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Assessment of Physicochemical Properties and Identification Of Bacterial Strains From Effluent Of Sanganer and Sitapura Industrial Area of Jaipur, Rajasthan

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ABSTRACT
In the present study effluent samples were collected from Sanganer and Sitapura industrial area, Jaipur, Rajasthan. The industries in these areas discharge their wastes in Amanishah Nalla, which is a source of irrigation to nearby vegetation. Sampling was done in the month of June, 2013 and December, 2014 in accordance to standard procedures. The objectives of the present study were to access the major physicochemical parameters like pH, EC, BOD, COD, TDS, Total Hardness and Chloride concentration of the effluent. The second objective was to isolate and identify the indigenous bacterial strains which are unnaturally present in the water resource. A total of 10 bacterial strains were identified. Some of the physicochemical parameters were above the standards recommended for an industrial discharge.
Key words: *Hardness, Chloride Concentration, Industrial Pollution, Effluent, Heavy Metals*

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INTRODUCTION

Pollution is a hazard for the continued existence of mankind and the most significant dispute of our era. Industrial area of Sanganer and Sitapura are typically crowded with textile industries. Textile industries are an important link of economic development in India. A textile industry also generates massive volume of effluents as they utilize water for the different steps involved in textile processing [1]. The effluents from textile industry have a distinctive odor and quit strong color. They are also characterized by high BOD, COD, electrical conductivity, hardness and suspended solids. Color of effluent is because of the extensive use of chemical dyes i.e. coloring agent, which plays a role of major pollutant [2]. Pollution indicators like COD, alkalinity, suspended solids, dissolved solids of textile mill when fail to meet the terms with standards, affects aquatic life.

The waste water discharged from the industries directly enters the open surfaces and cause infectivity of natural ecosystem. The effluents discharged from the textile mills raise the turbidity of water bodies due to usage of dyes and chemicals. Various dyes used in textile processing generally have a synthetic origin and complex aromatic molecular structures which make them more stable and more difficult to be degraded. The objective of the present study is to analyze the physiochemical properties of effluent samples to identify the environmental impacts.

MATERIAL AND METHODS

The study area selected was Sanganer and Sitapura industrial area, about 20 kms far from Jaipur city. This area is famous for textile industries i.e. Sanganer prints are famous not only in Rajasthan but also in the India. Dye industries required lot of water during dye processing. The untreated waste water is being discharged directly into drains that connect the industry to the main drainage network (The Dravyavati river) in the city. Since the waste water is being used for crops cultivation which affects the quality of nearby land. Sanganer town lies between 26°41'-26°57' latitude 75°45'-75°51'longitude. It has about 635.5 km^2 area in which urban area is 12.9 km^2 and rural area is 622.6 km^2. The population of Sanganer town is 36458.

Sample Collection and Measurement of Physiochemical Parameters

Wastewater samples were collected in different glass bottles from Sanganer and Sitapura industrial area, Jaipur (Rajasthan). Prior to collection different glass bottles were washed with 8M HNO3 solution followed by repeated washing with distilled water. Some physicochemical parameters of wastewater viz., temperature, pH, conductivity, hardness, chloride content, BOD, COD, alkalinity and TDS were measured [3].

Bacterial Isolation and Cultivation

Serial dilution method was used for isolation of bacteria from effluent using distilled water as diluent. Each of the dilution (0.1mL) was spread on Nutrient Agar (NA) plates in duplicate, which was incubated for 48 hours at 28^{o}C, and then the colonies were counted on a colony counter. Original broth culture viable cells, colony forming units (CFU) per mL, will be calculated according to the following formula:

CFU/ mL= (number of colonies X dilution factor)/ size of inoculums.

Isolated colonies were characterized and identified using standard methods.

RESULTS AND DISCUSSION

***Physicochemical Characteristics of Wastewater*:**

Table 1 shows the values of various physicochemical parameters reported in industrial effluent. Samples were collected yearly. The effluent samples collected were dark blue and grey in color. Color is the primary indicator of contamination in any effluent. Both the year samples had earthy and pungent odor. pH of the sample collected in 2013 was measured to be 8.37 and that for 2014 was 9.12. Gowrisankar *et.al*., [4], showed that textile effluents are generally alkaline in nature. Results from other previous researches of textile factory effluent, depicts the same trends in temperature and pH. Like a report of Adamjee textile mills and colony Sarhad textile mills of Pakistan showed similar results. Electrical conductivity was calculated as 3.38 and 3.14mS/cm respectively. 4972.2mg/L and 3528.84mg/L were the values of total dissolved solids (TDS) in 2013 and 2014 respectively. These TDS values were in line with a study carried on local textile mill present in Vapi, Gujarat. TDS is the measure of salinity of water said by Lokhande *et.al*., [5]. Many salts are found dissolved in water, like carbonates, bicarbonates, chlorides, sulphates, nitrates, calcium, magnese. Concentration of chlorides in 2013 was 593.16mg/L and in 2014 it was 440.73mg/L. Biological Oxygen Demand (BOD) was calculated as 326 and 411mg/L. BOD results are in line with the work by Gowrisankar *et.al*., [4] on textile mills effluent of India, he reported BOD ranging between 400-1000 mg/L. Chemical Oxygen Demand (COD) was 778mg/L for 2013 and 842.6mg/L for 2014 effluent samples. A high value of COD causes depletion of Dissolved oxygen in water. Total hardness, which comprises of Calcium hardness and magnesium hardness, was 1093mg/L and 858mg/L. Chemical Oxygen Demand (COD) is the value of oxygen required to oxidize organic matter and non-biodegradable matter present in it. It is a pollution indicator. It reflects the chemical quality of effluent.

Parameters	Year 2013	Year 2014	Standards from WHO
Color	Dark blue	Grey	-
Odor	Earthy	Pungent	-
pH	8.37	9.12	6.5- 8.5
Electrical conductivity(mS/cm)	3.38	3.14	600µmho/cm
Total dissolved solids (mg/l)	4972.2.	3528.84	2100
Chloride (mg/l)	593.16	440.73	1000
BOD (mg/l)	326	411	30
COD mg/l	778	842.6	250
Total Hardness (mg/l)	1093	858	600

Identification of bacterial strain:

Bacterial load was calculated in all effluent samples by serial dilution method. Several colonies were obtained. Gram positive and gram negative rods were obtained. A total of ten isolates were recovered; three belonging to *Bacillus* genera while three belonging to *Pseudomonas* genera. Others were *Alcaligenesfaecalis, Actinobacillus sp., E.coli* and *Proteus mirabilis* (Table 2).

The presence of these microbial communities clearly depicts that they are getting enough organic or inorganic material which they are able to utilize as substrate for their metabolism.

	Site 1	Site 2	Site 3	Site 4	Site 5
Strains	*Alcaligenesfaecalis* *Bacillus licheniformis* *Pseudomonas putida*	*Actinobacillus spp.* *Alcaligenesspp*	*Pseudomonas spp* *Bacillus brevis* *Bacillus megaterium*	*E.coli* *Proteus mirabilis*	*Bacillus licheniformis* *Pseudomonas putida* *Alcaligenesspp*
CFU/ml	12.3X10^{3}	10.2X10^{3}	11.3X10^{3}	5X10^{3}	12X10^{3}

CONCLUSION

The reality that textile industry is the major pool of water pollution and negatively effects the environment cannot be denied. The data on physicochemical investigations suggests that there is considerable difference in pollution loads in textile industries as it varies according to season and also on the work load on the mill, as per the demands.

These indigenous bacterial strains obtained from the effluents could be utilized for treatment of dye (pollutants) present in wastewater. As their presence in effluents is unnatural it means they have the capability of utilizing the pollutants present in the effluent as their metabolites and they might have the ability to degrade the toxicants to simpler compounds which do not have any harmful effects on Mother Nature. Hence it is proposed that these bacterial species has a practical application potential in the biodegradation of various dye effluents.

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