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Research Article

BIOLOGICAL TREATMENT USING MIXED FUNGAL CONSORTIUM IS THE MOST EFFECTIVE FOR TEXTILE DYE WASTEWATER TREATMENT

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ABSTRACT
Dyes from industrial effluents have created havoc in environment and has caused water pollution. The dye wastewater is poisonous and toxic to the flora and fauna in water bodies and should be treated by physical, chemical or biological techniques. There are constructed dye wastewater treatment plants where dye wastewater is subjected to primary, secondary and tertiary treatments. The physic-chemical modes of treatment are of high cost and the chemical methods may lead to the formation of large amount of sludge. Thus biological treatment utilizing fungi, bacteria and actinomycetes, algae etc are ecofriendly and have bioconcern. The present investigation proves that biological treatment using fungi is better than any mode of decolorization.

Key Words: *Dyewastewater, Biological, Physic-Chemical, Treatment Plants*

INTRODUCTION
The effluent from textile dye wastewater has high amounts of TDS, BOD and COD and has low DO (Eswaramoorthi *et al.*, 2008). Physicochemical methods of coagulation and adsorption of dye particles can be performed in treatment plants.
The dye wastewater treatment has been of major concern in recent times as they are maximally carcinogenic causing mutagenic effects (Arslan and Seremet, 2004). However, textile industries in India have great economic benefits and are major source of income.
These cannot be removed. Thus treatment path is more essential to form potable water from effluent.among physical processes advanced oxidation processes ($O3$, $O3/H2O2$, $O3/UV$, $UV/H2O2$, $O3/UV/H2O2$ and $Fe2+/H2O2$) for the degradation of nonbiodegradable organic contaminants in industrial effluents are attractive alternatives to conventional treatment methods. AOPs include hydrogen peroxide ($H2O2$), ozone ($O3$) and UV irradiations, which have proved to be much efficient treatment processes. AOPs based on the generation of very reactive and oxidizing free radicals have been used with increasing interest due to their high oxidant power. Bacteria, algae, actinomycetes and fungi are been of better concern in treatment technologies.
This paper reviews on the tools of purifying dye wastewater and recycling it for consumers to make it potable for washing, bathing and drinking purposes, which are fungi being better degraders than other modes of decolorization.
Textile industry effluents are known to present extreme variations of pH, high temperature, and high concentration of dissolved solids (both Total Dissolved Solids and Total Suspended Solid) and dissolved salts. Textile dye wastewater can be classified in 3 classes according to Chemical Oxygen Demand (COD) content and color density; high, average and low intense wastewater. High intense
Waste water has COD concentration over 1500mg/l and very low light permeability (Lın and Peng, 1994).
Dissolved Solids in dye wastewater- These can be salts, calcium, magnesium, ions in large contents.
Color in dye wastewater- Color particles/dye particles are the source of mutations and are harmful.
Toxic metals in dye wastewater- These are carcinogenic like Copper, cadmium, iron, mercury, arsenic etc
Organic pollutants in dye wastewater-Organic pollutants result from toxicity death of flora and fauna, organic compounds in large extent, carbon compounds from dye industry etc.

MATERIALS AND METHODS

Methodology

In the present investigation the dye effluent from Sanganer environ, Jaipur was collected from a drain in Mohana industrial area, and was divided into 5 parts named as samples 1, 2, 3, 4 and 5 respectively. These were utilized for degradation by physico-chemical and biological methods. One liter of each sample was taken and to this, treatment was carried out in different ways viz. physico-chemical and biological. The percent decolorization was calculated on the basis of optical density of the degraded medium.

$$\text{Percent decolorization} = \frac{\text{OD initial} - \text{OD final}}{\text{OD final}} \times 100$$

RESULTS AND DISCUSSION

In the present investigation it was observed that physical ways like addition of alum and activated charcoal did not show as good results as compared to addition of bacterial consortium and fungal consortium. Also, the fungal consortium was by far the better degrader than bacteria. In 10 days the results were seen to be satisfactory but on the 20th day the fungal consortium showed 100% decolorization of dye wastewater effluent.

Physico-Chemical and Biological Methods of Dye Effleuent Treatment

Some physical methods like adsorption, irradiation and ion-exchange are effective and proven technology having potential application in wastewater treatment. Some absorbents like chitin, which contain amino nitrogen, tend to have a significantly larger adsorption capacity in acid dyes. Many adsorbents made from waste materials, for removal of dye and colored organic matters from aqueous media are of low cost (Bousher *et al.*, 1997). The activated carbon having a high adsorption capacity for both acid and basic dyes, is most common method of dye removal by adsorption (Nassar *et al.*, 199l).The adsorption method has difficulties in the treatment of insoluble dyestuffs wastewater and it is difficult to find the desorption process (Kuo *et al.*, 1992; Kim *et al.*, 2002). Irradiation process is effective for removal of a wide range of colorants at low volume, but in this treatment dissolved oxygen requirement is very high. Ion exchange cannot accommodate a wide range of dyes and further perform poorly in the presence of other additives in wastewater. Chemical methods like coagulation and flocculation are generally used in order to eliminate

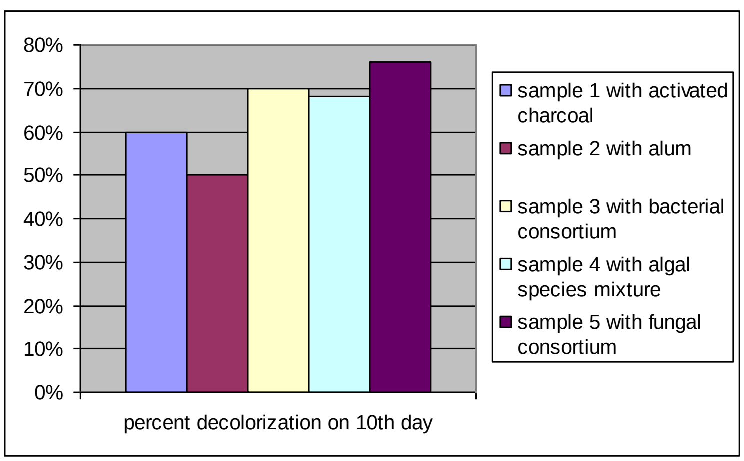

Figure 1: Percent decolorization calculated by utilizing physicochemical treatment methods and biological methods on 10th day

organic materials. Coagulant materials are usually effective on decomposed dyeing substance. Coagulation is effective for treatment of insoluble dyestuff wastewater but not so effective for soluble

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dyestuff wastewater (Kang *et al.*, 2000; Kuo *et al.*, 1992). The disadvantages of the method are excessive cost, excessive mud and cost for removing that mud (Gaehr *et al.*, 1994). The high cost of chemicals for precipitation as well as for pH adjustment, problem associated with dewatering and disposing of generated sludge and high concentration of residual action levels which remains in the supernatant is some of the limitations of this method.

Most of the biological processes are effective in removing chemical oxygen demand (COD) and turbidity whereas they are not effective in removing color (Lin *et al.*, 1997). An anaerobic step followed by an aerobic step may represent a significant advancement in biological treatment and decolourization in future (Bahorsky, 1998). In the present investigation it was observed that biological treatment utilizing bacteria and fungi was better than physic-chemical treatment.

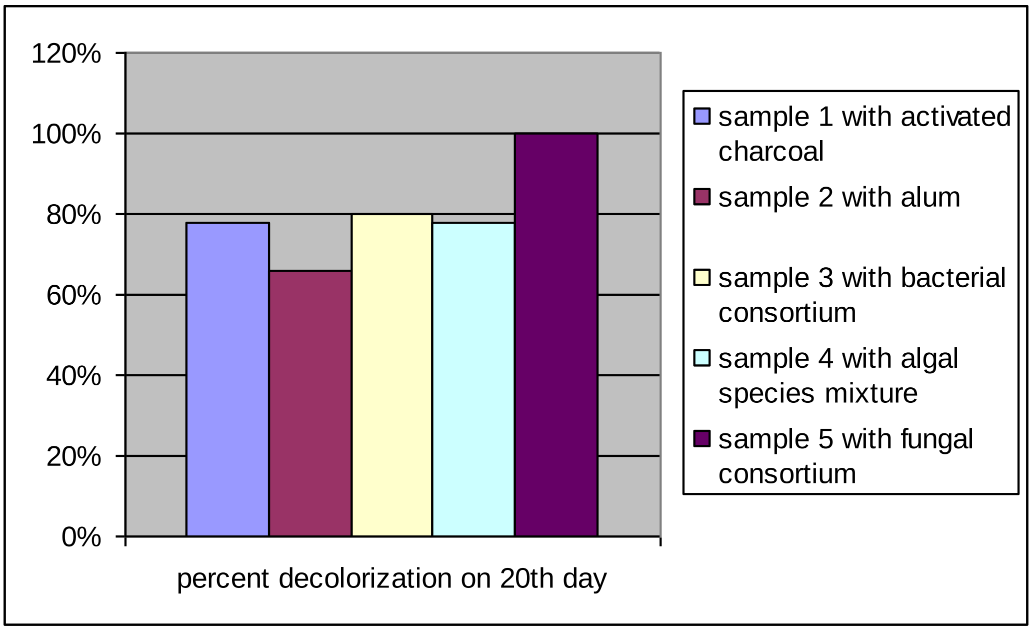

Figure 2: Percent decolorization calculated by utilizing physicochemical treatment methods and biological methods on 20th day

Process Water Re-Use

The impacts on the environment by textile industry have been recognized for some time, both in terms of the discharge of pollutants and the consumption of water and energy. The textile sector has a high water demand. Its biggest impact on the environment is related to primary water consumption (annual 839.8 million m3 of finished textile) and waste water discharge annual 637.3 million m3. Therefore, reuse of the effluents represents an economical and ecological challenge for the overall sector. The cleaning process depends on the kind of wastewater (not every plant applies the same production process) and also on the amount of used water. Water savings in textile processing industries can be made by recovering and re-using of water at processes itself. There are few areas where reuses options can be examined by the units listed hereunder:

• Recycling of final wash water after bleaching as wash water for second scouring step or for earlier bleaching steps.
• Reusing bleaching wash water to start another bleaching batch.
• Re-use of hot bleach water for starting optical brightening batch.
• Re-use of optical brightening wash water to start another batch of optical brightening batch.
• Final wash water of cone scouring and bleaching can be used as wash water for scouring and bleaching.

Conclusion

Water use in textile industry is very high due to a combination of factors including obsolete process technology, poor recycling and reuse practices and poor wastewater treatment. Advanced oxidation processes for the treatment of textile effluents are promising methods for purification aimed at reuse of textile wastewaters, resulting in direct environmental and economic benefits. These methods provide complete removal of color and reduce recalcitrant wastewater loads from textile dyeing and finishing effluents and treated waters can be reused satisfactorily in dyeing process. It is quite difficult to define a general quality standard for textile water reuse because of the different requirements of each fiber (Silk, cotton, polyester etc.), of the textile process (e.g., scouring, desizing, dyeing, washing, etc.) and the different quality required for the finalized fabric. It appears that advanced oxidation processes are preferable option compared to other wastewater treatment techniques because of the constant quality of effluent that is almost completely softened and free of color and surfactants.

REFERENCES

Arslan I and Seremet O (2004). Advanced Treatment of Biotreated Textile Industry Wastewater with Ozone, Virgin/Ozonated Granular Activated Carbon and Their Combination, *Journal of Toxic/Hazardous Substances & Environmental Engineering* **39**(7) 1687-1700.

Bahorsky MS (1998). Emerging Technologies for colour removal, no. Caroline. Div Pollu, Prevention Seminar, Sure 17, Chalotte NC.

Bousher A, Shen X and Edyvean RGJ (1997). Removal of coloured organic matter by adsorption onto low cost waste materials. *Journal of Water Research* **31**(8) 2084–2092.

Eswaramoorthi S, Dhanapal K, and Chauhan DS (2008). Advances in textile waste water treatment: the case for UV ozonation and membrane bioreactor for common effluent treatment plants in Tirupur, Tamil Nadu, India, Environmental Technology Awareness Series 1-17.

Gaehr F, Hermanuts F and Oppermann W (1994). Ozonation-An Important Technique to Comply With New German Laws for Textile Wastewater Treatment, *Water Science and Technology* **30**(3) 255-263.

Kang SF, Liao CH and Po TS (2000). Decolorization of textile wastewater by photo-Fenton oxidation technology. *Journal of Chemosphere* **41** 1287–1294.

Kang SF, Liao CH and Po TS (2000). Decolorization of textile wastewater by photo-Fenton oxidation technology. *Journal of Chemosphere* **41** 1287–1294.

Kim SH, Kim TW, Cho DL, Lee DH, Kim JC and Moon H (2002). Application of Characterization Procedure in Water and Wastewater Treatment by Adsorption. *Journal of Chemical & Engineering* **19** 895-891.

Kuo WG (1992). Decolourizing Dye Wastewater with Fenton's reagent. *Journal of Water Research* **26**(7) 881- 886.

Lin SH and Lo CC (1997). Fenton process for treatment of desizing wastewater, *Journal of Water Research* **31** 2050-2056.

Lin SH and Peng CF (1994). Treatment of Textile Wastewater by Electrochemical Method, *Journal of Water Research* **28** 277-82.

Nassar MM and El-Geundi MS (1991). Comparative cost of colour removal from textile effluents using natural adsorbents. *Journal of Chemical Technology & Biotechnology* **50** 257–264.