



ASSESSMENT OF EFFLUENT WATER QUALITY OF S.P. PAPER BOARD MILL, BARASAT, WEST BENGAL

Environmental Biology

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ABSTRACT

In current study, the principle and working of physiochemical and biological oxygen demand plant, of SP paper board mill, Barasat is presented. Here mainly the study is concerned with the treatment of waste water analysis and by products, plant effluent and its recycling. The various physiochemical and biological treatment methods are also discussed in the report. Nevertheless, the emphasis is more towards the removal of TSS and oil and grease maintaining with in permissible limits of BOD, COD, pH etc. Finally the various standard procedures for determination of concentration of the contaminants and standard concentration of contaminants are comparing with the permissible norms. Here I have also perform the bacteriological study from the waste water sample and finally I also reported about the economically benefit product of the industry and give our attention for making zero level discharge in final outlet during treatment operation.

KEYWORDS:

Effluent water, ETP, BOD, COD, pH, TSS, Oil and grease, Bacteriological study.

Introduction:

Environment may be defined as the whole complex of physical, social, economic and aesthetic factors which affect individuals' communities and ultimately survival. A substance present in nature, in greater amount / concentration than natural abundance due to human activity, which ultimately detrimental effect on the environment and there from on living organisms and mankind (De A.K.). Any physical or chemical change in surface water or ground water that can harm living organisms or make water unfit for certain uses. General effects of water pollution on organisms are Genotoxicity, Carcinogenicity, Neuro toxicity, Disturbance of energy transfer, Reproductive failure, Behavioral effect etc. The industrial wastewater recycling is a very essential step. The drinking crisis in Indian cities has reached explosive proportions. For years, urban dwellers have silently suffering and intermittent supply of poor quality water. Water riots have already occurred in several cities and could be in repeated in many more.

Our recent work is mainly concerned with two aims, i.e. ECOLOGICAL and ECONOMICAL. Among **Ecological** part our main aim is to reduce environmental pollution by applying various methods of ETP operation. So that our environment remain sustainable for the use of future generation. Secondly by aiming towards "ZERO DISCHARGE" our environment remains pollution free as maximum amount is recycled into the operation unit. Thirdly by this we can also maintain water consumption level, so that in future we can overcome the problem of water scarcity. Considering **Economical part**, it can be achieved by less water consumption as a result, need of electricity will also be decreased. Here the waste product (Fibres) are separated and mainly reused to manufacture new products viz. sundry paper board, grey paper board, ticket board. Maximum profit of the industry is gained from this reuse. Here, the major contribution of product quality is from water quality, which has to be recycled.

Thus our purpose is towards gaining success in 3 R's: **RECYCLE** (used water), **REDUCE** (electric consumption) and **REUSE** (fibre) and our final objective is to compare final outlet with the PCB norms and bacteriological analysis.

Materials and Methods:

In the current study the grab samples were collected manually from effluent water of S.P. Paper Board Mill, Barasat, North 24 Parganas, West Bengal. The various sample collected are given: From incoming [S1], After first hill screen [S2], After aeration chamber [S3], After secondary clarifier (Final outlet) [S4] and Screened reach water [S5]. The industry considered for the study is SP Paper Board Mill, Barasat. The product handled here are Sun dry paper board, Grey paper board, Ticket board etc. The raw materials are Waste papers, Plastic, Packaging material, Newspapers etc. The waste water is generated from the manufacturing process. The quantity of treated waste water is nearly 144 KL/ day, out of which nearly 100 KL is recycled per day after ETP treatment. So amount of discharge water after complete ETP=144KL (treated in ETP) - 100 KL

(recycled in system from treated water) = 44 KL/ day (maximum).

Presently, the major part of waste water is recycled and only a minor part is discharged into the environment. But the future aim is towards '0' level discharge and utilizing the whole in entire recycling process. After collection of samples, these were brought into our laboratory for physico-chemical analysis of water.

Brief process of treatment in the Paper mill:

Waste water treatment involves the addition of chemicals to alter the physical state of dissolved and suspended solid and facilitate their removal by sedimentation. Here polyelectrolyte solution is added to incoming effluent so that the fine fibre suspended particles would get coagulated better and would get filtered easily on hill screen on a continuous basis and then the alum solution is added to produce a bulky gelatinous flock that settles slowly though the waste water sweeping out suspended and dissolved material. As the effluent is biodegradable, biological treatment is required to remove biodegradable load. Aeration is used transferring oxygen to biological treatment process. Under proper PH 7.0 - 7.5 the biodegradable organic substances of waste water are completely destroyed by biological oxidation, part of it is oxidized while raised are converted into biological mass in the biological reactor. The end product of the metabolism is either low molecular weight gas or liquid.

Brief process of ETP operation:

A. Unit/System operation:

- 1) The effluent water coming from plant would first come to the incoming effluent chamber or suction chamber through a long distance drain from plant to ETP. Coagulating chemicals would be dosed for better coagulation of fibrous suspended solids prior to pump suction and feeding to hills-screen.
- 2) Two hill- screen of different mesh size are installed at different position of unit operation. First hills-screen is installed in process house, where from the lignin/live fibrous suspended solids are collected to reuse in the process. And Second hills-screen is installed to filter the recycling reaches water to get back the suspended live fibrous solid for reuse in the process. The effluent water coming from overflow of this two hills-screen pits are again screened through further inclined screen (hills-screen) of final mesh size in ETP.
- 3) The water would be then pumped along with requisite dosing of coagulating chemicals to hills-screen to requisite mesh size, so that the fibres would get separated by filtration on a continuous basis under gravity.
- 4) The partly fibre free water after hill-screen would be then drained to consecutive flat bottom chamber working as the primary clarifier for the further sedimentation of the residual TSS.
- 5) After sedimentation chamber the partly sludge free water would be run/passed to aeration chamber under gravity flow for microbial treatment in activated sludge process to low down the BOD in desire level. Here required concentration of bacterial mass would be maintain and propagate by numbers at the expense of the pollutants present still after primary clarification.
- 6) After aeration chamber, water is passed through secondary clarifier under gravity flow where the bacterial mass would get

sediment and recycled to aeration chamber.

- 7) Finally the water would overflow the secondary clarifier and would be discharged to an intermediate small tank where from it is taken to an overhead tank and can be reused for other purposes.

B. Utility of dosing of different chemicals:

Dosing of poly electrolyte solution prior to incoming effluent tank so that the fine fibers suspended particles would get coagulated and filter easily on the hill-screen on a continuous basis. The alum solution is added to the incoming effluent tank to produce a bulky gelatinous floc that settles slowly through the waste water, sweeping out suspended and dissolved material. Modification of previous lime dissolving tank as an intermediate tank to feed the hill-screen under undisturbed gravity flow.

C. Program for starting secondary treatment:

The secondary treatment of water is started after sedimentation tank using existing plant. In the removal of BOD the coagulation of colloidal solids and stabilization of organic matter are accomplished biologically using a variety of microorganisms particularly bacteria. The micro-organisms are used to convert dissolved organic matter into various less toxic gases and into cell-tissues. Because cell-tissue has a specific gravity slightly higher than water, the resulting tissue can be removed from the treated liquid by gravity settling. Firstly here, aeration chamber is required where the total water is aerated for microbial treatment. In the aeration chamber mainly the COD and BOD values are reduced by the activated sludge process. A secondary clarifier is provided where a bacterial mass is sedimented at the bottom of the clarifier and pumped to an aeration chamber again to maintain the pollutant level. The blower and purge compressor are installed to provide requisite quantity of air for an effective activated sludge process.

D. Table for ETP design of different unit/ chambers:

Serial No.	Unit operation	Size
1	Hill-screen total 2 in number with inclined installation.	Length - 3 meter Breath - 2.5 meter
2	Extra tank as sedimentation tank	Approx. 25 KL
3	Aeration chamber	Total volume 110 KL
4	Secondary clarifier (circular tank)	Total volume 60 KL
5	Blower and diffuser for aeration	Blower - 1 in No Diffuser - 20 in No.(Approx.)
6	Mechanical of secondary clarifier	Complete set with motor, gear box and scrapper.

2 pumps: One pump for pumping the first screen water from process house to ETP hill-screen. One pump for pumping the primary clarified water to aeration chamber.

E. By product/ economically profitable part:

Though the main objective of the ETP is to reduce the pollutant level in the discharged waste water and recycled water for further reuse in the process, yet along doing so it also serves another purpose. During the entire process rich fibres are collected as by-product from the waste water at hill-screen no.2 and this by-product are used to manufacture good quality ticket board, sun dry paper board and grey paper board.

The parameters considered for water quality assessment are pH, Temperature, Total Suspended Solids, Oil and Grease, Chemical Oxygen Demand, Biochemical Oxygen Demand and Bacteriological analysis. The values were estimated following the method of APHA, 2012. The bacteriological analysis was done through Qualitative and Quantitative analysis of microbes using Macconkey's agar and Macconkey's broth.

Results and Discussion:

The results of physico-chemical analysis of the effluent water are given in table 1. The final effluent water is well under the PCB norms prior to discharge in the environment. In microbiological analysis of final discharge, Qualitative and Quantitative analysis of microbes using Macconkey's agar and Macconkey's broth was done. In quantitative analysis, an estimate of Coliform count is made from the tubes showing acid and gas production by the help of a statistical table. As each and every 15 tube contain gas, thus we can conclude that the probable number of Coliform bacilli in 100ml of water is 1800+. In

qualitative analysis, Gram staining was done and we have observed pinkish rod shaped bacterial colony. Thus we can infer that the gram negative (Gm-ve) Coli form Bacilli was present there.

Before the establishment of ETP, we came to know that the toxic contaminants of the paper mills were cellulose, fibers, free Chlorides, resin, starch, clay, keel liquor and NaOH. At that time the quantities of these contaminants were above the PCB norms and it creates many health hazards and environmental deterioration. As a result the surrounding cultivable lands were affected by these toxic contaminants and that was a big source of stomach disease. But after the establishment of the ETP (Effluent Treatment Plant), the effluent is being treated properly and the pollution control is achieved according to the standard norms which really mitigated the health hazard condition and environmental problems. By doing all this, in future with time span this effluent treatment system will further open its wings to match with the modernization and up gradation of the plant's production capacity.

Conclusion:

At present, going through the project report it is seen that some modifications are required in the ETP. So that Complete 'Zero discharge' can be achieved through maximum quantity of water recycling, Electricity consumption can be further reduced, Product quality from the reused waste can be improved, Sustainable use of the resources (water), keeping in mind the basic concepts of 3 'Rs' (Recycle, Reduce, Reuse). To achieve all the above mentioned proposals, modifications that are required are given: Proper dosing of Alum and Polyelectrolyte solution prior to the suction pump, Further programming to improve secondary treatment, Further increase of sludge drying beds and number of hill-screen, Choosing of appropriate bacterial strain for particular pollutants. By doing all this, in future with time span this effluent treatment system will further open its wings to match with the modernization and up gradation of the plant's production capacity.

Table 1: Results of physico-chemical analysis of the effluent water. Where S1=Sample from incoming Effluent, S2=Sample from after 1st hill-Screen, S3=Sample from after aeration chamber, S4= Sample from after Secondary clarifier (final outlet), PCB= State Pollution Control Board.

Parameters	S1	S2	S3	S4	PCB norms
pH	7.26	7.15	7.60	7.56	7.0
Temperature (°C)	40	37	30	28	25-30
Total Suspended Solids (mg/l)	1986	1237	1524	65	100
Oil and Grease (mg/l)	23	12	07	06	10
Chemical Oxygen Demand (mg/l)	872	416	53.3	48	250
Biochemical Oxygen Demand (mg/l)	367	283	30	24	30

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