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Physico chemical and biological parameters of paper industry effluent

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ABSTRACT

Physico chemical and biological characteristics of of paper effluent from the paper mills of Nilakotai Dindigul(Dt), TamilNadu,were analyzed from Nov 2010 to Apr 2011 in terms of pH,colour,odour,temperature EC,TDS,BOD,COD,Na,Ca and Mg. All the parameters were found to be higher than the WHO prescribed discharge limits for effluent.

Keywords: Paper mill, effluent, physicochemical characteristics.

INTRODUCTION

Man has been interfering nature since the dawn of civilization. The primitive man being persistent forager and relentless hunter overexploited the resources of nature. The rapid increase in population and the increased demand for industrial establishment to meet human requirement have created problems such as overexploitation of available resources and pollution of the land, air and water. In recent times disturbances in the living environment such as changes in climate, water and air are being caused due to industrial explosion.

Pollution refers to undesirable changes in the physical, chemical or biological characteristics of our environment namely air, water and soil. This has adversely affected the humans and other species of our biosphere directly or indirectly.

Industries play a major role in polluting the environment. Paper industry is one among them. The industry is dealing with a large amount of processed water under mill operations conditions. The most significant sources of pollution among various processing stages are wood preparation, pulping, pulpwashing, screening, washing, bleaching and , coating operation etc. Among the processes, pulping especially by chemical pulping generates a high strength wastewater This wastewater contains wood debris and soluble wood materials similarly pulp bleaching generates toxic substances as it utilizes chlorine for brightening the pulp. Various toxic chemicals such as resin acids, unsaturated fatty acids, diterpene alcohols, juvaniones,chlorinated resin acids and others are generated in the pulp and paper making process.

The pollutants discharged from the pulp and paper industry affect all aspects of the environment. Presence of toxic pollutants affect aquatic system[1] and [2]. The effects of the treated paper industry effluent on irrigated soil, which showed serious changes in soil chemistry. The health impacts of paper mill effluent such as diarrhea, vomiting, headache, nausea and eye irritation on humans [4] and [5] .

MATERIALS AND METHODS

Study area

For the present investigation the paper mill effluents samples were collected from paper mill, situated at Nilakottai. Which is situated twenty kilometers away from research site. The research study was carried out during Nov2010-April 2011.



Nilakottai ●

Sampling

The effluents samples were collected in plastic containers that were previously cleaned by washing in non ionic detergent, rinsed with tap water and later soaked in 10% HNO₃ for 24 hrs and finally rinsed with deionised water[4] and the effluent samples were subjected for physico, chemical and biological parameters by using standard methods [5].

Table 1: Standard method followed for Physico chemical parameters

Physico-chemical parameters	Method Applied for laboratory analysis
pH	pH Meter
Color (Apparent)	Visible
Odour	Sensation method
Electrical Conductivity	Potentiometry
Total Dissolved Solid (TDS)	Gravimetric, Oven drying at 100 ^o C
Total Suspended Solid (TSS)	Gravimetric , Residue, drying at 100 ^o C
Chemical Oxygen Demand (COD)	Potassium dichromate , closed reflux method
Biological Oxygen Demand (BOD)	5 days incubation at 20 °C
Sodium(Na),Magnsium(Mg)and Calcium(Ca)	Flame photometer

RESULT AND DISCUSSION

Physico chemical and biological characters were analysed by using standard methods[5] Table2

Table :2 Physico chemical parameters of paper industry effluent

Ccdec22'2s2_fm

Parameters	Mean value ±SD
Colour	Light white
Odor	Un pleasant
PH	8.56±0.33
Temp°C	30.33±1.52
Ec(µs)	1300±26.0
TDS(mg/l)	2950±38.0
BOD(mg/l)	380±36.55
COD(mg/l)	1830±81.85
Na(mg/l)	260.99±7.06
Ca(mg/l)	299.66±19.09
Mg(mg/l)	184.2±12.48

The colour is usually the first contaminant to be recognized in wastewaters that affects the aesthetics, water transparency and gas solubility of water bodies[6].The samples recorded the pH value of 8.56 ± 0.3 which slightly alkaline as reported by [7]. However WHO guidelines the tolerance limit of pH as 6-9[4] . the pH value of the paper industry effluent as 6 to 9 reported by [8]. The discharge of waste water into water bodies may cause a drop or increase in their pH due to the size and activities of microbial population.

Temperature is the basically important factor for its effect on other properties of waste water.Aveage temperature of paper effluent was recorded as $30.33\pm 1.52^{\circ}\text{C}$.Electrical conductivity is an useful indicator to show the salinity or total salt content of the effluents.The EC value of effluent samples was recorded as $1300\pm 26.0\text{ms}$.This is higher than that value of WHO guidelines(ie) $1000\ \mu\text{s}$. EC value of the paper mill effluent as $6020\mu\text{s}$ reported by [9]. Increase in EC values indicates the presence of higher concentration of ions [7].

The mean value of total dissolved solids(TDS) was $2950\pm 585.0\text{mg/l}$. The values obtained for TDS is were more than WHO standard of 2000mg/lr for the discharge of wastewater into surface water. The TDS may increase salinity of the water and thus may render it unfit for irrigation and drinking purposes. Consumption of water with high concentrations of total dissolved solids has been reported to cause disorders of alimentary canal, respiratory system, nervous system, coronary system besides ,causing miscarriage and cancer[10].

Dissolved oxygen is the measure of the degree of pollution by organic matter the destruction of organic substances as well as the self purification capacity of the water body. The DO value of the paper effluent sample was recorded as $7.43\pm 0.76\text{mg/lr}$. Biological Oxygen Demand is the measure of the oxygen required by microorganisms whilst breaking down organic matter. In the present study ,BOD of the effluent was $380\pm 36.05\text{mg/lr}$.while WHO guidelines of BOD value was 50mg/lr .BOD value of the paper mill effluent as 425 to 360 mg/lr reported by .[11] and [12]. The high BOD levels are indications of the pollution strength of the waste waters. The high BOD and low oxygen content of effluent will affect survival of gill breathing animals of the receiving water body[13].

Chemical Oxygen Demand is the measure of amount of oxygen required to breakdown both organic and inorganic matters. The COD value of the sample was recorded as $1830\pm 81.85\ \text{mg/lr}$. This sample value was higher than that of WHO guidelines value of $1000\ \text{mg/lr}$.[14] .The COD of paper effluent as 953mg/lr . High COD levels indicate toxic state of the waste water along with the presence of biologically resistant organic substances [15].

Trace amounts of minerals such as Na,Ca, and Mg were presented above than WHO recommended level in the range of 260.99 ± 7.06 ; 299.66 ± 19.09 ; 184 ± 12.48 respectively. The presence of various trace elements in the pulp and paper mill effluents reported by [16] and [17]. The presence of Na,Ca and Mg in excess makes water unfit for irrigation since its application increase problems of soils salinity and its permeability determination to crop plants[18].

CONCLUSION

On the basis of above discussion it is concluded that the effluent discharged from paper industry is much contaminated and has exceeding values as prescribed by the standards of WHO. Hence proper strategies should be used to treat the effluent prior to its disposal to the environment.

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