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Physiochemical characteristics of textile effluents through common effluent treatment plant of Pali district

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Abstract

Textile effluents are one of the major causes of degradation of environment quality, resulting in long term adverse health effects. These wastes have the potentiality of ultimately polluting soil and groundwater they come in contact with. Studies have shown that areas in close proximity of industrial activities are marked by contamination of soil, water and agricultural fields. Almost 90% of the textile processing units in Pali district are connected with CETP installed in different areas for treatment of textile effluents to control soil and water pollution. In Spite of the installation of CETP, the Bandi River still has enormous water and soil pollution adversely affecting the fertility of soil and purity of drinking water. In order to check the efficiency of a common effluent treatment plant (CETP), installed at Mandia Road, Pali, to control the industrial pollution of textile processing units in terms of effluent treatment. Samples were collected from inlet and outlet source of CETP and analyzed for various parameters such as Color, Odour, pH, Total suspended solids, (TSS), Total dissolved solids (TDS), Total solids, Chemical oxygen demand (COD), Biological oxygen demand (BOD) and electrical conductivity (EC). The results indicated that the sample had high value in TDS, COD, BOD and EC. Only pH is found within the permissible limit.

Keywords: Physiochemical characteristics textile effluents, common effluent treatment plant, efficiency

Introduction

Textile industry is one of the largest industrial users of processed water and huge quantities of complex chemicals that are to be used at different processing contributes about 70% of the environmental pollution. Due to the nature of various chemical processing of textiles, large volumes of waste water with numerous pollutants are discharged. The unused material from the process house is discharged as waste water that is high in pH, TDS, SS, BOD, COD, EC and toxic chemicals. The direct discharge of this waste water on water bodies like rivers etc. pollute the water and affect the flora and fauna of that region. It is very important to treat the waste water discharged from textile chemical processing industries to protect our surroundings from pollution problems.

Pali is the largest erstwhile hand processing cluster, now gradually moving to power processing machines. The area constituting Pali district has been known for a number of industries, best known for dyeing and printing of cotton and synthetic fabrics. Textile processing units at Pali, Marwar are located at Mandia Road Industrial Area, Phase I and II industrial area and industries which are situated in the city are also shifted to the outskirts, at Punayata industrial area. According to a joint survey of District Industries Centre (DIC), Pali and Pollution Revenue Association in the year 2008-2009, there are 867 registered units, engaged in various cotton & synthetic textile processing operations.

The dyeing and printing is the major source of livelihood in this region, these industries provide substantial contribution to the economy in terms of income and employment generation. The waste water from these textile processing units is in and around Bandi River causing not only soil pollution but also degrades the water quality. The groundwater quality in this vicinity has resulted in damage to agricultural crops and has caused various health problems among surrounding population.

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Further to be in tune with the government restriction to be connected to Common Effluent Treatment Plant (CETP), majority of textile processing houses/units of Pali are now adjoined to CETP. According to the water quality assessment studies done by the pollution monitoring lab of Center for Science and Environment (CSE) in 2006 and 2007, the entire water resources in Pali region is contaminated due to improper treatment of industrial waste.

According to Rajasthan state pollution control Board (RSPCB) textile processing units discharge effluents approximately 40 million per day (mld.) Now a days, four common effluent treatment plants (CETP) with a capacity to treat 34.68mld of industrial effluents are under functioning in Pali district which are connected with major textile processing

units. In view of this the present research work was planned to study the efficiency of these CETP, especially the major one installed at Mandia Road Pali, adjoined with 500 textile processing units.

Methodology

To study the efficiency and efficacy of these common effluent treatment plants, samples of textile effluents were taken from inlet and outlet sources. The samples were analyzed for various parameters like pH, colour, odour, TDS, TSS, COD, BOD (3 days at 27 °C) EC at 25 °C and total solids. The analysis was carried out systematically both volumetrically and by instrumental techniques using standards as per Pollution Control Board.

Table 1: Effluent quality of inlet and outlet water collected from common effluent treatment plant, Madia Road, Pali

S. No.	Quality Parameters	Inlet Water	Outlet water(Treated)	Tolerance Limits
1.	Colour	Dark Green	Light green	Unobjectionable
2.	Odour	Chemical	Chemical	Unobjectionable
3.	pH	10.53	8.72	5.5-9
4.	Suspended Solids	1206 mg/l	80 mg/l	100mg/l
5.	Total Dissolve Solids	8776 mg/l	8066 mg/l	21000mg/l
6.	Total Solids	9982 mg/l	8146mg/l	2200mg/l
7.	COD	2624 mg/l	736 mg/l	250 mg/l
8.	BOD, 27° C (3 day)	440 mg/l	182 mg/l	30mg/l
9.	Electrical Conductivity	11.84 u mho/cm2	11.24 u mho/cm2	0-1 µmho/cm2

Results and Discussion

The results pertaining to various physiochemical characteristics of textiles effluent are shown in table. The following table portrays the inlet and outlet water collected from CETP. The tolerance limits of various quality parameters as per regulatory standards are also presented for comparison.

Color and odour

The sample collected from inlet source of CETP was dark green in colour & after treatment the colour became light green. Colour was not fully removed by the treatment process. The above mentioned findings are in tune with sivaramkrishnan (2009) [2] who stated the textile mill waste water is highly colored due to the presence of dyes used as coloring materials. The waste water containing dyestuff with intensive color and toxicity was introduced in the aquatic system.

Odour pollution in water is usually present due to both chemical and biological agents. Both the samples before and after treatment possessed chemical odour. Findings of the present study are supported by the Shamra and Kaur (1997), who reported the presence of unpleasant odour and dissolved organics in water, which makes the water unfit for drinking and domestic use.

pH

The pH value of sample collected from inlet sources of CETP was found 10.53 which on treatment became 8.72. It means pH value was within the permissible limit. These results are in accordance with the results of Junkins (1982), who reported that textile wastes are highly alkaline in nature. pH of effluents affects physiochemical properties of water which in turn adversely affects aquatic life, plants and humans. This also changes the soil permeability which results in polluting underground sources of water (Rump and Kriot 1992) [7].

Total Dissolved solids (TDS) and suspended solids (SS)

TDS are the inorganic salts and substances that are dissolved in the water. The process accelerates corrosion in the water

system and pipes & depresses crop yields if used for irrigation (Nadraj, 2005) [1]. TDS value was found higher in treated textile effluents. TDS value was 8066 mg/l limit Suspended solids value was found within the permissible limit of effluent discharge standard (80mg/l) against tolerance limit of 100mg/l.

Chemical oxygen demand (COD)

Samples collected from CETP revealed that COD norms were violated at the inlet as well as outlet sources. At the inlet, COD concentration was reported to 2624 mg/l and at the outlet, COD value was 736 mg/l which was 3 times higher than the effluent discharge standard of 250 mg/l. Despite not meeting the standards, the effluents are disposed of into the Bandi River.

Biological oxygen demand (BOD)

BOD values were also found higher than the permissible limit. At the inlet source BOD concentration in textile effluent was 440 mg/l and in treated textile effluent, this value was reduced to 182 mg/l but still it was six times higher than the effluent discharge standards. The high level of BOD is an indication of pollution strength of the waste water. This also indicates that there could be low oxygen available for living organisms in the water where this treated wastewater is discharged.

Electrical conductivity (EC)

Electrical conductivity of water is a direct function of its total dissolved salts. Hence it is an index to represent the total concentration of soluble salts in water. EC of textile effluent at inlet source of CETP was 11.84 u mho/cm² and after treatment it was 11.24 u mho/cm². On comparisons with standards, it shows 10 times higher values than prescribed regulatory standard. Hence it was found highly unsuitable and injurious for proper growth of plants and production of crops.

Conclusion

On the basis of research findings obtained for various

physiochemical parameters of treated textile effluents though CETP, it can be concluded that conventional wastewater treatment system in textile processing industries include screen chamber, oil & grease trap equalization and coagulation in primary treatment system and activated sludge treatment, a two stage aeration followed by clarifier in secondary treatment system. Although COD/BOD reductions are achieved through this conventional system, objectionable color, high TDS level of effluent remain and effluents are not fit to be discharged to surface water or on land. Hence tertiary treatment systems are becoming necessary for achieving disposal standards.

Thus there is an immediate need for this industry to adopt cleaner production technologies through waste minimization, adoption of new technologies and carefully planning resource utilization in processing units.

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