cardboard and Egg Tray Manufacturing Industries.

STEPS TO NON-CONDENSABLE GASES MONITORING

There are two phases for heat recovery. First one being for the sulfate stage venting vapour and blow vapour. The other one is meant for Pre-hydrolysis stage vapour. **Pre-hydrolysis vapour heat recovery:** The vapour phase stage vent vapour which at present escapes to atmosphere will be passed through tube side of a tubular condenser. Condensing water will be passed in the shell side to pick-up heat from the vapour and shall be sent back to sheeting machine. Required temperature control loop will be provided in the system so that the hot water generated will be at required temperature level. As there are chances for two simultaneous vapour phase venting, the tubular condenser will be of sufficient capacity to handle two digester vapour phase vent vapours. **Blow heat recovery system:** In the proposed system, the blow vapour leaving the blow tank as well as the sulfate vent vapour will be taken to a Cyclone Separator where the carryover particles like pulp, liquor etc. in the vapor would be removed. The flash steam free from carryover particles will then be taken to the bottom of the Spray Condenser. The Spray Condenser will be mounted over the level of existing Accumulator Tank. The Accumulator tank will always be full with water and the level will be maintained with the help of level control loop provided. Leading consultants visited and checked the existing Blow Heat Recovery compatibility to introduce NCG handling system. Strengthening of existing BHR to meet the parameters of 100 % moisture free dry gases release from BHR system and recovery of pH venting is being carried out. CPPRI also conducted the study of NCG and given the detailed report. As per their report, the work has been started for NCG incineration project which is under progress.

BILT TREE TECH

National Forest Policy 1988 stipulations progressively reduce sourcing from Government forest and Industry to work with farming community for sourcing Raw Material(pulp-wood) through Farm Forestry activity. BILT TREE TECH was incorporated during 1989 as a wholly owned subsidiary of BILT to encourage farmers to plant short rotation pulpwood species and procure the produce from farmers. Our Mill at Kamalapuram produces 1 lac tonnes of rayon/paper grade pulp and needs 4.5 lac tonnes of wood. We had leveraged our need of wood fiber through research in plantations, farmers and economically backward wasteland owners. This has resulted in mutual benefit for both growers/farmers and company.

Farm forestry: Farmers in our catchment area are besieged with problems like crop losses due to vagaries of monsoon, pests, diseases etc., perennial floods, anti-social problem, fluctuating market prices for agricultural produce, soils subjected to degradation etc. To change this scenario and to create sustainable income to farmers as well as raw material to our mill we have started Farm Forestry activity. To start with we have distributed seedlings of Eucalyptus, Subabul and Casuarina in three states i.e. Andhra Pradesh, Orissa & Maharashtra. Subsequently, from 2002 we have started distributing Eucalyptus Clonal plants and from 2008 totally switched over to Eucalyptus Clones. Productivity of seedling plantations was very low (6 MT/ha/annum i.e. 42 tonnes/ha after 7 years). The low productivity of seedlings was uneconomical to farmers to take up plantations on a commercial scale. Thus, plantations are playing an increasingly important role in rural economic development and poverty alleviation. Since employment generation for farm labours is important for reducing poverty, the plantations provided employment through tasks such as nursery, planting, logging and maintenance operations.

INEGRATED MANAGEMENT SYSTEM (IMS)

For an organization to function effectively, it has to identify and manage numerous linked activities. To lead and operate successfully, it is necessary to direct and control it in a systematic and transparent manner. Success can result from implementing and maintaining a management system that is designed to continually improve performance while addressing the needs of all interested parties. Steps were initiated to improve Eco Friendly Balancing and marching towards continual improvement as per IMS which will include Quality, Environment and Safety Controls which is under streamline.

CONCLUSIONS

Pumping of water within the scheduled time to colony and village and recycling of WTP sand filter backwash water in to clariflocculator saved water apart from energy conservation. Treated water is used for wooden logs washing, gardening, cleaning & wetting of the RCC roads inside the mill campus, farm forestry plantation activities and in power boiler area for ash quenching. Lab trials were conducted for color reduction in combined effluent by chemical treatment by using ferrous Chloride by which Color reduction of

60%, COD reduction of 62% and TSS reduction of 53% were observed. Plant trial was conducted using ferrous chloride by which Color reduction of 44%, suspended solids reduction of 47%, COD reduction of 41% were observed. Waterfalls system was arranged in activated sludge process by which there is an improvement in aeration and reduction in temperature of around 3 to 5°C and increased the biological activity in ASP and reduced the BOD, COD and suspended solid levels. R&D study is being carried out for the injection of direct oxygen for increasing the dissolved oxygen in ASP. By encouraging country brick industries to use fly ash, disposing 100% fly ash for brick manufacturing and road works. Sawdust & Wood bark/yard wastes are used in our existing sawdust boiler by which around 13 Tons/day of coal consumption is being saved. ETP Sludge is being sold to pollution control board authorized Cardboard and Egg Tray manufacturing Industries. Through leading consultants, strengthening of existing BHR to meet the parameters of 100 % moisture free dry gases release for NCG incineration project which is under progress. To conserve our forest, the mill through its wholly owned subsidiary BILT TREE TECH Ltd is arranging saplings to farmers under its farm forestry activity and inturn through these plantations is meeting its wood requirement. Steps were initiated to improve Eco Friendly Balancing and marching towards continual improvement as per IMS includes Quality, Environment and Safety Controls which is under streamline.

EXPERIMENTAL

FERROUS CHLORIDE TREATMENT IN COLORED EFFLUENT LAB TRIAL

Lab scale trial with ferrous chloride was carried out. Depending on the initial color of combined effluent, ferrous chloride dosages were given for optimization. For comparison study, PAC dosage was also optimized. Experiments were conducted through Jar test method. For the filtrate, pH, Color, Chemical oxygen demand and Total suspended solids were measured and given in Table 2 & 2a.

FERROUS CHLORIDE TREATMENT IN COLORED EFFLUENT PLANT TRIAL

By encouraging results observed from lab trial, plant scale trial with ferrous chloride was carried out. Depending on the initial color of combined effluent, ferrous chloride dosages were adjusted. For comparison study, PAC trial was also conducted. For inlet and outlet samples of primary clarifier pH, Color, Chemical oxygen demand and Total suspended solids were measured and given in Table 3.

ACKNOLODGEMENTS

The authors would like to thank the BGPPL management for their kind permission for publishing the results of the study.

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