



Received: 27-03-2020

Accepted: 15-06-2020

Publication: 31-08-2020

Indian J.Sci.Res. 11 (1): 41-44, 2020

Original Research Article

PHYSICO-CHEMICAL PROPERTIES OF CARPET INDUSTRY EFFLUENTS OF DISTRICT BHADOHI, INDIA

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ABSTRACT

Entering of industrial effluents in to the water bodies is one of the major sources of environmental toxicity. It not only affects the quality of drinking water but also has deleterious impact on the plant and aquatic ecosystems. In the present study, we have analyzed the physico-chemical properties of the effluents from the carpet industry. The effluents were collected from Ghosia town of Bhadohi District, U.P., India. In this study, physico-chemical parameters such as pH, alkalinity, dissolved oxygen (DO), biological oxygen demand (BOD), chemical oxygen demand (COD), total dissolved solid (TDS) and total suspended solid (TSS) were determined using standard procedures. The results of the analysis were compared with the water quality standards of BIS (Bureau of Indian Standard). Some parameters were within the permissible limit prescribed by BIS and some above the limit.

KEYWORDS: Carpet Effluents, Physico-Chemical Parameters, BIS Limits

Carpet industries are large consumers of water as well as producer of waste water with the increased demand for carpet products. However, surface water is also being polluted by anthropogenic activities and idol immersion, making it one of the main sources of severe pollution problems worldwide. The effluents contain a variety of chemicals from the various stages of operations which include printing, bleaching and dyeing. In carpet Industry, fabrics, after its manufacturing, are subjected to several wet processes collectively known as “finishing” and in these finishing operations the major effluents are produced (Abo-Elela *et al.*, 1988.)

The discharge of dye-containing effluents into the water bodies are undesirable because of their colour, released directly and breakdown products are toxic, carcinogenic or mutagenic to life forms mainly because of benzidine, naphthalene and other aromatic compounds. The recycling of effluents have been recommended due to the high levels of contamination in dyeing and finishing processes (i.e. dyes and their breakdown products, pigments, dye, auxiliary chemicals and heavy metals (Bisschops and Spanjers, 2003; Correia V.M, *et al.*, 1994.) . If the huge amount of untreated effluents are discharged in to natural water bodies, the receiving water bodies and drains carry precarious industrial effluents which affect the quality of water, aquatic ecosystem and human life. The carpet industry in India is one of the most important and most polluting industrial group of chemicals such as dyes (Asia *et al.*, 2006). To operate different processes such as resizing, bleaching, dyeing and printing of fabric, a vast amount of water is used and waste is generated (Ghaly *et al.*, 2014). The treatment of carpet effluent prior to its release into water bodies is must. Thus, the pollution caused by the carpet effluents

has become a critical concern to the environment and human health (Sarker *et al.*, 2015). Heavy metals, present in carpet dyes as a chromophoric group, are non biodegradable, hence, they accumulate in primary organs in the body and lead to various diseases. Thus, untreated or incompletely treated carpet effluents can be harmful to both aquatic and terrestrial life by adversely affecting the natural ecosystem and causing long term health effect (Chung, 2016). The present study deals with the physico-chemical properties of Bhadohi carpet industry effluent.

MATERIALS AND METHODS

Effluent Sample Collection

Effluent samples (S1 and S2) were collected in sterile bottles from two carpet industry of Ghosia town of District Bhadohi. Effluent samples were brought to the laboratory and analyzed for various physico-chemical parameters.

Physico-Chemical Properties of Effluent Samples

After sampling, the analysis was started immediately in the laboratory. The standard methods recommended by APHA (2005), Trivedy and Goel (1984) were employed for the determination of various physicochemical parameters like pH, alkalinity, dissolved oxygen (DO), biochemical oxygen demand (BOD) and chemical oxygen demand (COD), total dissolved solids (TDS), total suspended solids(TSS). pH of the effluent samples were determined by using a pH meter. TDS and TSS were analysed by the gravimetric method by using evaporating dishes and Whatman filter paper. The COD and BOD were analysed by modified Winkler's method in BOD bottles.

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RESULTS AND DISCUSSION

Discharge of treated and untreated effluents by the carpet industries disturb the environmental integrity. Two carpet industries have been selected that is located in the Ghosia Town of Bhadohi District. Observed values of the physicochemical parameters of collected effluent samples are given in Table 1.

pH

In the present study, the collected effluent sample S1 has higher pH value (8.5) than S2 (8.0) which are within the BIS limit (5.5-9) and slightly alkaline in nature (figure 1). pH of an effluent is very important in determination of water quality since it affects other chemical reactions such as solubility and metal toxicity. The alkalinity may be due to the usage of different types of dyes in the industry.

DO, BOD and COD

Observed values of effluent S1 has lower dissolved oxygen (2.9 mg/L) than effluent S2 (5.44 mg/L), (figure 2). S1 has lower DO than the BIS limit (4-6 mg/L) but S2 within the BIS standard limit. Effluent sample S1 has higher BOD (9.1 mg/L) than S2 BOD (7.5 mg/L) and COD of effluent S1 (11.56 mg/L) is higher than S2 (10.16 mg/L) also (figure 2). Both BOD and COD are within the BIS standard limits. The BOD is the measure of the amount of oxygen required by bacteria

in the water to break the decomposable organic matter into simpler substances. The high values of BOD are indicators of the pollution strength of the water and specify that less oxygen is available for the living organisms in the effluents. COD test is useful in pinpointing toxic condition and presence of biological resistant substances.

Alkalinity

Alkalinity of water is acid-neutralizing capacity of the water to pre-designated pH. Alkalinity is the sum of all the titratable bases. Alkalinity in water is mainly due to carbonate, bicarbonate and hydroxide content. Borates, phosphates, silicates or other bases if present also contribute for alkalinity. In the present study, alkalinity of S1 was found higher (600 mg/L) than S2 (500 mg/L), (figure 3) that is equal and within the BIS Standard limits respectively.

TDS and TSS

Total suspended solid and Total dissolved solid is the measure of total inorganic salts and other substances that are dissolved in water. The effluents with high TDS value may cause salinity problem if discharged in to irrigation water. In present study value of Total dissolved solid of S1 is 3565 mg/L and S2 is 2456 mg/L, i.e. higher than permissible limit of BIS. Total suspended solid of S1 and S2 are 380 mg/L and 286 mg/L respectively that is higher than permissible limits.

Table 1: Physico-chemical Properties of Carpet Industry Effluents

| Parameters | Observed values of effluent S1 | Observed values of effluent S2 | BIS Limits |
|------------------|--------------------------------|--------------------------------|------------|
| pH | 8.5 | 8.0 | 5.5-9 |
| Alkalinity(mg/L) | 600 | 500 | 200-600 |
| DO(mg/L) | 2.9 | 5.44 | 4.0-6.0 |
| BOD(mg/L) | 9.1 | 7.5 | 30 |
| COD (mg/L) | 11.56 | 10.16 | 250 |
| TDS(mg/L) | 3565 | 2456 | 2100 |
| TSS(mg/L) | 380 | 286 | 100 |

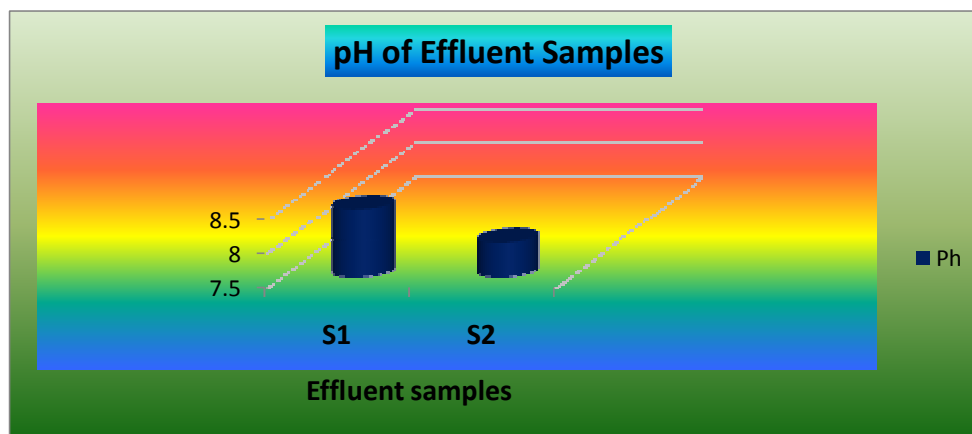


Figure 1: pH of Carpet Industry Effluent Samples

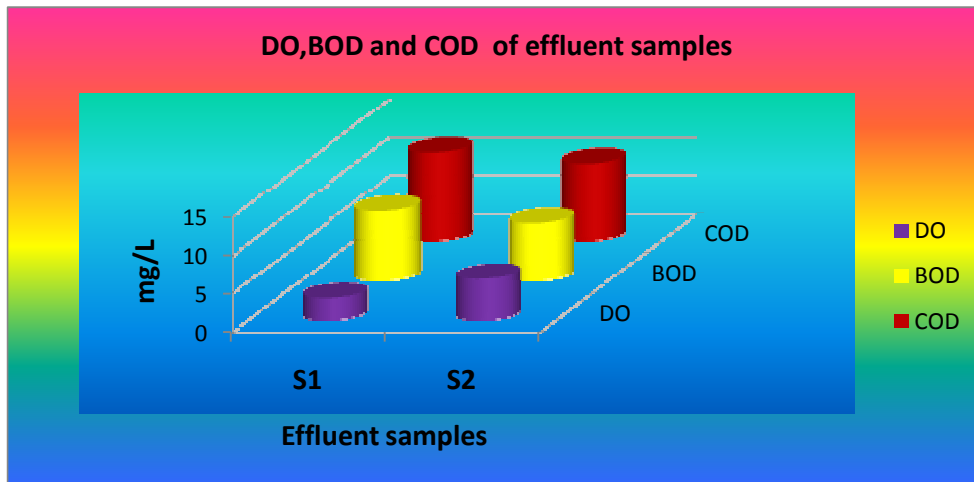


Figure 2: DO, BOD and COD of Carpet Industry Effluent Samples

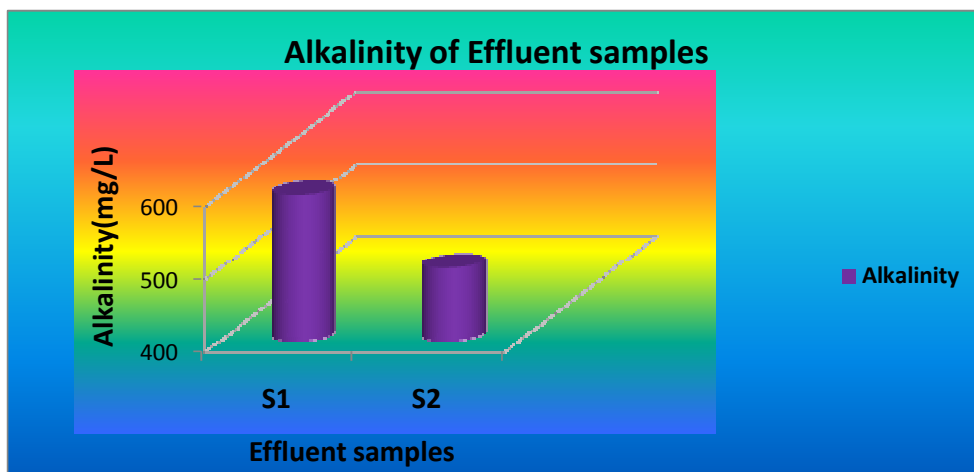


Figure 3: Alkalinity of Carpet Industry Effluent Samples

CONCLUSION

The carpet industry effluents were analyzed and the analysis reports of physico-chemical parameters like pH, Biological oxygen Demand, Chemical oxygen Demand, and Alkalinity lies within the permissible limit prescribed by BIS. But some parameters like TDS, and TSS have higher values than BIS permissible limit. So the effluents are polluted because they contain heavy metals. The high level pollution of the industrial effluents cause environmental problems which will affect plant, animal and human life.

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