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Research Article

Analysis of Chemical characteristics in untreated and biotreated Silk dyeing effluent by *Azospirillum sp.*, and *Pseudomonas fluorescens*

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Abstract

The project work has been focused on the analysis of chemical characteristics in untreated and treated Silk dyeing effluent degraded by *Azospirillum sp.,* and *Pseudomonas fluorescens*. The Chemical characteristics were measured in terms of pH, temperature, pH alkalinity as $CaCO_3$, total alkalinity as $CaCO_3$, total hardness as $CaCO_3$, calcium, magnesium, sodium, potassium, iron, manganese, free ammonia, nitrite, nitrate, chloride, fluoride, sulphate, and phosphate were analysed in collected and biotreated effluents. The results were performed using standard methods and compared against the Global effluent requirement, 2010 to determine the highest efficiency of *Azospirillum sp.,* and *Pseudomonas fluorescens* microbes in degradation of silk dyeing effluent.

Keywords - *Azospirillum sp., Pseudomonas fluorescens,* $CaCO_3$, calcium, magnesium, sodium, potassium, iron.

INTRODUCTION

The Silk industry uses a lot of process dyes generating about 3773 metric tons per annum (MTA) of hazardous waste of which only 3.25% is recyclable. Dyeing process emit volatile organic compounds (VOCs) (Nupur Bahl, 2009). The essential need for the small scale industries a low-cost efficient method for biotoxification of toxic compounds and also should offer environmentally friendlier. The ubiquitous nature of bacteria makes invaluable tools in the effluent biotreatment (Maier *et al.,* 2004). Microbial decolorization and degradation is an environment friendly and cost – competitive alternative to chemical decomposition process (Verma and Madamwar, *et al.,* 2003). Bacteria such as *Pseudomonas sp.,* and *Azospirillum sp.*, are the micro-organisms that effectively decompose organic pollutants through co-metabolism in natural water and soil environment. (Anderson, T.A *et al.,* 1993; Curl. E. A *et al.,* 1986). So the chemical characteristics which will be high in the untreated effluent may change in the biotreated effluent was analysed.

The aim of the study was to know the differences in the chemical characteristics of untreated and biotreated effluent (by *Azospirillum sp* and *Pseudomonas fluorescens*) as well as to check the efficacy of maximum reduction of two biotreated effluents.

MATERIALS AND METHODS

Collection of Silk dyeing effluent

The Silk dyeing effluent was collected from Small scale industry in Seelanayakanpatti near Salem.

Collection of Biofertilizers

The Biofertilizers such as *Pseudomonas fluorescens,* and *Azospirillum sp.* were collected from Tamil Nadu Agricultural University, Coimbatore.

Inoculation of biofertilizers *Pseudomonas fluorescens* and *Azospirillum sp.* in silk dyeing effluent

The collected silk dyeing effluent was inoculated with a loop of culture from different cultivated medium of biofertilizers *Pseudomonas fluorescens* (in King's B medium)and *Azospirillum sp*.(in Azospirillum medium) in separate flasks incubated at 28 ^{0}C in shaking incubator at 150rpm for 10 days and then subjected to chemical analysis.

Chemical characterization

1. Identification of pH

The analysis pH in Silk dyeing effluent was by Potentiometric method .

2. Identification of Temperature

The Temperature analysis in Silk dyeing effluent was by Mercury Thermometer was determined.

3. Estimation of pH Alkalinit

The pH Alkalinity was determined by the protocol of Natarajan *et al.*, 1988.

4. Estimation of Total Alkalinity

The Total Alkalinity was determined by the protocol given in APHA, 1995.

5. Estimation of Total Hardness

The Total Hardness was determined by the procedure given in APHA, 2005.

6. Estimation of Calcium

The Estimation of Calcium was determined by the protocol given in APHA, 2005.

7. Estimation of Magnesium

The Estimation of Magnesium was determined by the protocol given in APHA, 2005.

8. Estimation of Sodium and Potassium

The Estimation of Sodium and Potassium was determined by the protocol given in Natarajan *et al.*, 1988.

9. Estimation of Iron

The Estimation of Iron was determined by the protocol given in Shanmugam *et al.*, 1994.

10. Estimation of Manganese

The Estimation of Manganese was determined by the protocol given in by Persulphate Spectrophotometric Method.

11. Estimation of Free ammonia

The Estimation of Free ammonia was determined by the protocol given in APHA, 1995

12. Estimation of nitrite

The Estimation of nitrite was determined by the protocol given in APHA, 2005

13. Estimation of nitrate

The Estimation of nitrate was determined by the protocol given in APHA, 2005

14. Estimation of Chloride

The Estimation of Chloride was determined by the protocol given in Vogel, 1978.

15. Estimation of Fluoride

The Estimation of fluoride was determined by the protocol given in APHA, 2005.

16. Estimation of Sulphate

The Estimation of sulphate was determined by the protocol given in APHA, 2005.

17. Estimation of Phosphate

The Estimation of phosphate was determined by the protocol given in APHA, 1995.

RESULTS AND DISCUSSION

The table 1 and figure 1, 2 indicate the chemical characteristics of untreated and biotreated effluents. The pH range was maintained between 6-9.The biotreated effluent by *Azospirillum sp.* and *Pseudomonas fluorescens* were basic in nature. Though the GER limits (2010) is 37°C the collected effluent from the spot area 45°C was reduced to room temperature 27°C. Last few decades many microorganisms have been found to be capable of degrading dyes, these include bacteria in treating waste water (Palanivelan Ramachandran *et al.*,2013).The biotreatment with *Azospirillum sp.* as well as *Pseudomonas fluorescens* did not change pH alkalinity as $CaCO_3$ (20mg/l).The total hardness as $CaCO_3$ (which is calculated by the sum of Ca and Mg ion concentration levels) was reduced by both *Azospirillum sp.* and *Pseudomonas fluorescens*. Among the two organisms used *Pseudomonas fluorescens* alone had shown the total hardness within the WHO standards limits (2010).The levels of calcium, magnesium, iron, free ammonia, chloride, fluoride, sulphate and phosphate of silk dyeing effluent were within the prescribed limits before biotreatment and were reduced maximally after biotreatment by *Pseudomonas fluorescens* and *Azospirillum sp*. The manganese level was not detected in both untreated and biotreated samples. The sodium and nitrate of the effluent were above the set limits which were highly reduced by biotreatment II. Similar reduction was also detected for nitrite. In case of potassium the value has increased in biotreatment II effluent .The results revealed that the *Pseudomonas fluorescens* had efficiently reduced the physiochemical characteristics of the silk dyeing effluent when compared to the *Azospirillum sp.*

1.1 Comparison of untreated and treated chemical characterization of silk dyeing effluent with standard set limits.

The Chemical parameters of silk dyeing effluent of untreated and biotreatment I, II with *Azospirillum sp., Pseudomonas fluorescens* resp., were pictorially represented in the table I, figure 1and 2.

SUMMARY AND CONCLUSION

On analysis of the chemical parameters such as total alkalinity, total hardness, sodium and nitrate were above the set limits in untreated effluent .The silk dyeing effluent II treated by *Pseudomonas fluorescens* reduced it in maximum level than compared to the biotreatment by *Azospirillum sp.* All other parameters were below the standard limits. Thus this shows the silk dyeing effluent degradation in case of chemical parameters were high by *Pseudomonas fluorescens* and recommended to small scale silk dyeing industries to utilize this biofertilizers.

Table 1

1. Chemical Examination of Treated Silk Dyeing Effluent

S No	Parameters	GER Limits (Global Effluent Requirement, 2010)	Initial Results of collected effluent	Effluent biotreated with *Azospirillum sp.* (Biotreated effluent I)	Effluent biotreated with *Pseudomonas fluorescens* (Biotreated effluent II)
1.	**pH**	6-9	9	7.9	7.9
2.	**Temperature ◦C**	37◦C	45◦C	28◦C	27◦C
3.	**pH Alkalinity as $CaCO_3$**	-	20	20	20
4.	**Total Alkalinity as $CaCO_3$**	500mg/l(WHO ,1990)	280	240	229
5	**Total Hardness as $CaCO_3$**	<345 mg/l (WHO,1990)	520	380	327
5.	**Calcium as Ca**	<380 mg/l (WHO,1990)	139	101	89.5
6.	**Magnesium as Mg**	<190 mg/l (WHO,1990)	50	41	30
7.	**Sodium as Na**	<90 (Water act, 1984)	108	83	32
8.	**Potassium as K**	-	12	11	3
9.	**Iron as Fe**	<3 mg/l	0.48	0.41	0.36
10.	**Manganese as Mn**	<2 mg/l	ND	ND	ND
11.	**Free ammonia as NH_3**	<5 mg/l	0.12	0.11	0.11
12.	**Nitrite as NO_2**	-	0.04	0.04	0.03
13.	**Nitrate as NO_3**	<10 mg/l	26	22	8
14.	**Chloride as Cl**	<1000 mg/l (EPA,2010)	200	198	170
15	**Fluoride as Fl**	<2 mg/l	1.4	1.3	0.8
16.	**Sulphate as SO_4**	<1000 mg/l (EPA,2010)	60	60	60
17.	**Phosphate as PO_4**	<5 mg/l	0.09	0.10	0.15

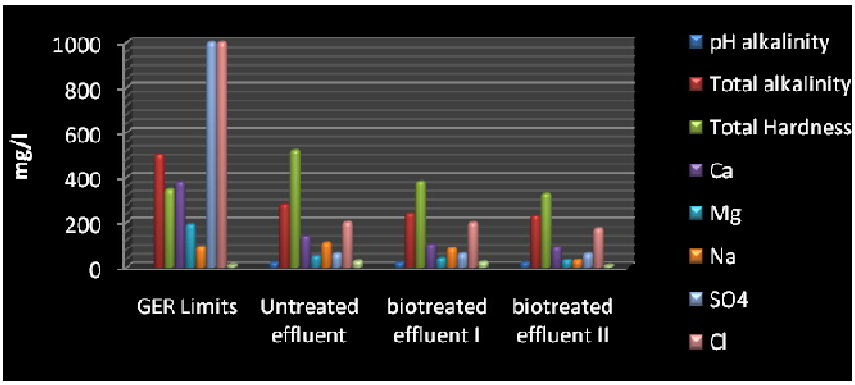

FIGURE 1

Chemical Characterisation of Untreated and Biotreated silk dyeing Effluent.

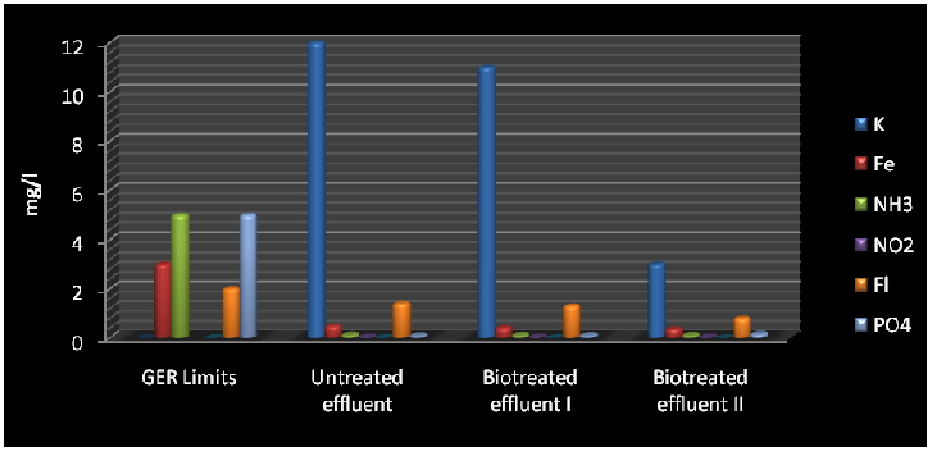

FIGURE 2

REFERENCES

1. Anderson TA, Guthire EA, Watton BT. Bioremediation in the rhizosphere. Plant roots and associated microbes clean contaminate soil. Environ. Sci.Technol.1993; 27: 2630.
2. APHA. Standard methods for the examination of water and wastewater, 19th edition. American public health association, Washington, DC.1995.
3. APHA. Standard methods for the examination of water and wastewater, 21th edition. American public health association, Washington, DC.2005.
4. Curl EA, Truelove B. The rhizosphere. Spring Verlag Heidelberg, Berlin, 1986.
5. Kamlesh nath, Dharam singh and yogesh kumar Sharma. Combinatorial effects of distillery and sugar factory effluents in Crop plants. Journal of environmental biology 2007;28(3): 577-582.
6. Maier J, Kandelbauer A, Erlacher A, Cavaco-Paulo A, Gubits GMA new alkali –Themostable azoreductase from bacillus sp., strain SF.Appl. Environ. Microbial. 2004;70: 837-844.
7. Natarajan S, Selvakumar G, Chandrabose MS and Shanmugam K. Method of water analysis, I edition, Books world Publication, Coimbatore. 1988: 3-20.
8. Nupur Bahl. Low cost effluent treatment plants for small scale industries –Need for experience of dyes and Inputs. www.indiawaterportal.org. 2009
9. Palanivelan ramachandran, Rajakumar sundharam, Jayanthi palaniyappan and Ayyasamy pudukkadu munusamy. Potential process implicated in bioremediation of Textile effluents: A Review. Pelagia research library 2013;4(1): pp 131-145.
10. Shanmugam M, Valliappan K, Poongothai S and Rani perumal. Soil and plant analysis for micronutrients and sulphur, TNAU, India.1994;11-12.
11. Verma P, Madamwar D. Decolorization of synthetic dyes by a newly isolated strain of Serratia marcescans. World J.Microbial.Biotechnol.2003; 19:615-618.
12. Vogel. Text book of quantitative inorganic analysis, IV edition, ELBS, London.1978