Journal of Aquatic Biology and Fisheries Vol. 2/2014/ pp. 728 to 732

A COMPARATIVE EVALUATION OF EFFLUENT CHARACTERISTICS OF TRAVANCORE TITANIUM PRODUCTS LIMITED AND HINDUSTAN LIFECARE LIMITED, THIRUVANANTHAPURAM

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Received on: 10 October 2013, accepted on: 12 December 2013

Abstract: The analysis of industrial effluent is required for two primary purposes - environmental monitoring and monitoring of the industrial processes involved. The present study aims to undertake a comparative analysis on the extent of pollution in the effluent characteristics of two major industries in Thiruvananthapuram viz. Travancore Titanium Products Limited and Hindustan Latex Limited by studying the physico-chemical parameters. The result of the analysis reveals that although the effluent of HLL is conforming to the standards set by PCB, the effluent of TTPL shows wide variations. Based on the result, adoption of proper environmental management measures for pollution control and effluent treatment in TTPL is strongly suggested as the effluent characteristics revealed are highly detrimental to both the biotic and abiotic constituents of the receiving ecosystem.

Key words: Industrial effluent, Water pollution, Physico-chemical analysis, Effluent standards.

INTRODUCTION

Environment pollution is an emerging threat and of great concern today. Among the various facets of environmental pollution, the predicament due to water pollution is one of the greatest concerns. In recent years, considerable attention has been paid to industrial wastes discharged to land and surface water. The nature of constituents in any effluents is determined by the raw materials used, the type of process employed and the efficiency with which materials are removed from the effluent either through recovery processes or effluent treatment. Industrial effluents which are mainly disposed onto the nearest surface water resources pose serious threat to the inhabitants of the area and they also have far reaching effects on the biota as well as the ecosystem.

The present study aims to undertake a comparative study on the extent of pollution in the effluent characteristics of the two major industries in the district of Thiruvananthapuram viz. Travancore Titanium Products Limited and Hindustan Latex Limited by studying the physico-chemical parameters. An attempt has also been made to assess whether the physico-chemical parameters are falling within the prescribed limits for effluent discharge standards as set by the Kerala State Pollution Control Board. Such an assessment would eventually lead to tackle the pollution issue in the hydrological realms of the effluent discharge points from an ecological and social point of view thereby creating a safer and healthier environment.

Travancore Titanium Products Limited is the leading manufacturer of anatase grade titanium dioxide in India whereas Hindustan latex limited is an Indian health care products manufacturing company both of which are based in Thiruvananthapuram, Kerala. The former is found to have little or no material recovery or waste water (effluent) treatment facilities and it dumps huge quantities of toxic and polluting matter on the marine coastal belt near Veli in Thiruvananthapuram. Hindustan Life care Limited has its own water treatment plant which treat latex water, waste water, slurry water and canteen effluent.

By and large, very few studies have been initiated with regard to estimation of effluent characteristics and treatment of latex effluents. Thongnue and Puetpaiboon (2004) studied the nitrogen removal from concentrated latex wastewater by land treatment system to treat and utilize nitrogen in treated wastewater from the concentrated latex factory.

METHODOLOGY

With the objective of assessing the effluent characteristics of the two industries, TTPL and HLL, samples were collected from effluent discharge sites of these industries and analysed. The collected samples were analysed for eight physico-chemical parameters viz. pH, Suspended Solids, Total Dissolved Solids, COD, BOD, Oil and grease, Ammoniacal nitrogen and Kjeldahl nitrogen using the methodology as given in the Bureau of Indian Standards, (BIS, 2009). The various parameters analysed and the methodology employed is given in Table 1.

RESULTS AND DISCUSSIONS

Samples were collected monthly from the TTPL discharge site for three consecutive months and analysed. The averages of the three monthly values were generated for the comparison study. Additionally samples of the final effluent from the ETP of HLL was also collected and analysed. The results obtained were compared with the standards as prescribed by the Kerala State Pollution Control Board (1974) for the discharge of treated effluents into the surface waters. The results of the said analyses and the standard values are given in Table 2.

The variation in different physico-chemical parameters such as pH, suspended solids, TDS, COD, BOD, oil & grease, ammoniacal N_2 and Kjeldahl N_2, among the industrial effluent samples of TTPL and HLL are compared and discussed in detail in the following sections. Also an assessment as to whether these values are within the range of maximum permissible limits as prescribed by the KSPCB is also carried out.

pH

pH is the concentration of hydrogen ions in an aqueous solution. It is used to measure the concentration of hydrogen ions in a solution to determine acidity. The result of the study as shown in Fig. 1 depicts the variation of pH value in the effluent of TTPL and HLL. It shows a wide variation. The pH of TTPL effluent is 1.64 and HLL is 7.1. Thus the effluent of TTPL is acidic in nature where as effluent of HLL is alkaline in nature. The standard pH value ranges from 6 to 8. From the graph, it can be seen that although the pH value of HLL effluent is well within the standards, the pH of TTPL effluent shows very high deviation from the prescribed limits.

Suspended Solids

It refers to the small solid particles which remain in suspension in water as a colloid or due to the motion of the water. Fig. 1 shows the wide variation of suspended solids in the effluent of TTPL and HLL. The suspended solids of TTPLis 2886, whereas the suspended solid content of HLL is 65. The standard for suspended soilds as set by the PCB is 100. It can be seen that the effluent from HLL is well within the maximum

Table 1. Parameters analysed and the methodology employed

Sl. No.	Parameters	Methodology	Reference
1	pH	Electrometric method	(BIS,2009)
2	Suspended Solids(ppm)	Gravimetric method	
3	Total Dissolved Solids(ppm)	Gravimetric method	
4	COD(ppm)	Titrimetric method	
5	BOD(ppm)	Titrimetric method	
6	Oil and Grease(ppm)	Gravimetric method	
7	Ammoniacal N_2 (ppm)	Titrimetric method	
8	Kjeldahl N_2 (ppm)	Titrimetric method	

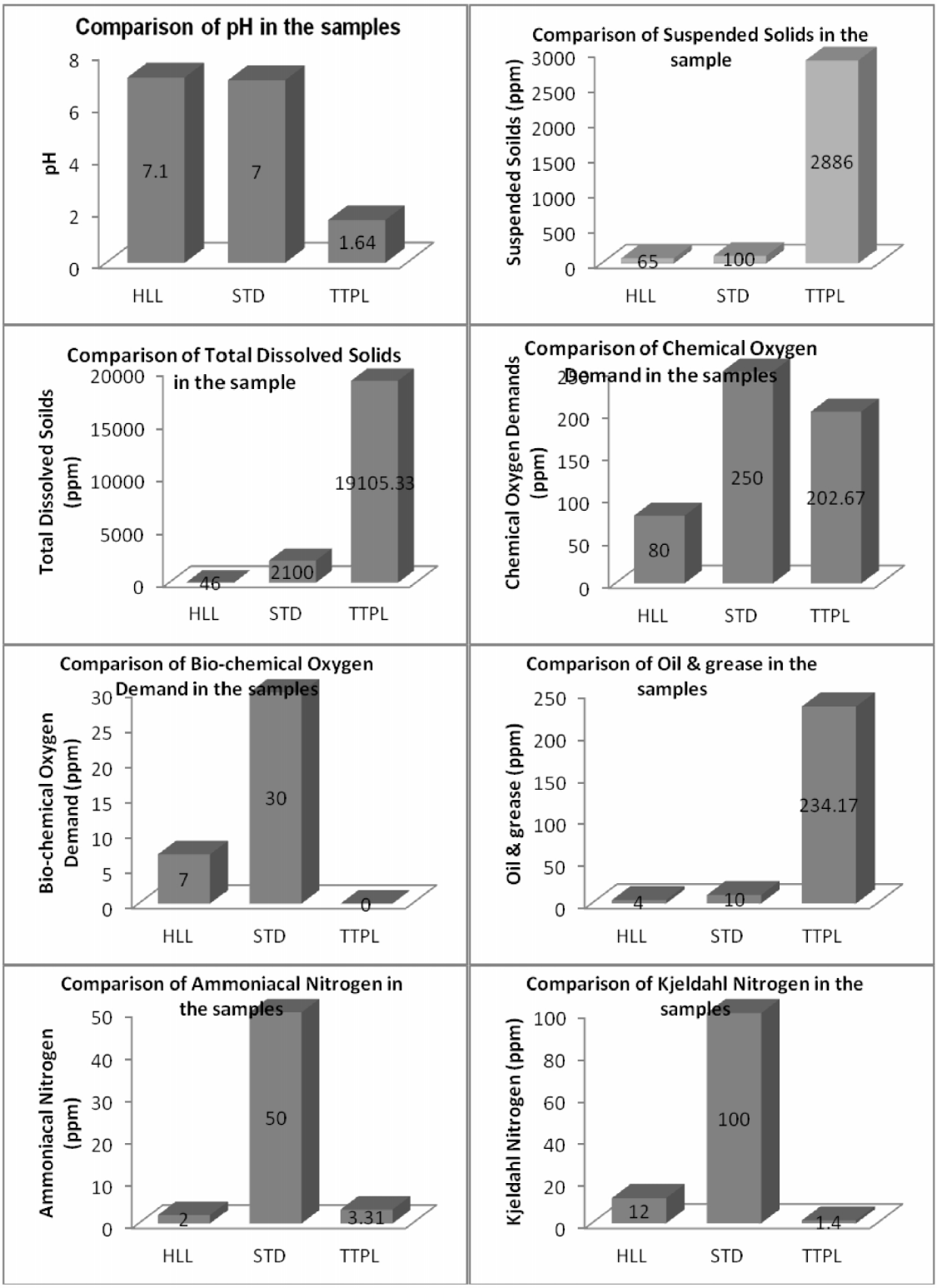

Fig. 1. Variation of various physico-chemical parameters in the effluent samples of HLL and TTPL compared with the standards

Table 2. Results of the analysis of final effluent characteristics of TTPL and HLL along with the KSPCB standards for effluent discharge to surface waters

PARAMETERS	TTPL Sample 1	TTPL Sample 2	TTPL Sample 3	Avg. TTPL	HLL Effluent	PCB Standards
pH	1.93	1.13	1.86	1.64	7.1	6-8
Suspended Solids (ppm)	3326	2374	2958	2886	65	100
Total Dissolved Solids (ppm)	2985	51258	3073	19105	46	2100
COD (ppm)	520	0	88	202	80	250
BOD (ppm)	0	0	0	0	7	30
Oil & Grease (ppm)	70.8	342.4	289.3	234.17	4	10
Ammoniacal Nitrogen (ppm)	2.35	3.36	4.21	3.31	2	50
Kjeldahl Nitrogen (ppm)	2.8	0	1.4	1.4	12	100

permissible limits whereas the effluent from TTPL is highly exceeding the standard value .

Total Dissolved Solids

Total Dissolved Solids is a measure of the combined content of all inorganic and organic substances contained in a liquid in molecular, ionized or micro-granular suspended form. It is used as an aesthetic characteristics of drinking water. The graphical representation (Fig. 1) gives the TDS value of TTPL and HLL. The TDS value of HLL is 46 and TTPL is 19105.33. Although the HLL effluent is seen conforming to the standards prescribed by PCB, the TTPL effluent is showing very high variation from the standards.

Chemical Oxygen Demand

The chemical oxygen demand (COD) determines the amount of oxygen required for chemical oxidation of organic matter using a strong chemical oxidant, such as, potassium dichromate under reflux conditions. The graph (Fig. 1) shows that the COD value of TTPL is greater than that of HLL. The COD of TTPL effluent sample is 202.6667 where as COD of HLL sample is 80. The standard value of COD is 250. Thus both the TTPL and HLL effluents have COD values within the set standard value [250 ppm].

Biochemical Oxygen Demand

BOD is the amount of dissolved oxygen needed by aerobic biological organisms in a body of water to break down organic material present in a given water sample at certain temperature over a specific time period. It is widely used as an indication of the organic quality of water. The graph (Fig. 1) shows the variation of BOD value in the samples. The effluent sample from HLL contained 7 ppm of BOD whereas TTPL sample had no BOD at all. The standard prescribed by PCB for BOD is 30 ppm. The effluent from TTPL being highly acidic, as evident from the pH, naturally has very low BOD. Thus both HLL and TTPL have BOD values conforming to the set standards [100].

Oil and grease

Oil is any neutral, non polar, chemical substance that is viscous liquid at ambient temperatures and is immiscible with water but soluble in alcohols or ethers. Grease is a semi-solid lubricant. It generally consists of soap emulsified with mineral or vegetable oil. The results of the study (Fig. 1) show a wide variation in Oil and grease. The Oil and grease of TTPL effluent sample is 234.1667 whereas Oil and grease of HLL sample is 4. Thus TTPL is showing great variation from the standard value [20] and HLL value of oil and grease is well within the standard value.

Ammoniacal Nitrogen

It is the measure of the amount of ammonia, a toxic pollutant often found in landfill leachate and in waste products. The term is used widely in waste treatment and water purification systems. The graph (Fig. 1) gives the value of Ammoniacal Nitrogen in TTPL and HLL samples. The effluent of TTPL (3.306667) and HLL (2) is showing normal values for ammoniacal nitrogen within the standard value (50).

Kjeldahl Nitrogen

It is a common parameter for the evaluation of soil and water quality. The samples require digestion with sulphuric acid to convert nitrogen into ammonium sulphate. The result of the study as given in Fig. 1 shows the variation of Kjeldahl Nitrogen in TTPL and HLL effluent sample. The value of Kjeldahl Nitrogen in TTPL sample is 1.40 and HLL is 12 which is less than the standard value of effluent [100].

Thus a comparative evaluation of the effluent characteristics of the two industries, TTPL and HLL reveals that the effluent of HLL is conforming to the standards set by PCB, whereas the effluent of TTPL shows wide variations. Although the TTPL effluent has parameters such as COD, BOD, Ammoniacal nitrogen and Kjeldahl nitrogen within the standard values, other parameters such as pH, Suspended Solids, Total Dissolved Solids and Oil and Grease shows values outside the prescribed standards.

CONCLUSIONS

The study acquires special significance owing to its application in the socio- environmental realm as well as the delicate ecological balance of the surface water resources concerned. A comparative evaluation of the effluent characteristics of the two industries, TTPL and HLL reveals that the effluent of HLL is conforming to the standards set by PCB, whereas the effluent of TTPL shows wide variations. Although the TTPL effluent has parameters such as COD, BOD, Ammoniacal nitrogen and Kjeldahl nitrogen within the standard values, other parameters such as pH, Suspended Solids, Total Dissolved Solids and Oil and Grease shows values outside the prescribed standards.

Based on the result of the present study, adoption of proper environmental management measures for pollution control and effluent treatment in TTPL is strongly suggested as the effluent characteristics revealed are highly detrimental to both the biotic and abiotic constituents of the receiving ecosystem.

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