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Effect of egg waste treatment on the microbial load of textile dye effluent

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ABSTRACT

Samples of textile dye effluent collected from Chinnalapatti were analysed for the microbial load characteristics including bacterial, fungal and actinomycete count. Biotreatment of textile dye for 21 days with egg membrane and egg shell waste could reduce the microbial load especially that of actinomycetes and fungi. The advantages of egg wastes in the biotreament of textile dye effluent are discussed.

KEYWORDS

Textile dye effluent;
Microbial load;
Egg membrane;
Egg shell.

INTRODUCTION

Industries produce large quantities of effluents, which have polluted adjoining sites to a considerable extent causing hazards to human population, flora and fauna[1]. Synthetic dyes are used extensively in textiles; paper printing and dye houses and effluent of these industries are highly colored. Direct discharge of this waste results in the formation of toxic aromatic amines under anaerobic conditions in receiving water[2]. The release of colored effluent into the environment is of growing concern, as color is visible pollutant that is increasingly being regulated in several countries[3]. It has been reported that 10% of total dye stuff used globally is released into the environment[4]. Though physical and chemical methods of treatment are available for treatment of such wastes, they are expensive and generate a large volume of sludge[5]. According to Azmi *et al*[6] biological treatment is cost- effective and environmentally friendly option. Several low cost biosorbents have been tried in effluent treatment processes[7]. Egg wastes are reported to possess adsorption properties[8]. Hence in the present study, egg wastes like egg membrane and egg shell were employed to study their effect on microbial load of textile dye effluent.

MATERIALS AND METHODS

The samples of textile dye effluents were collected from a textile-dyeing unit near Chinnalapatti village, which is sixty five kilometers away from Madurai. They were brought to the laboratory in polyethylene containers. Employing standard protocols, actinomycetes, fungi and bacterial counts were enumerated both in the textile dye effluent and the soil samples collected from effluent contaminated sites[9]. In the second part of the study microbial groups actinomycetes, fungi and bacteria were enumerated in textile dye effluent of two concentrations (50 and 100%) prepared by dilution with tap water, after twenty one days of treatment with egg membrane (0,3,4,5 and 6 grams) and egg shell (0,50,100,150 and 200grams) separately. Broken egg shells of approximately 1cm diameter were used for the experiment. Egg membrane was collected from

boiled eggs after removing the shell. Throughout the experiment the troughs of control and experimental sets were kept unstirred.

RESULTS AND DISCUSSION

TABLE 1 shows the microbial count of the textile dye effluent. Actinomycetes and fungal counts were 3.32×10^6 and $7.4x10^6$ CFU/ml respectively. Bacteria were too numerous to count. For the microbial load of the soil samples collected from textile dye contaminated sites, among the three groups of microbes enumerated, bacteria were numerous followed by actinomycetes and fungi.

Effect of egg membrane treatment on the microbioal count of textile dye effluent after twenty one days of treatment is shown in TABLE 2. In general, decline in actinomycetes and fungal counts were observed. Actinomycetes count was nil for four gram egg membrane treatment in both 50 and 100% textile dye effluent concentration. Likewise, fungal count was minimum at six gram egg membrane quantity.

TABLE 1 : Microbial load of textile dye effluent and dye effluent contaminated soil

Sample	Group	Count (CFU/ml)
Dye effluent	Actinomycetes	$3.23x10^6$
	Fungi	$7.4x10^6$
	Bacteria	TNTC
Dye effluent contaminated soil	Actinomycetes	$4.10x10^6$
	Fungi	$1.25x10^6$
	Bacteria	TNTC

***TNTC – Too numerous to count**

TABLE 3 shows the effect of egg shell treatment on the microbial load of textile dye effluent after twenty one days. In all the categories of treatment, bacterial count was too numerous to count. Actinomycetes count was nil for 50 and 100 gram egg shell treatment in 50% textile dye effluent concentration. Minimum value of fungal count was noticed at fifty grma egg shell treatment in both the concentrations of textile dye effluent.

TABLE 2 : Effect of egg membrane treatment on the microbial count of dye effluent after 21 days

Biosorbent	Microbial count (CFU/ml)	Dye effluent (%)	Quantity of egg membrane (g)				
			0	3	4	5	6
Egg membrane	Actinomycetes ($x10^4$)	50	13	10	0	7	18
		100	14	1	0	0	5
	Fungi ($x10^4$)	50	13	7	12	13	3
		100	14	17	9	10	9
	Bacteria ($x10^4$)	50	TNTC	TNTC	TNTC	TNTC	TNTC
		100	TNTC	TNTC	TNTC	TNTC	TNTC

TABLE 3 : Effect of egg shell treatment on the microbial count of dye effluent after 21 days

Microbial count (CFU/ml)	Dye effluent (%)	Quantity of egg shell (g)				
		0	50	100	150	200
Actinomycetes ($x10^4$)	50	13	0	0	11	9
	100	14	10	2	5	1
Fungi ($x10^4$)	50	13	1	3	7	4
	100	14	1	1	3	9
Bacteria ($x10^4$)	50	TNTC	TNTC	TNTC	TNTC	TNTC
	100	TNTC	TNTC	TNTC	TNTC	TNTC

***TNTC – Too numerous to count**

Textile dye effluents discharged into the environment not only impart color which is not aesthetically pleasing, but also affect the ecosystem by impairing light penetration and gas solubility in aquatic environments[3]. In addition, some synthetic dyes like azo dyes are reported to be carcinogens or mutagens[10,11]. Physical and chemical methods have certain disadvantages while biological treatments have low removal efficiencies[12]. Several low cost biosorbents like eucalyptus bark, biogas residual slurry etc, were tried in the removal of metal from industrial waste[13].

In biosorption studies, attention has been focused

on waste materials like the waste mycelia from fermentation process[7]. Olive mill solid residues[14] activated sludge from sewage treatment plants, bio solids and aquatic macrophytes. In the present study, egg wastes, both egg membrane and egg shell were able to reduce the microbial load especially that of actinomycetes and fungi.

Although abundant natural materials of cellulosic nature were suggested as biosorbents, less work has been done. Moreover, the mechanism of biosorption is complex involving ion exchange, chelation, adsorption by physical forces, entrapment in inter and intra capillaries in the structural polysaccharide network.

Egg wastes tried in the present study were already used in the de-colorization of textile dye containing effluents. In addition to the efficiency of bio de-colorization, egg wastes could reduce the microbial load. There are various species of bacteria, fungi and other microbes having variable potential of degrading complex pollutants. The extent to which they participate in bioremediation appears to be a function of the ecosystem and local environmental conditions.

Temperature also influences the process of biodegradation by affecting physical and chemical nature of compounds, composition of microbial community and enzymatic activity of microbes[2].

There are many fungi occurring naturally in conditions ecologically modified by effluent and they degrade the surrounding substrates. The whole process occurs in a slow manner[1]. Begum and Noorjahan[15] reported more reduction of BOD, COD and TSS in sterilized effluent compared to unsterlized effluent. This indicates the inhibition posed by microbes towards biotreatment. As egg wastes are able to reduce the microbial load of textile dye effluent in the present work, they can be employed as biosorbents in the treatment of textile effluents.

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