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ASSESSMENT OF PHYSICO-CHEMICAL CHARACTERISTICS OF PAPER INDUSTRY EFFLUENTS

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ABSTRACT

This paper presents the physico-chemical characteristics of effluent discharge from paper industry. The effluent from the paper industry is characterized by colour, extreme quantities of COD, BOD, pH, TDS, and SS .The samples were collected from the inlet and outlet of the effluent treatment plant of paper mill. The samples were analyzed and compared with the Indian standards of effluent discharge. The effluent before treatment contains pH of 8.2-8.3, Suspended Solids of 246-249 ppm, Total Dissolved Solids ranges from 2800-2850 ppm, BOD and COD varies 181-120 mg/l and 1195-981 mg/l respectively. After treatment pH varies 7.2-7.4, Suspended Solids 76-80 ppm, Total dissolved solids ranges from 1803-1830 ppm, BOD and COD ranges from 65-102 mg/l and 195-205 mg/l, respectively. Result shows that the pH and TDS is in the permissible limits and COD, BOD, SS does not meet the permissible standards after treatment. The paper mill does not meet the Standards set by Central Pollution Control Board, India

Keywords: Physico-chemical parameters, Treated effluent, Bleaching, Effluent loads, BOD, COD.

INTRODUCTION

India's rank is 20th paper producing country among world[1]. Pulp and Paper industry is considered as one of most polluter industry. These industries disturbing the ecological balance, and affect the environment by discharging a wide varieties of effluent. Depending upon the nature of raw material, the effluent is generated per metric tonne of paper produced[2]. The paper-making process consists two main steps pulping and bleaching, requires large amount of water; hence it is a water-intensive process. Consumption of water depends upon the raw material used in industrial processes. The natural raw material are used for the processes are wood, cellulose, bagasses, rice husk, fibres and also waste-paper. This discharge a high level of effluent from processing of paper. The paper mill effluent characteristically contains colour, very high level of Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), due to presence of lignin and its derivatives from the raw cellulosic materials, chlorinated compounds, suspended solids (mainly fibres), fatty acids, tannins, resin acids, sulphur and sulphur compounds, etc[43] The dark colour of the effluent exhibits the toxic effects on the biota and inhibits the photosynthetic activity by reducing the sunlight[4]. Most of these industries discharged their insufficiently treated waste into the rivers or streams, which makes serious problem to aquatic life and flora-fauna. Thus, it is necessary to develop economical solution on the effluent discharged. The main objective of the paper is to analyze the physico-chemical characteristics of the effluent of the paper mill. The world demand for paper has grown rapidly and was around 5-6% per year. In India the total production 60-70% is from hardwood and bamboo fibre, agro-waste and other 30-40% is from recycled material.

EXPERIMENTAL

The samples for the analysis were collected from the effluent treatment plant of paper industry of Kashipur Paper Mill, District Uadhamsingh Nagar. The effluent samples were collected from the inlet (raw effluent) and outlet (final treated effluent) of the effluent treatment plant of the paper mill for analysis. The samples were collected in the plastic containers which were refrigerated at 4°C prior to

further treatment. The samples were analyzed using standard methods of analysis of water and waste water[5]. Effluents samples collected from paper mills were analyzed for the required parameters in order to evaluate the pollution load of water streams in which they are thrown[6]. Physiochemical analysis of effluent, the samples collected from the paper industry was brought for the physiochemical analysis in laboratory of Pulp and Paper Department, Forest Research Institute, Dehradun .The pH was measured by pH meter. For colour measurements standard solution of 500 pt.co (ppm) units was prepared to dissolve the 1.246g of potassium hexachloroplatinate and 1g of cobaltous chloride in 100 ml of conc. HCl and make up to 1 litre with distilled water. 10 ppm to 100ppm standard colour solution is prepared by diluting the solution is 500 ppm stock solution. Unknown colour is matched with standard solution. The COD and BOD_5 were determined titrimetrically, suspended solids and total dissolved solid was measured by using WHATMAN filter paper.

RESULTS AND DISCUSSION

The paper mill produces variety of writing and printing paper using bagasse as raw material. The average production of paper in the mill is around 50,000 tonne per year to produce huge different varieties of paper. The effluent generated from the paper mill consists of white water from stock preparation, paper machine and from the bleach section etc .The effluent for analysis is collected from the inlet, which is more polluted and from the outlet, that after treatment from the ETP. The results of monthly analysis of pH, colour, COD, BOD, TDS, SS are analyzed after treatment and compared with the standard values (Table-1).

Table -1: Parameters Raw and after treatment of effluent of paper mill

S. No.	Parameters	Raw Water	Final Outlet of water treatment plant in a paper mill
1	pH	8.2-8.3	7.2-7.4
2	Colour (pt.co units)	54-56	228-229
3	Total Dissolved Solids (ppm)	2800-2850	1803-1830
4	Suspended Solids(ppm)	246-249	76-80
5	COD (mg/L)	1195-981	195-205
6	BOD (mg/L)	181-120	65-102

pH

The hydrogen-ion concentration is an important parameter to check the quality of effluent discharge from the plant or to a measure of acidity and basicity of an aqueous solution. Discharges water from pulping and bleaching plant has both acidic and alkaline effluents. The pH of the influent (raw effluent) was measured to be 8.1-8.2 which is alkaline as reported[7] compared to 7.2-7.4 with treated effluent. Low value of pH is due to the metabolism of fungus, micro flora and activities of microbial population[8].

Colour

The colour is usually the first contaminant to be recognized in effluents that affects the aesthetics, water transparency and gas solubility of water bodies[9]. This colour is due the high concentration of lignin content in the outlet sample. Colour derived from lignin is an indicator of the presence of potentially inhibitory compounds and in addition, may have direct inhibitory effects on some of the lower organisms in the food chain. The colour of the effluent typically depends upon the different industrial processes. The final outlet of the water treatment plant has the value of 228-229 pt.co units.

Suspended Solids

The un-dissolved matter present in water or waste water is usually referred as suspended solids. Suspended solids reduce the photo synthesis activities of water plants by smothering benthic organism. The concentration of suspended solids measured from inlet of ETP ranges from 246ppm-249ppm after treatment the concentration of suspended solids is ranges from 76 ppm-80 ppm respectively. Suspended solids from the effluent reduce slightly due to the presence of fibres in the effluent.

Total Dissolved Solids

The total dissolved solids concentration varied from inlet 2800-2870 whereas from treated effluent varied from 1803-1830 ppm respectively. The value shows The TDS may increase salinity of the water and thus may render it unfit for irrigation and drinking purposes. TDS are in permissible limit as compared with Indian standards.

BOD and COD

Biological Oxygen Demand is the measure of the oxygen required by microorganisms whilst breaking down organic matter. BOD measures the organic loading of streams and thereby quantifies the dissolved oxygen levels and Chemical Oxygen Demand is the measure of amount of oxygen required to breakdown both organic and inorganic matters. The BOD and COD levels of influent effluent varied from 181-210 mg/l and 1195-981 mg/l respectively. Whereas the BOD and COD levels of effluent varied from 65-102 mg/l and 195-205 mg/l respectively. The levels of BOD and COD is reduced to certain extent by biological treatment process for which the effluent is treated which consists of equalization, primary clariflocculator , aeration tank and the secondary clariflocculator. Biological treatment process results in oxidation of organic matter, which provides energy for microbial metabolic process[6]**.** The pH and TDS of the effluent is within the Indian standard limits. And also within the permissible limit set by Central Pollution Control Board, India to discharge for irrigation. Whereas, the other parameters such as SS, COD and BOD are not within the limits of Indian standard. High COD levels indicate the toxic state of the waste water along with the presence of biologically resistant organic substances[10]. The high BOD and low oxygen content of effluent will affect survival of gill breathing animals of the receiving water body.[11]

CONCLUSION

The paper mill is growing fast and produces different varieties of paper. The physico-chemical characteristics of effluent from this mill revealed that the effluent is light brown in colour, pH shows alkaline nature of the effluent, SS, BOD, COD are the parameters from the treated effluent is high in concentrations compared to Indian standards.

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