Comparative studies on various physico-chemical parameters of different industrial waste water

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ABSTRACT: *Physico-chemical characteristics of four different industrial effluents such as tannery, paper mill, textile and sugarcane collected from various parts of Tamil Nadu were analyzed. The effluents were collected at discharge site after pre-treatment indicated different parameters of alkalinity and salinity. pH, chloride, organic and inorganic constituents. Tannery (222 mg/l), textile mill (158 mg/l) and paper mill (187 mg/l) effluent contained high amount of chloride, whereas sugarcane mill effluent contained high value of nitrate (132 mg/l). Due to the discharge of these effluents, the ground water and crops adjacent to these industries were cruelly affected. The tannery effluent was found to be highly toxic for the growth of crop plants compared to other industrial effluents.*

Key Words: *Tannery, Paper mill, Textile, Sugarcane effluent, Physico-chemical characteristics*

Introduction

Water is essential to all forms of life and makes up to 50-97% of the weight of all plants and animals and about 70% of human body. Water is also a vital resource for agriculture, manufacturing, transportation and many other human activities. Despite its importance, water is the most poorly managed resource in the world. The availability and quality of water always have played an important role in determining the quality of life. Water quality is closely linked to water use and to the state of economic development (Ramamurthy *et al*., 2014). Ground and surface waters can be contaminated by several sources. In urban areas, the careless disposal of industrial effluents and other wastes may contribute greatly to the poor quality of water (Ramamurthy *et al*., 2015). Most of the water bodies in the areas of the developing world are the end points of effluents discharged from industries.

A major environmental problem facing the chemical dyeing and manufacturing industry is that the industry produces large volumes of high strength aqueous waste continuously. The discharge of wastewater containing recalcitrant residues into rivers and lakes lead to higher biological oxygen demand (BOD) causing serious threat to native aquatic life. The modern civilization, industrialisation, urbanisation and increased population have led to fast degradation of our environment. The environment pollution espeacially water pollution is a major problem in India. In the modern context of environmental pollution, not only the industries are playing spoil spot but also the domestic sewages. The water after it is used for industrial purpose is often let free without any treatment. In many places in India, the town authorities let the sewage into streams or brooks or rivers without any effluent treatment. In the present study, some important water quality parameters were analysed for effluents and it has been correlated with ICMR values.

Materials and Methods

The samples of effluents were collected immediately outside the boundary of the industry. The physico-chemical analyses of the effluents were done following the method of APHA (1995). The important parameters considered were total solids, total dissolved solids, chloride, carbonate, calcium, magnesium, sodium, potassium, phosphate, salinity, sodium absorption ratio, dissolved oxygen, dissolved bcarbon dioxide, COD, BOD, oil and grease. The water quality index (WQI) values were calculated from these physico-chemical parameters (Tiwari & Ali 1987).

Result and Discussion

The results of physico-chemical characteristics of effluent are presented in Table 1. The effluent was slightly alkaline and contained high amounts of nutrients. Though BOD and COD levels were high as per IS

Standards, their levels were not so much high as compared to other types of effluents. The pH of the textile mill effluent was very high, while in the other effluents the pH was very low. Electrical conductivity was very high in tannery effluent (10,000 micromhos/cm). The values of four industrial effluents were exceeded the permissible limits. Total dissolved solids were responsible for the higher EC values. The treated tannery effluent was having high total dissolved solids. The values are lower than that of WHO value. Total hardness was very similar in both tannery effluent and sugarcane mill effluent. The four industrial effluents contained four cations such as Na, K, Ca and Mg. Mg content were high in treated tannery effluent. Calcium content was higher in sugar cane mill effluent than other effluents. Chloride content was an indicator of salinity, which was analysed in four effluents. Textile mill, paper mill and tannery effluent contained high amount of chloride content. The effluent contained high amounts of ammonia, which affects the soil as well as quality (Satry 1981). Tannery wastewater when applied in fields resulted in land infertility and poor germination of seeds (Rajagopalan & Davis 1967).

The effluents discharged from the tanneries have high values of pH (alkaline), EC, Chlorides, Sulfides, BOD, COD etc. The values are much higher than the tolerance limits for an industrial effluent discharged into land surface or into public swears as prescribed by ISI standards (Sastry 1981).

Jayabalan *et al* (1994) reported that the higher level of these factors indicated that the tannery effluent is more toxic than other effluents. But the amounts of calcium, magnesium, nitrogen and phosphate were low in the tannery effluent. The high amount of organic matter in the effluent inhibits the enzymatic activity of the plant thereby causing the decay of the plant resulting in bad smell (Vilmmen 1972). The biological activity in the soil is also thus severely affected (Rao *et al* 1993), Dutta (1999) reported that paper mill wastewater at Nagon Paper Mill of Assam, had toxic effect on growth of paddy plants. It can be concluded from the presented investigation that the effluents of sugar cane mill effluent is sufficiently polluted as they produce toxic effects on the growth and physico-chemical parameters of plants and hence it is not suitable for irrigation unless it is pretreated. Water quality index (WQI) calculated for wastewater sample from textile mill effluent showed a very high value than other effluents. Hence, the effluent is not suitable for any use by human activities.

Table 1.Physico-chemcial parameters of selected industrial effluents

S. No	Parameters	Effluent			
		Tannery Mill	Textile Mill	Sugar Mill	Paper Mill
1	Tamperature (°C)	27.8	28.5	28.0	27.1
2	pH	7.6	8.1	5.7	6.5
3	Colour	Brownish	White	Brownish	White
4	Total solids	1062	1080	1033	1137
5	TDS	450	430	400	437
6	Calcium	25.8	12.6	32.4	16.0
7	Magnesium	28.2	11.5	18.5	13.1
8	Chloride	222	158	68	187
9	Carbonate	6.0	9.0	4.0	2.5
10	Bicarbonate	10.3	11.0	5.40	4.4
11	Dissolved O_2	1.5	3.0	4.4	5.2
12	BOD	190	185	225	210
13	COD	210	180	452	320
14	Free CO_2	20	33	13	25
15	Nitrate	107	101	132	109
16	Nitrite	88	84	90	88
17	Ammonia	45	41	44	42
18	Total phosphate	77.25	71.17	80	76
19	Inorganic P	38.25	38.17	38	41
20	Organic P	40.25	33.2	42.5	45

Except pH and temperature, all values are expressed in mg/l.

Conclusion

The industry effluent affects the many physico-chemical characteristic of aquatic medium. The turbidity of water is increased by the dark colour of the effluent. The industry effluents are cleaning products derived from synthetic organic chemicals. Generally, effluents are xenobiotic compounds which

are usually washed into water bodies and are made up of several compounds of which the active components are the surface-active agents. The major toxic constituents in effluent are high dissolved solids, chlorides, sulphite. This effluent has variable composition whose values are far exceed the permissible limits there by posing great danger to the aquatic biota. The dilution and biological treatment requirements are needed before discharge in the effluent safely to the ecosystem.

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