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Research article

MICROBIAL FLORA OF TEXTILE EFFLUENTS AREAS OF WESTERN RAJASTHAN

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ABSTRACT: Synthetic dyes are extensively used in Textile Industries for coloring and dyeing purpose. In this Azo, Anthraquinone, Triarylmethane dyes and many other are used in which the Azo dye represent largest and most versatile class of synthetic dyes. Approximately 10-20% of dyes released into environment through industries during manufacture and usage. This lead to one of the most pressing environmental problem due to dye contents. Many methods were applied for treatment of such pollutants which were found to be expensive and have operational problem. The microorganisms isolated were identified to species level. Majority of microorganisms were true bacteria. Since species and microbial population differences in environment of normal areas are directly proportional to the availability of carbon source (nutrient), soil acidity, oxygen level and other factors, the significant variation in species and slight difference in microbial population observed are indicative of the effect of dyes on microbial flora of given area.

Key words: Bioremediation, Biodegradation, environment, textiles effluents, dyes, pollution

INTRODUCTION

Next to the food, the second basic need of man "cloth" is supplied by processing of natural and synthetic fibers in industries called textile. A textile industry is one of the largest industries earning large amount of foreign exchange and attract public attention [1]. In order to produce quality product a number of dyes and auxiliary chemical are used producing strongly colored effluents. [3]. The effluent consist of high concentrations of dyestuff, biochemical oxygen-demand, total dissolved solids, sodium, chloride, sulphate, hardness, heavy metals and carcinogenic dyes ingredients. [9]. The inefficiency in dyeing processes has resulted in 10% -20% of unused dyestuff entering the wastewater directly [7]. Dyes are released into the environment through industrial effluents from three major sources such as textile dyestuff manufacturing and paper industries. One of the most pressing environmental problems due to the dye content. Color present in dye effluents gives a straightforward indication of water being polluted. Major classes of synthetic dyes used include azo, anthraquinone, and triarylmethane dyes and azo dyes, the largest group of all synthetic dyes represent 70% of all organic dyes used by the textile industry [8]. Azo dyes constitute a major class of environmental pollutants. With regard to their color removal by conventional treatment methods lead to severe water pollution, thus developing cost effective clean-up operations. Microbial degradation seems to be promising compared to other organisms and the method of application are simpler compared to other available methods. [4]. When there is a dyestuff, certain microorganisms, which degrade it, grow on it, degrading the crude to different components. The disappearance of dyes from the environment is attributable to the activities of the micro flora of the soil. The discovery of activities of microorganisms in the breakdown of crude to less harmful products, gave rise to bioremediation. Bioremediation involves the use of microorganisms to accelerate the natural breakdown of dyes into less harmful products. Man-made bioremediation technologies are intended to improve the effectiveness of natural biodegradation [6]. This research therefore was aimed at determining the microbial flora of the textile industrial areas of Western Rajasthan with the hope of determining possible differences and effect of such differences on the environment.

MATERIALS AND METHODS

Samples used for this study were collected from textiles areas of different location of Jodhpur, Pali and Baalotra of Western Rajasthan.

Several different samples were collected from the textile industries. Samples were labeled accordingly. Standard microbiological procedures were employed in collection and handling of the samples and they were analyzed within 24hrs of collection.

In laboratory, samples were taken in sterile test tubes. Serial dilution of each sample was made and 1ml of the required dilution added to sterile Petri dishes. The total plate count was done by the pour plate method using nutrient agar. The plates were incubated at 37˚C for 48 hrs. Total plate count (APC) was carried out using a colony counter model M.E.16. Identification characterization of bacterial genera was done according to Bergey's Manual of determinative bacteriology.

RESULTS AND DISCUSSION

Table 1. Shows the microbial population of obtained from textile effluents collected from different locations of Western Rajasthan. The average bacterial population of the different samples from textile areas was observed.

The most commonly isolated bacteria genera in textile area were *Pseudomonas, Bacillus, staphylococcus, E.Coli*, Table 2. The result showed that the sites studied had some microbiological characteristic in common. The microbial biomass of the environment were of the order 10^6 and 10^7 for bacteria showing some differences when compared with the normal microbial population. The normal microbial population is in the order of 10^5 to 10^9 bacteria per ml depending on the composition of soil and the determinative method used for analysis [2]. The bacterial population of such areas falls within this range since they were of the order 10^6 and 10^7. Difference in microbial population is a reflection of many factors such as nutrient and oxygen levels, temperature and availability of minerals.

Table-1. Total microbial population of textile effluents from Western Rajasthan.

Area		Microbial Population									
		10^{-1}	10^{-2}	10^{-3}	10^{-4}	10^{-5}	10^{-6}	10^{-7}	10^{-8}	10^{-9}	10^{-10}
Jodhpur	1	11	19	29	29	14	56	46	45	21	25
Jodhpur	2	49	28	24	28	69	20	39	37	38	17
Jodhpur	3	8	7	25	23	20	40	26	10	13	18
Baalotra	1	20	15	27	34	44	37	37	24	21	22
Baalotra	2	30	26	25	35	25	36	24	38	40	47
Pali	1	35	36	38	28	28	29	34	40	45	24
Pali	2	36	34	38	34	45	38	47	25	20	28
Average		189	165	206	211	245	256	253	219	198	181

Table-2. Bacteria most frequently isolated from textile effluents from Western Rajasthan.

S.No.	Textile effluent area	Species
1	Jodhpur	*E.Coli, Bacillus. Sps.*
2	Jodhpur	*Bacillus. Sps.*
3	Jodhpur	*Pseudomonas, E.Coli, Bacillus, Staphylococcus*
4	Baalotra	*Bacillus. Sps.*
5	Baalotra	*E.Coli*
6	Pali	*Bacillus. Sps., E.Coli, Staphylococcus*
7	Pali	*E.Coli, Staphylococcus*

Carbon (nutrient) level of a given sample increases which also effect nitrogen level in the soil and other mineral elements of surrounding areas which finally become limiting with time. The slight difference in bacterial population of these areas might be due to the effect of slight increase in the acidity of soil with dyes. Following every dyestuff, there is always slight increase in acidity of soil of affected environment mostly when the dyes compound is of high azo content.

The increase in the soil acidity of the area studied could therefore be due to high azo content in textile effluents of Western Rajasthan. This explains the slight decrease in bacterial population in textile areas. Also the depletion in the oxygen level of the textile areas contributed to the population differences.

There were no living grasses around the area with dyestuff as at the time this study was carried out which is quite different from the other environment. This could be due to oxygen depletion brought about by the dyestuffs that covered the area and also because of the increase in the soil acidity following the effluent of high azo compound. The microbial content of the sample collected from the textile areas included *Pseudomonas, Bacillus, Staphylococcus, E.Coli*, the differences in microbial population and strain of microorganisms respectively could majorly be attributed to the volume and time of drainage of dyestuff.

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