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Research Article

GREEN AND CLEAN TECHNOLOGY FOR INDUSTRIAL EFFLUENT TREATMENT USING INDIGENOUS BACTERIAL CONSORTIUM

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ABSTRACT

Effluent produced by the cellulose and textiles industries contains inorganic and organic substances. These can only be removed by pretreatment of the wastewater followed by biological treatment. The microbes help to accelerate the degrading process. Some bacteria are isolated from environment playing a fabulous role in improving the quality of waste water. The present study was conducted to find out the potential of bacteria for reducing the hardness and total dissolve solid in effluent. Three microbial cultures SLB8, QY, QAC showed capability to reduce TDS and Hardness and increase the pH. Maximum TDS reduced by SLB8 13% followed by QY 7% and QC 5% and Hardness decreased by QAC 35% followed by SLB8 28 % and QY 20 %. Maximum pH value was increased by SLB8 6.63 followed by QY 6.57 and QAC 6.0. Such method is very economic and eco-friendly, it can be useful for large scale effluent treatment.

INTRODUCTION

Environmental problem occurs through effluent produce by various industries e.g. cellulose fiber and textiles industry, combined with the higher cost of reuse and recycling of this effluent (Vida *et al*. 2007, Vilascca *et al*. 2010). Waste water of Effluent Treatment Plant (ETP) in different production steps of a cellulose fiber industry have high range of Hardness, Total dissolved solid and pH (Kumar *et al*. 2007, Tufekci *et al*. 2007). It is a complex and highly concentrated mixture of many polluting substances, color reagents, dyes, inorganic salts like sodium sulphate, calcium carbonate, ammonium chloride and organic compound (Brown and Laboueur 1983).

Total dissolve solid (TDS) was measured by variety of compound like organic and inorganic salts that are dissolved into water during industrial process. Sulphate and carbonate compound are frequently found in effluents which is cause of increasing the level of TDS. When water passes through or over deposits such as limestone, the levels of $Ca^{2+,}$ Mg^{2+}, and HCO_3^- ions present in the water can greatly increase and cause the water to be classified as hard water (APHA 1985)

These can affect adversely on human health as either acute or chronic disease, livestock and agricultural production around the industry and its disposable site can also be hampered. Waste prevention, recycling, minimization and the use of energy efficient processes technologies are more desirable option in treatment of effluents. Bioremediation can involve indigenous microbial populations with or without nutrient supplementation, or it can involve inoculation of exogenous organisms into the site, whereas when exogenous organisms are added, the process is called bioaugmentation (Mrozik and Seget 2010)

To study the physicochemical parameters (pH, TDS, Total Hardness) of wastewater from effluents treatment plants of cellulose fiber industry. To isolate and identify the microbes which help in the effluent treatment and preparation of microbial consortium. To ascertains the bioremediation potential using bacterial isolate and consortium from industrial effluent for physicochemical parameter.

MATERIALS AND METHODS

Physical, chemical, organic and biological parameters were analyzed to evaluate wastewater pollution. For quantitative analysis of wastewater, pH, TDS and hardness test and bacterial growth measurement were considered.

Screening of bacteria isolates

Isolates of Non- native bacterial culture which was not present in the industrial effluent was obtained from environmental pollution site and used for biodegradation of industrial effluent. Soil and water suspension was prepared. Bacterial isolates were obtained by serial dilution and spread plate method (Abo-State *et al*. 2010). The bacterial isolates were separately grown in

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submerged culture in a minimal salt medium. Minimal salt medium (gl^{-1}) : $MgSO_4$ - 0.1 , KH_2PO_4 – 0.1 , NH_4NO_3 –2.0 , K_2HPO_4 - 7.0, $C_6H_5Na_3O_7$ - 0.5 , 1% carboxy methylcellulose (CMC) as carbon source , Distilled water – 1.0 L , pH -7.0 (Ekperigin *et al.*2007).

Inoculums and consortium preparation

Minimal salt medium were prepared, 0.1ml fresh inoculum was added in 100ml of the medium containing 250ml conical flask then incubated at 37°C and 120 rpm for optimum growth in incubator (Scigenics Biotech, ORBITEK). Equal amount of culture broth from the selected isolates were used to prepare the bacterial consortium (QY and QAC). Growth of potential isolates at regular intervals of 24 hrs was determined by measuring absorbance at 600 nm using UV visible spectrophotometer (Systronics UV Spectrophotometer 117).

Preparation of inoculum: waste water ratio

Fresh bacterial culture (24 hrs old) was inoculated in waste water sample in the ratio 1:9. They were kept in shaker incubator at 150 rpm at 37 °C for a period of 72hrs. The growth was monitored at regular time intervals of 24 hrs up to 72hrs through measuring absorbance by Spectrophotometer (Systronics UV Spectrophotometer 117) at 610nm.

Measurement of pH value

The measurement of pH was done by using a pH meter (Systronics µ pH SYSTEM 361). The pH meter was calibrated with standard buffer solution of pH 4 and 7 making adjustments for temperature and asymmetry potential required from the instrument. The electrode was removed from the buffer and rinsed with the sample and after adjustment the pH was recorded (Chergui *et al.*2013)

Total dissolved solid (TDS) analysis

The TDS was measured by using TDS meter (PNS Genuine TDS Meter Digital HM-TDS).Taking a 50 ml of sample wastewater in a beaker, probe of the TDS meter was rinsed with distilled water and cleaned, firstly the accuracy of meter was checked by immersing probe in distilled water then, used for sample, making sure that the sensor was accrued until the reading was stabilized (Gilbert *et al.*1992).

Total Hardness analysis

Total hardness was obtained by titrating a sample solution with a 0.1N ethylenediamine acetic acid (EDTA) solution by using Erichrome black T indicator until the color changes from purple to blue. Approximate 50 ml of water sample was accurately transferred into 250 ml conical flask and then 2ml of buffer solution were added stirred and mixed with well until dissolved. After that the mixture was titrated with 0.01N EDTA solution until the color changes from purple to pure blue (Prasad and Patil 2008)

Statistical Analysis

One-way analysis of variance (ANOVA) was run using the Statistical Analysis System (SAS/STAT(R) 9.22). Tukey HSD test was used to determine the significance of differences within TDS, Hardness, and pH on growth of bacterial isolates.

RESULTS AND DISCUSSION

In present study microbial cultures SLB8 and consortium QAC and QY were isolated and pH, TDS and Total Hardness of wastewater of ETP in presence of microbial culture were analyzed. The total hardness was major parameter of effluent water which is average between 800 to 1000 ppm. The value of pH was 6.0, TDS was 1450 and total hardness was 920 at 0 hr. Figure 1 is indicating the growth pattern of these bacterial culture (Absorbance versus time) and Figure 2 showed the pH value (0-7), TDS (percentage) and Hardness (percentage) represented in Figure 3 and 4 at regular interval (0 to 72 hrs) respectively.

The efficiency of microbial inoculums on TDS and total hardness reduction is shown. It indicated the difference in TDS and hardness removing ability of microbial consortium. The probability of this result, assuming the null hypothesis, is 0.020. Values were considered to be significantly different when $P < 0.05$. The pH of ETP wastewater before degradation is acidic in nature but after added bacterial inoculums QY, QAC, SLB8 into effluent sample, the value of pH was shifted towards neutral state. pH value in case of SLB8 was 6.63 followed by QY (6.57 pH) and QAC (6.0 pH), after 72 hrs of incubation SLB8 showed near to 7.0 pH. The result indicates the strength of the microbes to considerably degrade the effluent. This is in agreement with report of Noorjhan *et al.* (2014).TDS of ETP water sample before individual microbes and consortium was 1450 ppm which is beyond the permissible limit level ($100mgml^{-1}$) according to CPCB (1995). but after the addition microbial culture into sample in 1:9 ratio, degradation started and reduced the (TDS) upto 13% by SLB8, 7% by QY, 5% by QAC. TDS are the major kind of pollution, this type of microbial degradation results are scale up studies for ETP wastewater at pilot scale is required.Total hardness of the ETP sample before application of microbial culture was beyond the permissible limit due to the presence of inorganic salt like calcium carbonate, sodium sulphate. The bacterial consortium QAC reduced the level of total hardness up to 35% followed by SLB (28%) and QY (20%) in 72hrs incubation.

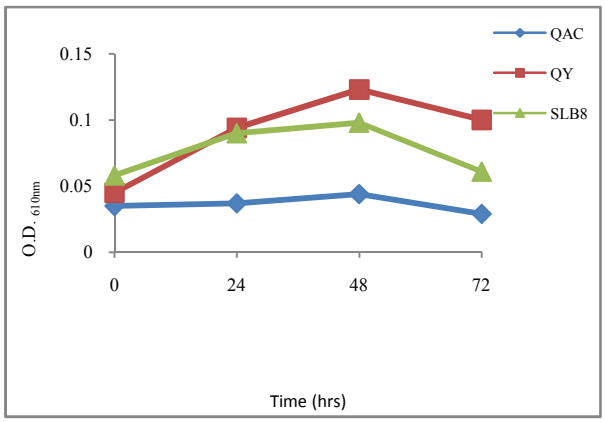

Fig. I Growth pattern of SLB8, QAC and QY in presence of effluent sample

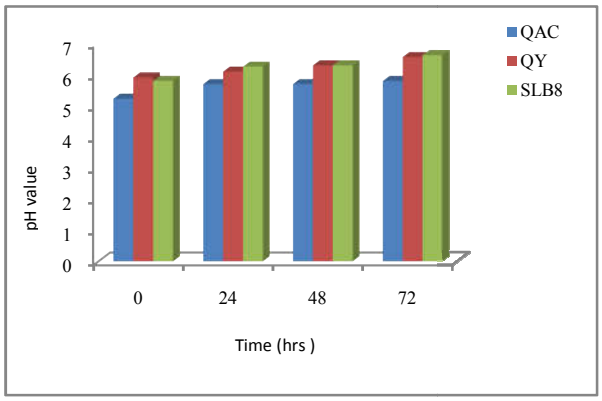

Fig. II pH increase by QAC, QY and SLB8 of ETP

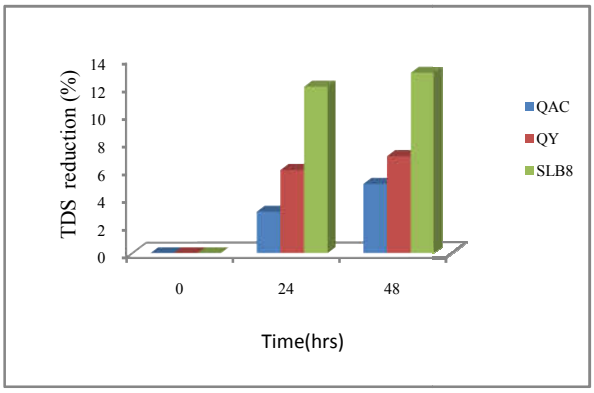

Fig. III Reduction in TDS (%) by QAC, QY and SLB8 of ETP

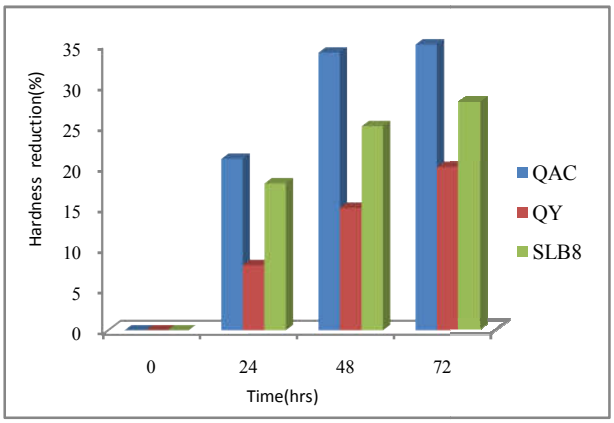

Fig. IV Reduction in Hardness (%) by QAC, QY and SLB8 of ETP

CONCLUSION

On the basis of above findings it can be concluded that the TDS and Hardness of wastewater is significantly reduced in the presence of potent bacterial consortium and individual isolate. The so called Micro-bioremediation can further be beneficial to pilot scale studies in industry for waste water purification, which can be recycled and reused reducing the water pollution to generate eco-friendly technology for green and clean environment.

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References

Abo-State M.A.M., Hammad M.A.M., Swelim, M. and Gannam, R. H. (2010): Enhanced Production of cellulase (S) By *Aspergillus* spp. Isolated from Agriculture Wastes by Solid State Fermentation. American-Eurasian *J. Agric. Environ. Sci.*, 8 (4): 402-410

APHA (1985): Standard Methods for the examination of water and waste water, 18th Edition: American Public Health Association, Washington D.C

APHA (1998): Standard Methods for the examination of water and waste water, 20th Edition: American Public Health Association, Washington D.C

Brown, D. and Laboureur, P. (1983): The Aerobic Biodegrability of Primary Aromatic Amines. *Chemosphere*, 12: 405 – 414

Chergui, F. H., Errahmani, M. B., Benouaklil, F., and Hamaidi, M. S. (2013): Preliminary Study on Physico-Chemical Parameters and Phytoplankton of Chiffa River (Blida, Algeria). *Journ. of Ecosyst*. 1: 1-9

CPCB (1995): Pollution Control: Acts, rules and modifications. Central Pollution Control Board, New Delhi

Ekperigin M.M. (2007): Preliminary studies of cellulase production by Acinetobacter anitratus and Branhamella sp. *Africa. Journ. of Biotechnol.* 6 (1): 028-033

Kumar, P. Prasad, B. Mishra I M and Chand S (2007): Catalytic thermal treatment of desizing wastewaters, Jour. of Hazard. *Materi.* 149 (1): 26-34

Mrozik, A. and Seget, Z. P. (2010): Bioaugmentation as a strategy for cleaning up of soils contaminated with aromatic compounds. *Microbiolog. Resea*. 165 (5): 363–375

Noorjahan, C.M. (2014): Physicochemical Characteristics, Identification of Bacteria and Biodegradation of Industrial Effluent. *J. Bioremed. Biodeg*. 5 (3): 219

Prasad, N.R. and Patil, J.M. (2008): A study of physico-chemical parameters of Krishna river water particularly in western Maharashtra. *Rasayan J. Chem*. 1 (4): 943-958.

Singh, S.N. and Srivastav, G. and Bhatt, A. (2012): Physicochemical Determination of Pollutants in Wastewater in Dheradun. Curr. *World Environ*. **7**(1): 133-138.

Talarposhti, A.M., Donnelly, T. and Anderson, G.K. (2001): Colour removal from a simulated dye wastewater using a two-phase anaerobic packed bed reactor, *Water Res*., 35: 425–432

Tufekci, N., Sivri, N. and Toroz, I. (2007): Pollutants of Textile Industry Wastewater and Assessment of its Discharge Limits by Water Quality Standards. *Turk. J. Fish. Aquat. Sci*. 7: 97-103

Vida, M., Akbar, S. and Zahra, G. (2007): Biodegradation of effluents from dairy plant by bacterial isolates**.** *Iran. J. Chem. Eng*, 26: 55–59

Vilaseca, M., Gutie, M.C., Grimau, V.L., Mesas, M. L., Crespi, M. (2010): Biological Treatment of Textile Effluents after Electrochemical Oxidation of Reactive Dyes. *Water Environ. Res*. 82:176-181

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