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Studies on Dye Reducing Activity of Free And Immobilized Bacterial Isolates on Textile Effluent

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ABSTRACT:

Dyes and dyestuffs are found in a wide range of industries. Wastewater from these industries contains variety of toxic chemicals and dyes. These dyes and chemicals are toxic and harmful agents in environment and biota of both aquatic as well as terrestrial ecosystem. Many microorganisms are known to have an ability to degrade or reduce the dyes and colors. This ability of microbes can be employed for the treatment of water. Thus, an attempt has been made to study the efficiency of dye reduction by microbes.

Keywords: *Azo dyes, biosorption, textile effluent.*

INTRODUCTION:

Water pollution is presently one of the major concerns of the world. The treatment of wastewater from industry or any other source is necessary before its discharge. Textile industries generate number of dyes, pigments and large wastewater that causes damage to the environment and its biota. All those damages occur because of carcinogenicity, mutagenecity and intense coloration. Some physicochemical methods are available to treat the water but due to their drawbacks, microbial remediation technique has gained much attention. This technique of decolorization is based on the principle of "Biosorption". The microbial remediation of dyes from water is eco-friendly, cost competitive and effective technique than other physicochemical methods

MATERIALS AND METHOD:

The textile dye effluent sample, glass wares, soil sample, spectrophotometer, centrifuge, rotary shaker etc.

The polluted status of textile effluent was measured by estimating Chemical Oxygen Demand (COD) and Biological Oxygen Demand (BOD) before decolorization treatment. The dye decolorizing bacteria were isolated from the rhizospheric soil by spread plate technique using

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modified effluent agar medium. After proper incubation the colonies showing competitively zone of decolorization were selected and nominated as, AD1, AD2, AD3, AD4, AD5 etc. The standardization of effluent is carried out to achieve the competence between dye concentration and bacterial growth. Four concentrations of effluent (100%, 75%, 50%, 25%) were prepared. All the bacterial isolates were further spreaded separately on effluent agar medium having different concentration at which the maximum growth was obtained. These were further selected for decolorization studies.

The dye decolorization process with immobilized cell cultures were conducted in 500 ml culture bottles containing 50 ml of effluent broth and inoculated with 10% immobilized cell culture beads. Similarly, the free cells were inoculated at 10% v/v separately. Effluent broth without inoculums served as control. The inoculated sets were incubated for 6 days in shaking incubator with 100 rpm. Meanwhile, 2 ml sample were withdrawn after incubation from the both sets as well as from control and centrifuged at 8,000 rpm for 15 minutes. The absorption spectra of this centrifuged material were measured at 600 nm using UV-VIS spectrophotometer. The percent decolorization of effluent was calculated by adopting formula.

Where, D = percentage of decolorization, A0 = initial absorbance, A1 = final absorbance.

The Chemical Oxygen Demand and Biological Oxygen Demand of the effluent were calculated after treatment.

RESULT AND DISCUSSION:

The decolorization efficiency after 6 days in immobilized cells was recorded as IC/AD1 (56.86%), IC/AD2 (53.59%), IC/AD3 (56.86%), IC/AD4 (51.63%), IC/AD5 (64.37%), IC/AD6 (66.33%) etc. Among the isolates, the consortium (IC/AD6) shows maximum color removal.

Table no. 1: Chemical oxygen demand.

Treatments	Initial absorbance (A0)	Final absorbance (A1)	% decolorization (after 6 days)
IC/AD1	0.306	0.132	56.86%
IC/AD2	0.306	0.142	53.59%
IC/AD3	0.306	0.132	56.86%
IC/AD4	0.306	0.148	51.63%
IC/AD5	0.306	0.109	64.37%
IC/AD6	0.306	0.103	66.33%
Control	0.306	0.306	----------

Similarly in case of free cells the efficiency of decolorization was recorded as FC/AD1 (32.67%), FC/AD2 (53.59%), FC/AD3 (33.66%), FC/AD4 (52.28%), FC/AD5 (54.57%), and FC/AD6 (51.30%). Among the isolates, FC/AD5 shows maximum decolorization and color removal activity.

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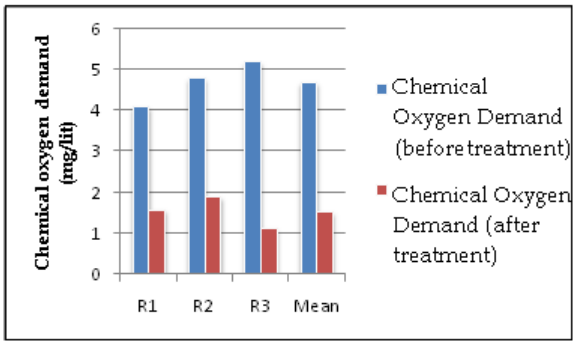
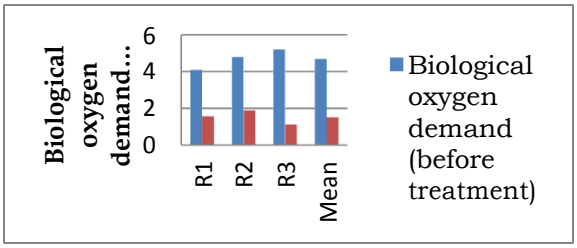
Table no. 2: Biological oxygen demand.

Treatments	Initial absorbance (A0)	Final absorbance (A1)	% decolorization (after 6 days)
IC/AD1	0.306	0.206	32.67%
IC/AD2	0.306	0.142	53.59%
IC/AD3	0.306	0.203	33.66%
IC/AD4	0.306	0.146	52.28%
IC/AD5	0.306	0.139	54.57%
IC/AD6	0.306	0.149	51.30%
Control	0.306	0.306	----------



Graph no. 1: Chemical oxygen demand.



Graph no. 2: Biological oxygen demand.

The isolated strains were confirmed as *Bacillus species* from the cultural and morphological characteristics. It was observed that immobilized *Bacillus species* have maximum dye decolorization ability. Thus, the study has confirmed the potential of *Bacillus species* in dye

The COD and BOD were also calculated before and after treatment and were found to decrease. The COD decreases from 252.33 mg/lit to 102 mg/lit as shown in graph no. 1 BOD reduces from mg/lit to 1.53 mg/lit as shown in graph no. 2 decolorization and their possible application for treatment of textile effluent.

CONCLUSION:

Current investigation has confirmed the decolorization of textile effluent by the *Bacillus species* under in vitro condition. Thus, biosorption of dyes by bacteria (*Bacillus species*) is an effective method, cost competitive and eco-friendly.

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