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Physico-Chemical Characteristics of Mixed Wastewater for biological hydrogen production

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ABSTRACT

The physicochemical parameters of wastewater collected from starch and sugar industry were investigated and parameters were analyzed by standard methods. The colour of the collected sugar industry wastewater was dark brown in color and starch wastewater white in color, both the wastewater was turbid in nature. Unpleasant odor was noted in starch wastewater as compared to the sugar industry wastewater. The pH of the wastewater varied from 4.5 to 5.5. The combined wastewater for different mixing proportions (Distillery Spent Wash: Starch wastewater) (50:50, 60:40, 70:30, 80:20, 90:10, 40:60, 30:70, 20:80, 10:90) were also analyzed. The maximum total dissolved solids of 9200mg/l was found in the ratio 60:40. The chemical oxygen demand of the combined wastewater ranged between 16 – 20 g/l and the pH varied from 4.5 to 5.5 mg/l. The combined wastewater with different proportions were rich in carbohydrate and hence it's suitable for biological hydrogen production. The physicochemical parameters studied in this work were varied for different mixing ratios and almost all parameters studied were higher compared with the permissible limit prescribed by the United States Environmental Protection Agency and World Health Organization.

KEYWORDS: Wastewater, Physicochemical, Total Dissolved Solids, Mixed Liquid Volatile Suspended Solids, Chemical Oxygen Demand.

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INTRODUCTION:

The pollutants from the wastewater are harmful to the public health and the environment, and they are toxic to the aquatic organisms as well. The wastewater treatment helps to remove contaminants from water to decrease pollutant load[1]. Water pollution occurs through natural processes in certain cases, but most of the pollutions caused by human activities[2]. The used water of a community is called wastewater or sewage. The sewage water is not treated before being discharged into waterways, which causes serious pollution in the particular environment[3]. Wastewater is any water that has been adversely affected in quality by anthropogenic influences. It comprises liquid waste discharged by domestic residences, commercial properties, industries, and/or agriculture and can encompass a wide range of potential contaminants and concentrations[4]. The contamination and quality of irrigation water are of the main concern especially in the regions with limited water resources[5]. Characterization of wastewater and activated sludge has been used for control and optimization of existing processes and development of new processes. The most possible sources of water, soil, and plant pollutions are sewage sludge and residues of industries and intensive fertilization[6]. The importance of testing a waste characterization in this study is to identify the composition of the waste so actions can be taken to reduce the amount of trash discarded[7, 8]. The sewage water discharged from various domestic and industrial sources has been characterized by various researchers [4, 6]. Urban environmental management is one of the important issues as the urbanization trend continues globally. The under-management of municipal wastewater in many southern urban areas is a major challenge. Management of wastewater in metropolitan cities is a very difficult task. The unsafe disposal of wastewater results in water pollution as well as terrestrial pollution. It causes various health problems, whichare epidemics due to the processing of the contaminated water[9, 10]. This wastewater eutrophicates the water bodies, causing the mortality of aquatic biological resources. Hence, the role of treatment plants is in the sustainable use of wastewater as they make the water usable for various purposes[11]. The major objective of the present study was to characterize the wastewater indifferent mixing ratios. A study of this kind will improve our knowledge on the quality of wastewater being discarded into the environment due to various anthropogenic activities. The other parameters of the wastewater samples analyzed for adopting wastewater for biological hydrogen production process in future with the standard procedures from the manual of APHA 2005.

MATERIALS AND METHODS

The physicochemical parameters such as color, odor, pH, Total Solids, Total dissolved solids (TDSs), Mixed Liquid volatile Suspended Solids, and COD of the wastewater were tested in this study. The samples were collected from Nellikuppam, Cuddalore District and Attur, Salem District, Tamilnadu, India. The above mentioned parameters were estimated by standard methods of American Public Health Association APHA 2005[12]. The other parameters of the wastewater samples analyzed for biological hydrogen production process in future with the standard procedures from the manual of APHA.

RESULTS AND DISCUSSION

The values of the physicochemical parameters observed in the present study may serve as an indicator of the pollution level of the industries and also appropriate for biological hydrogen production. The experimental data on physicochemical properties of wastewater samples were collected from sugar and starch industry. The physicochemical parameters which are mostly considered for biological hydrogen production such as pH, TDS, COD, and MLVSS were analyzed separately and different mixing ratios were given in the following section.

Table: 1 Physico-chemical characteristics of Starch and Distillery Spent Wash

	pH	COD	BOD	TS	TSS	TDS	VS	MLSS	MLVSS
Starch wastewater	3.725	68209.5	30082.5	25850	2180	23670	8055	8900	3000
Distillery Spent Wash	4.48	43254	17955	12255	8255	4000	7620	7500	2600

All Values are in mg/l except pH

pH

The pH of all mixing ratios of wastewater samples was measured immediately after its collection using a pH meter. The pH of the different mixing ratios was ranging from 4.4 to 5.5, and the result was shown in Figure 1. The pH of the wastewater is known to influence the availability of micronutrients as well as trace metals[13]. It is well known that the pH is an important parameter in evaluating the acid–base balance of water. A pH value of 7 is neutral; a pH less than 7 is acidic, and a pH greater than 7 represents base saturation or alkaline.

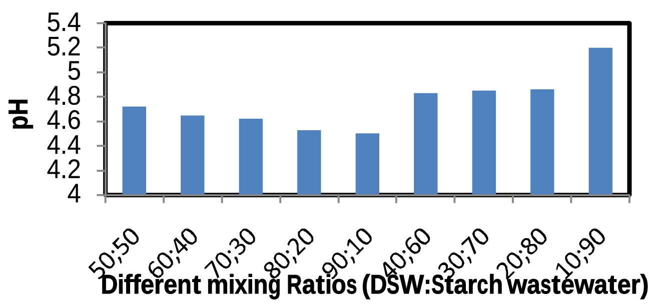

Fig. 1 pH vs. Different Mixing Ratios of Wastewater

Total Dissolved Solids

The amount of TDSs in this study varies from 4000 to 9000mg/l, and the result was shown in Figure 2. In water, TDSs are composed mainly of bicarbonates, chlorides, carbonates, phosphates, and nitrates of calcium, magnesium, sodium, and potassium; manganese; salt; and other particles[14]. The higher values of TDS may be due to the discharge of waste from effluents from various industries. [15]reported that increase in the value of TDS indicated pollution by extraneous sources.

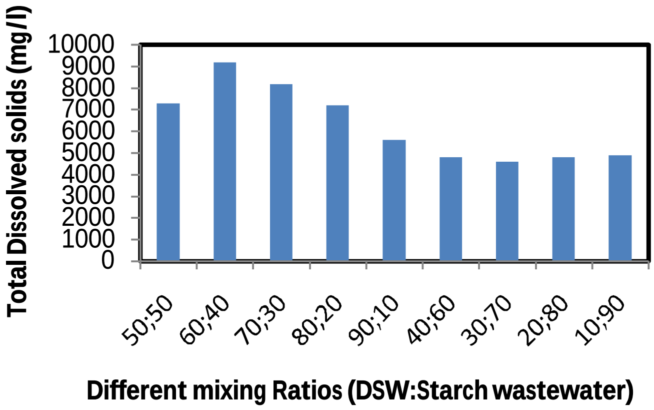

Fig. 2 Total Dissolved Solids vs. Different mixing ratios of wastewater

Chemical Oxygen Demand and Mixed Liquid Volatile Suspended Solids

COD showed the minimum value of 1650mg/l and the maximum value of 19200mg/l (Fig. 4). All organic compounds with few exceptions can be oxidized by the action of strong oxidizing agents under acidic condition. The COD determination is a measure of the oxygen equivalent of that portion of the organic matter in a sample that is susceptible to oxidation by a strong chemical oxidant. While determining COD, oxygen demand value is useful in specifying toxic condition and presence of biologically resistant substances. The COD and BOD values are a measure of the relative oxygen-depletion effect of a waste contaminant. Both have been widely adopted as a measure of pollution effect. COD is also one of the most common measures of pollutant organic material in water. COD is similar in function to BOD, in which both measure the amount of organic compounds in water[16].

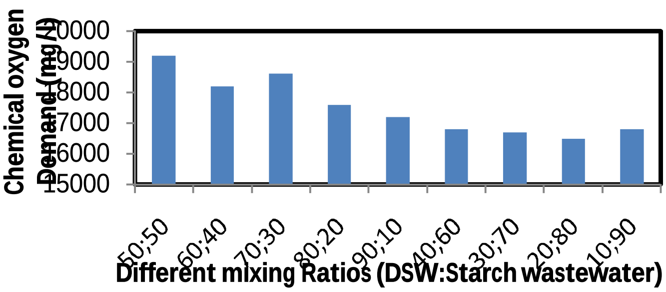

Fig. 3 Chemical Oxygen Demand vs. Different mixing ratios of wastewater

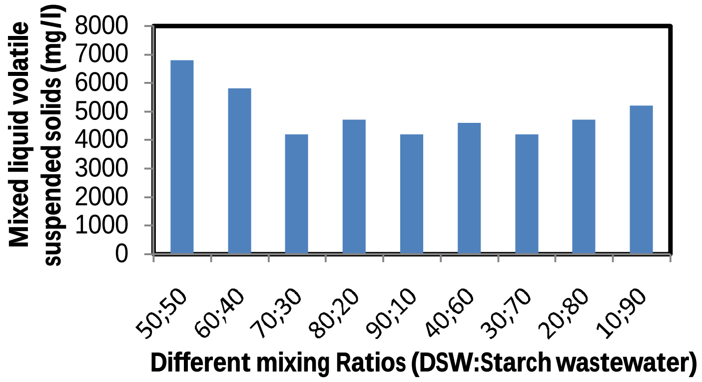

Fig. 4 Mixed Liquid Volatile Suspended Solids vs. Different mixing ratios of wastewater

CONCLUSION

The physico chemical characteristics of the mixed wastewater (Distillery Spent Wash and Starch wastewater) having pH range between 4.4 to 5.5 shows acidic in nature with high Chemical Oxygen Demand(16-20g/l) and Total Dissolved Solids(4-9g/l); hence it requires proper treatment before discharge into the water bodies.Mixed wastewaters having rich in carbohydrate content, so it can be treated well by biological methods. From the wastewater characteristics analyzed, the presences of carbohydrate indicate that it can be adopted for biogas production especially for biological hydrogen production. From this study concluded that the combined wastewater was suitable for biological wastewater treatments as well as biological hydrogen production.

REFERENCES

1. Zhang L.Y, Zhang. L, Liu Y. D, Shen Y. Liu W. H, and Xiong Y et al. Effect of limited artificial aeration on constructed wetland treatment of domestic wastewater. Desalination 2010; 250(3): 915-920.
2. Wang Y. C, Peng Y. A, and Li Y. M. The characteristics of water pollution and engineering-oriented prevention on Dianchi. Areal Res. Develop. 2004; 23: 88–92.
3. Chauhan, R. K. Physico-Chemical Analysis of Untreated Sewage Water of Ladwa town of Kurukshetra District of Haryana and Need of Waste Water Treatment Plant. Int J. CurrMicrobiol. Appl. Sci. 2014; 3(3): 326-333.
4. Sulieman M. H, Yousif W. M, and Mustafa A. M et al. Chemical, Physicochemical and physical properties of wastewater from the Sudanese fermentation industry (SFI). Fourteenth International Water Technology Conference, IWTC Cairo, Egypt. 2010; 305 - 315.

5. Rahmani, H.R. The pollutant sources of soil, water and, plant in Yazd Province. The final report. Approved National Scientific Iranian Government Board Proposal. Yazd University, Iran. 2001; 142.
6. Arslan and Ayberk S. Characterization and biological treatability of “Izmit industrial and domestic wastewater treatment plant” wastewaters. Water SA, 2003; 29(4): 451–456.
7. M. Kahmeyer, C. Miller, K. Neppel, C. Ronnebaum, J. Webber, and B. Zinke et al. Waste Characterization Study for KSU Recycling. 2011.
8. Arutchelvan V, Kanakasabai V, Elangovan R, Nagarajan S et al. Physico-chemical characteristics of wastewater from bakelite manufacturing industry. Indian J. Environ. Ecoplann. Sep 2004; 8:757-60.
9. Som S, Gupta S. K and Banerjee S. K et al. Assessment of the quality of sewage effluents from Howrah sewage treatment plant. J. Indian Soc. Soil Sci.1994; 42: 571-575.
10. Yadav R. K, Goyal B, Sharma R. K, Dubey S. K and Minhas P. S et al. Post-irrigation impact of domestic sewage effluent on composition of soils, crops and ground water-a case study. Environ. Int. 2002; 28: 481-486.
11. Dixon, Butler D, and Fewkes A et. Water saving potential of domestic water reuses systems using greywater and rainwater in combination. Water Sci. Technol. 1999; 39: 25-32.
12. APHA Standard Methods for the Examination of Water and Waste water, 20th edition, Washington, D.C. 2005.
13. Kirkham M. B. Cadmium in plants on polluted soils: Effects of soil factors, hyper-accumulation, and amendments. Geoderma. 2006; 137: 19-32.
14. Mahananda M. R, Mohanty B. P, and Behera Mahananda N. R. Physico – chemical analysis of surface and ground water of Bargarh district, Orissa, India. IJRRAS. 2010; 2: 26 -30.
15. Kataria H. C, Quereshi H. A, Iqbal S. A and Shandilya S. K et al. Assessment of water quality of Kolar Reservoir in Bhopal (MP). Poll. Res.1996; 15: 191-193.
16. Lokhande R. S, Singare P. U, and Pimple D. S. Study on Physico-Chemical Parameters of Waste Water Effluents from Taloja Industrial Area of Mumbai, India. Int. J. Ecosyst. 2011; 1(1): 1-9.