International Journal of Fauna and Biological Studies
Available online at www.faunajournal.com

IJFBS International Journal of Fauna And Biological Studies

ISSN 2347-2677
IJFBS 2016; 3(3): 81-83
Received: 15-02-2016
Accepted: 07-03-2016

Uma T
PG-Research Department of advanced Zoology and Biotechnology, Govt Arts College, Nandhanam, Chennai-35.

Saravanan N
Endocrinology Unit, Department of Zoology, Madras Christian College, Chennai-59.

Jothi Narendiran N
PG-Research Department of advanced Zoology and Biotechnology, Govt Arts College, Nandhanam, Chennai-35.

Correspondence:
Uma T
PG-Research Department of advanced Zoology and Biotechnology, Govt Arts College, Nandhanam, Chennai-35.

Comparative analysis of physico-chemical characters and heavy metals in dye industry effluent and sugarcane industry effluent along with lake water

Uma T, Saravanan N, Jothi Narendiran N

Abstract
The physico-chemical characteristics and water quality of Lake Water, Sugarcane mill effluent and Dye industry effluent were found to be toxic as it contains large amount of organic, inorganic chemical elements and heavy metals. The present study focused on evaluating the chemical parameters and toxicity of water. In this paper we comparatively analyzed three different water samples from different sources. The result indicated a significant increase in Calcium in all the water samples. Phosphate was found in high amount next to Calcium, in lake water and dye industry effluent. Among the heavy metals, Lead was found to be the highest amount of metal in lake water and dye industry effluent. In sugarcane industry effluent, Cadmium was present in high concentration. From the overall assessment, the lake water also contains heavy metals in huge amount and proven to be unfit for drinking purpose.

Keywords: Heavy metals, Water, Calcium, Sugarcane, Effluent

1. Introduction
In India, sugarcane industry provides high employment opportunities after textiles (Trivedy, 1998: Sivakumar, 2011) [11, 17]. Sugarcane mill industry is one of the oldest industries in India which consumes a large amount of water and only a small fraction of water is used by the products and lost by evaporation. The rest finds its way into the water courses as waste water, pollution arises from high concentration of organic and inorganic solids and some of the chemicals used for processing purposes. Water pollution by industrial effluent has been one of the vital issues of the environmental concern today. The effluents from almost all industries of the country are directly or indirectly discharged into canals and rivers. This paper dealt with the analysis of heavy metals also which include lead (Pb), cadmium (Cd), mercury (Hg), arsenic (As), chromium (Cr), lithium (Li) and nickel (Ni). The surface water quality is deteriorated because of mixing of chemicals of the effluent with water (Jolly *et al*., 2009) [8]. Being a developing country, India is faced with problems that are arising from the negative impact of economic development due to water or industrial pollution Senthil *et al*., (2001) [13], studied the physico-chemical characteristics of sugar mill effluent having highly toxic chemicals and heavy metals that are affecting aquatic flora and fauna. Due to the lack of proper environmental safety measures causes water pollution thereby makes the water unfit for drinking and cultivable purposes. Effluent from dye industry contains various micronutrients which are essential for the growth of crop plants (Jolly *et al*., 2009) [8]. As the micronutrient contents of the dye industry effluent is higher than natural water, the effluent can supply greater input of minerals. The pollutants of effluent leach into underground waters, moving along water pathways and depositing in the aquifer, or are washed away by run-off into surface waters thereby resulting in water and soil pollution. When ingested, the pollutants combine with the bio-molecules, like proteins and enzymes to form stable bio-toxic compounds, thereby mutilating their structures and hindering their functions. The effluent generated from the sugarcane and dye industries were not treated before it is discharged into the water bodies. As lake water receives part of the effluent, there is a risk of accumulation of heavy metals within the body of fishes that can create toxicity in the human beings when consumed. The objective of this research work is to study the effect of chemicals and the toxicity of heavy metals of lake water by comparing with sugarcane and dye industry effluent.

2. Materials and Methods

2.1 Study area

The experimental sites were located in Kanchipuram and Thiruvannamalai districts, Tamilnadu. Effluent from sugarcane industry was collected from sugarcane mill located in Cheyyar, Thiruvannamalai district. Dye industry effluent was collected from Pudhupettai dyeing industry located in Kanchipuram. Lake water was collected from Nathapettai lake in Kanchipuram.

2.2 Collection of Sample

Samples were collected in20L polythene bottles which are cleaned with 8M HNO_3, followed by repeated washing with distilled water. Bottles were rinsed thrice with sample water. After collecting the samples, they are transported immediately to the laboratory for analysis. Before analysis, the water samples were filtered through whatman No.1 filter paper. During analysis the samples were preserved by adopting the techniques (APHA, 1990) [2].

2.3 Analysis of water samples

The physico-chemical characteristics like pH detection by the method of APHA 1995 [3] (Electrometric method), Temperature by partial immersion method of APHA, 1995 [3]. The calcium, silicate and nitrate estimated by Spectrophotometric screening method APHA, 1995 [3]. The aluminium, magnesium, phosphate were analyzed as per the procedure of Stannous chloride method (APHA, 1995) [3]. The heavy metals like cadmium, lead, arsenic, lithium, nickel, zinc and chromium were analyzed in the laboratory Spectrophotometric method (APHA, 1995) [3].

3. Results

The physico-chemical characters like pH, alkalinity, calcium, silicate, nitrate, aluminium, magnesium, phosphate and heavy metals Pb, Cd, As, Cr, Li, Zn and Ni of dye industry effluent, sugarcane industry effluent and lake water were analyzed. The values were measured in mg/l. and represented in table 1& table 2. Graph 1 shows the amount of chemicals and heavy metals present in three water samples. Our result shows the high concentration of chemicals and heavy metals in lake water. Sugarcane industry and dye industry effluent have high amount of heavy metals but comparatively lesser than lake water.

Table 1: The Physico-chemical parameters of Lake water, Dye industry effluent and Sugarcane industry effluent.

S. No.	Physico-chemical parameters	Lake water	Dye industry effluent	Sugarcane industry effluent
1	Ph	8.2	7.9	8.3
2	Alkalinity	11.3	15.67	18.92
3	Total dissolved solids	34.5	12.32	8.30
4	Total suspended solids	32	13.01	0.61
5	Calcium	65.89	63.16	8.32
6	Silicate	45.6	2.33	10.4
7	Nitrate	122.2	173	46.30
8	Magnesium	105.7	54.74	26.65
9	Phosphate	56.67	40.1	14.30
10	Aluminium	45.6	20.12	13

All the values are expressed in mg^{-1}/lit.

Table 2: Heavy Metals of Lake water, Dye industry effluent and Sugarcane industry effluent.

S. No.	Heavy Metals	Lake water	Dye industry effluent	Sugarcane industry effluent
1	Lead (Pb)	14.98	20.3	1.6
2	Cadmium (Cd)	2.43	3.45	2.37
3	Zinc (Zn)	0.11	2.14	9.23
4	Arsenic (As)	0.66	0.33	0.03
5	Lithium (Li)	0.45	0.06	0.02
6	Nickel (Ni)	0.26	0.05	0.4
7	Chromium (Cr)	0.97	2.23	0.01

All the values are expressed in mg^{-1}/lit.

4. Discussion

The lake water, sugarcane mill effluent and dye industry effluent contains high amount of silicate, calcium, total dissolved solids and heavy metals. The lake water becomes dark green in colour due to sedimentation of chemicals which in turn trap the penetration of sunlight to the extent. The industrial, municipal and agricultural wastes, which are legally or illegally discharged into the environment, are responsible for environmental pollution (Bakare *et al*., 2003; Shashirekha *et al*., 2005, 2008 and Vijayakumar, and Manoharan, 2012) [4, 14, 15, 19]. Among three water samples, lake water has a high concentration of total dissolved solids, alkalinity, BOD and heavy metals. High concentration of sodium, chloride and sulphate in the effluent interferes with or inhibit the uptake of other valuable elements by the plants. (Sureshkumar and Mariappan, 2013) [18]. Inhibition of these elements by plants caused by the accumulation of chemicals and heavy metals directly affects the photosynthesis of plants. The present investigation shows high concentration of magnesium, phosphate and heavy metals in sugarcane industry effluent. High concentration of nitrate in effluent leads to reduce the sugar content of crops when used for irrigation (Kirkham, 1986) [9]. Lake water acts as a fresh water habitat for fish species include Tilapia there is a risk of bioaccumulation of physico-chemical parameters and heavy metals in these organisms. Effluents are treated and have been used for irrigation in many parts of the world (Adekola *et al*., 2003) [1]. Sisodia and Bedi (2001) [16] reported that the germination and growth rate of wheat, jawar and paddy has been reduced when they irrigated with the effluent contain high amount of ions.

To assess the toxicity of the effluents, a study was undertaken to analyze the effect of chemical parameters present. The chlorophyll content of leaves gets reduced because of high concentration of nitrate, sulphate, phosphate in the effluent (Sahai *et al*., 1983) [12]. Lead, cadmium and mercury have been reported not to have any known function in human biochemistry or physiology, and do not occur naturally in living organisms (Lenntech, 2004) [10]. Hence even at very low concentrations they may be very harmful because they bio-accumulate. Lead toxicity leads to teratogenesis. Lead poisoning causes inhibition of hemoglobin synthesis; kidney dysfunction, acute and chronic damage to the central nervous system (CNS) and peripheral nervous system (PNS) (Ferner, 2001) [6]. Arsenic coagulates protein, forms complexes with coenzymes and inhibits the production of adenosine triphosphate (ATP) during respiration (INECAR, 2000) [7]. Our study reported that lake water is highly polluted by having high concentration of aluminium, magnesium, lead and copper. From our study, we conclude that lake water is

highly polluted. Any organism inhabiting this water body shows the deposition of heavy metals. In consistent with our findings, the heavy metals may get locked into the tissues of fishes. From fishes, it pass on to other organisms which eats the fish, it may finds its way into human being through food chain when consumed. Hence there will be imbalance in the ecosystem.

5. Conclusion

Effluent discharged from industries should be treated before releasing into the land or water bodies. Industries should be aware of reducing the migration of pollutants. Environment protection laws should be strictly followed. Reduce the use of highly toxic chemicals; recycle the effluent and reuse it for irrigation purposes not only to control the pollution but also preventing the loss of natural resources.

6. References

1. Adekola FA, Salami N, Lawai SO. Some Trace Elements Determination in Surface Water and Sediments of Oyunriver, Kwara State, Nigeria. Nigerian Journal of Pure and Applied Science. 2003; 18(3):1418-1422.
2. APHA, AWWA-WPCF. Standard methods for examination of water and waste water. 19th edition. American Public Health Association. Washington, DC, 1990.
3. APHA. Standard Methods for the Examination of Water and Wastewater (20th Edition), District of Columbia American Public Health Association, Washington DC, 1995, 230-295.
4. Bakare AA, Lateef A, Amuda OS. The aquatic toxicity in characterization of chemical and microbiological constituents of water sanples from oba river, odo-oba, Nigeria. Asian J Microbial Biotech Env Sci. 2003; 5:11-17.
5. Damodharan U, Reddy MV. Impact of Sugar Industrial Treated Effluent on the Growth Factor in Sugarcane-Cuddalore, India. Journal of Sustainable Bioenergy Systems. 2012; 2:43-48.
6. Ferner DJ. Toxicity, heavy metals. eMed. J. 2001; 2(5):1.
7. Institute of Environmental Conservation and research INECAR Position Paper against Mining in rapu-Rapu, Published by INECAR, 2000.
8. Jolly YN, Islam A, Mustafa I. Characterization of dye industry effluent and assessment of its suitability for irrigation purpose. Journal of Bangladesh Academy of Sciences. 2009; 33(1):99-106.
9. Kirkham MB. Problems of Using Waste water on Vegetable Crops, Horticultural Science 1986; 21(1):24-27.
10. Lenntech Water Treatment and Air Purification Water Treatment, Published by Lenntech, Rotterdam seweg, Netherlands, 2004. (www.ecelwater.com/thp/filters/Water-Purification.htm).
11. Trivedy RK. Advances in wastewater treatment technologies (1). Global Science, Aligarh, India, 1998.
12. Sahai RN, Neelm S. Effect of fertilizer factory effluent on seed germination, seedling growth, pigment and chlorophyll content in Phaseolus radiatus. L. Indian. J Ecol. 1983; 14(1):21-25.
13. Senthilkumar RD, Narayana Swamy R, Ramkrishan K. Pollution studies on sugar mill effluents physico-chemical characteristic & toxic metals. Poll. Res 2001; 20(1):91-97.
14. Shashirekha V, Pandi M, Mahadeswara S. Bioremediation of tannery effluents and chromium containing wastes using cyanobacterial species. J Amer Leath Chem Ass. 2005; 100:419-426.
15. Shashirekha V, Sridharan MR, Swamy M. Biosorption of trivalent chromium by free and immobilized blue green algae: kinetics and equilibrium studies. J Environ Sci Health a Tox Hazard Subst Environ Eng. 2008; 43:390-401.
16. Sisodia GS, Bedi SJ. Impact of chemicals and industrial effluent on seed germination of wheat. Ind. J Ecology. 2001; 12:189-192.
17. Sivakumar D. A study on contaminant migration of sugarcane effluent through porous soil medium. Int. J Environ Sci Tech. 2011; 8(3):593-604.
18. Sureshkumar K, Mariappan V. Evaluation of Sugarcane mill effluent and its impact on the growth, biochemical and DNA profile of *Chloroxylon swietenia*, DC. International Journal of Research in Environmental Science and Technology. 2013; 3(3):92-99.
19. Vijayakumar S, Manoharan C. Treatment of Dye Industry Effluent Using Free and Immobilized Cyanobacteria. J Bioremed Biodeg. 2012; 3:165.