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Short Communication

USE OF *ASPERGILLUS NIGER* FOR THE REDUCTION OF BIOLOGICAL OXYGEN DEMAND IN TEXTILE INDUSTRY EFFLUENT

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ABSTRACT

Textile industry utilizes large quantity of water and discharges highly contaminated waste water. The contaminants in effluents must be removed before entering into the water body, because it creates adverse effect on aquatic ecosystem. Bioremediation is one of the best methods for treating the industrial effluents. Bioremediation is the use of living organisms, to degrade the environmental contaminants into less toxic forms. It uses naturally occurring bacteria, fungi and plants to detoxify the pollutants in environment. In the present investigation, an attempt has been made to study the efficiency of *Aspergillus niger* in reducing the concentration of BOD from effluent. The result revealed that *Aspergillus niger* has great potential for reducing BOD concentration in textile industry effluent.

Keywords: Textile effluent, Pollutants, Fungi, *Aspergillus niger*, BOD.

1. INTRODUCTION

Industrialization and urbanization are the major contributors for releasing pollutants to environment. Industrial water pollution is one of the issues being faced by the developing countries [1]. Pollution makes water unsuitable for desired purpose [2]. Effluent discharged by textile industry disturbs the ecosystem of natural water bodies and chemicals present in effluent cause bioaccumulation and biomagnification across the food chain [3].

Global water consumption of textiles is currently around 28-30 million tonnes. There are four divisions in textile industry like spinning, fabric manufacturing, wet processing and garments manufacturing. Among them the wet processing division consumes more water [4].

The textile industry effluent is rich in biological oxygen demand (BOD), chemical oxygen demand (COD), sulphate, nitrate, toxic substances, recalcitrant organics and has intense color [5]. The purpose of treatment is to remove contaminants from waste water and bring the quality of water to the required standard [6].

The physico-chemical methods available for treatment of industrial wastes are: adsorption, precipitation, coagulation/flocculation, oxidation, electrolysis and membrane extraction. The chemical treatment processes are expensive and release the end product which is toxic in nature, so these techniques have failed in treatment processes. Bioremediation is an alternative method for treating the effluent and it has more applications [7]. Microorganisms used in treatment process may be either indigenous or isolated from elsewhere. Mycoremediation involves the use of fungi in the degradation of undesirable materials or compounds and convert them into harmless, tolerable or useful products [8].

In the present investigation fungal isolate *Aspergillus niger* was used to assess its efficiency for reduction of Biological Oxygen Demand in textile industry effluent. It is a common fungus belonging to the genus *Aspergillus*. It is filamentous having potency to develop in extreme environmental conditions. It plays a major role as a decomposer and the organism has significant importance in biotransformation of xenobiotics and bioremediation of wastewater.

2. MATERIAL AND METHODS

2.1. Effluent collection

Effluent for the present investigation was collected from a textile mill located in Karnataka, India. Dark colored, dry cans were used for sample collection and labelled properly. To obtain accuracy, triplet samples were obtained from the sampling station. Immediately after collection the effluent was bought to the laboratory for further studies.

2.2. Isolation of fungal strains and screening

For bioremediation studies, 1 ml of effluent was inoculated into PDA (Potato Dextrose Agar) media and was kept undisturbed at room temperature for 48 hours

for spore formation. Fungal colonies which appeared on the media were sub-cultured to obtain pure isolates.

2.3. Identification of fungi

Fungal isolate (Fig. 1) was identified on the basis of morphology *i.e.,* the spores, conidia, mycelia fragments etc. Isolated fungi was identified as *Aspergillus niger* (fig. 2) using microscope at 40X magnification by the culture identification technique [9] prescribed and presented in fig. 3.

Fig.1. Isolation of fungi from effluent

Fig. 2: Identification of an unknown microorganism

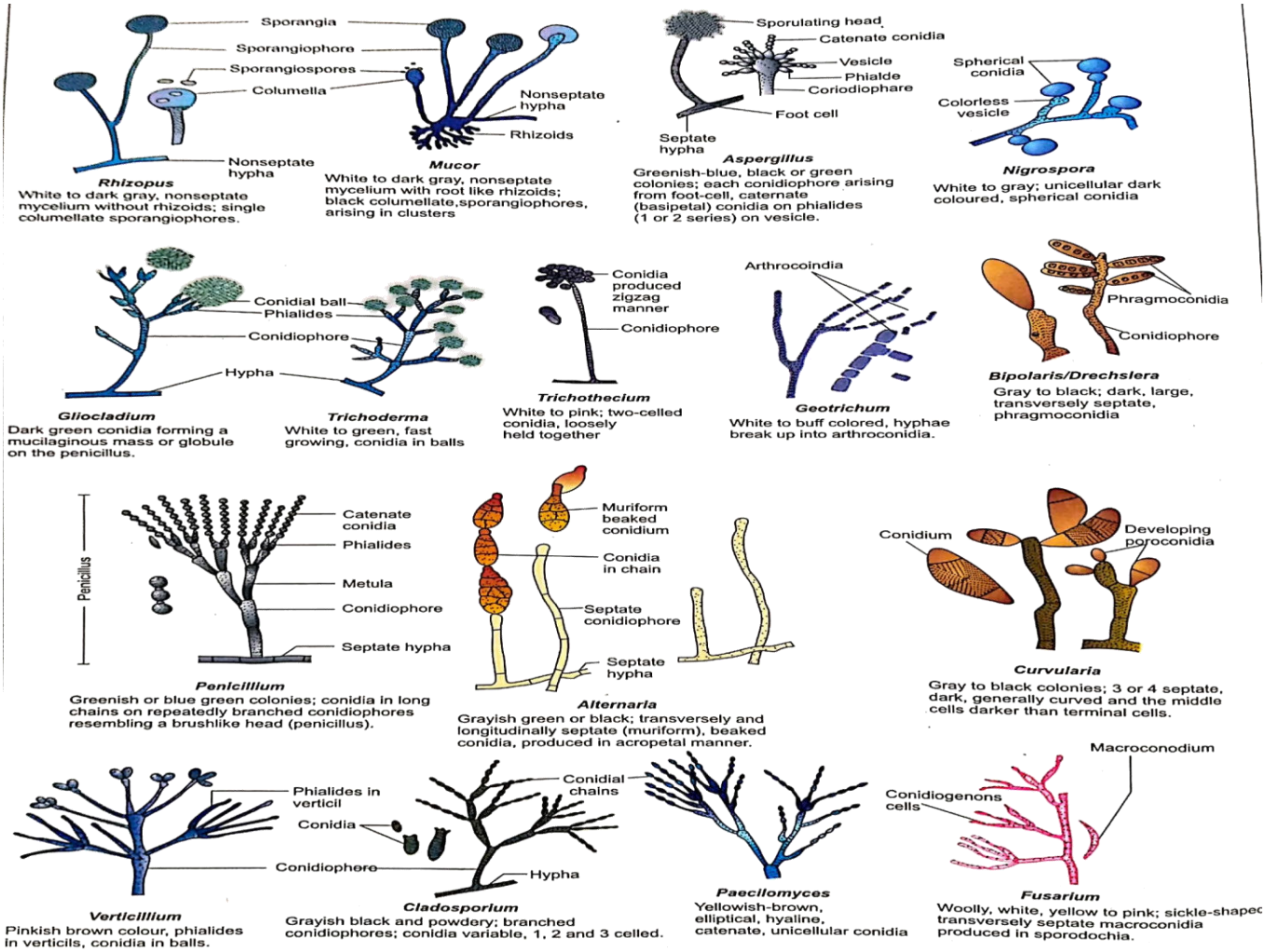

Fig. 3: Identification of an unknown microorganism

2.4. Degradation Studies

Effluent collected from textile industry was autoclaved at 121°C for 15 minutes to make it sterile before inoculating the selected fungal strains. Raw effluent is designated as 100% concentration and it was diluted to three different concentrations *viz.,* 25%, 50% and 75%. BOD was determined before treatment. Nine days old isolated *Aspergillus niger* was aseptically inoculated into the conical flasks containing 250ml of respective concentrations of textile wastewater. The effluent treated without introducing *Aspergillus niger* was kept as control. Treatment was conducted for a period of 10 days in triplicates under aseptic conditions. After treatment BOD was determined to evaluate the reduction efficiency of *Aspergillus niger*.

2.5. Analysis of BOD

BOD of effluent was determined by the standard dilution technique of APHA [10]. The method consists of filling an air tight bottle with sample and incubating at 20°C for 5 days. The dissolved oxygen (DO) was measured before and after the incubation. The difference in DO was computed and BOD calculated.

3. RESULTS AND DISCUSSION

3.1. Biochemical Oxygen Demand

Biochemical Oxygen Demand is the amount of oxygen utilized by microorganisms to stabilize the organic matter. BOD determines the strength of the effluent. In the present study, the capability of *Aspergillus niger* in reducing BOD concentration of textile wastewater was determined. The result clearly indicates that *Aspergillus niger* is highly efficient in reducing BOD in all concentration of treatment systems (table 1 and fig. 4). BOD after treatment reduced gradually by 42.39% in raw effluent, 53.37% in 75% concentration, 71.69% in 50% concentration and 90.38% in 25% concentration whereas in control only 5.04% reduction of BOD was observed. This finding is in agreement with Sarwar *et al.,* [11] and Deepa *et al.,* [12] who obtained similar results in BOD reduction in pharmaceutical industry effluent and tannery effluent *i.e.,* 50% and 77.22% respectively while working with the same organism. However, the present study showed that maximum BOD reduction was attained in 25% effluent concentration.

Table 1: Reduction in BOD concentration after treatment with *Aspergillus niger*

Concentration of Effluent	Before treatment (mgL^{-1})	After treatment (mgL^{-1})	Reduction (%)
Control	242.80±0.15	230.56±0.34	5.04
Raw	242.80±0.26	139.86±0.15	42.39
75%	171.66±0.41	80.04±0.22	53.37
50%	115.73±0.20	32.76±0.15	71.69
25%	61.26±0.30	5.89±0.10	90.38

Key: (mgL^{-1}) = milligram per liter. Values are expressed as mean ± SD (n=3).

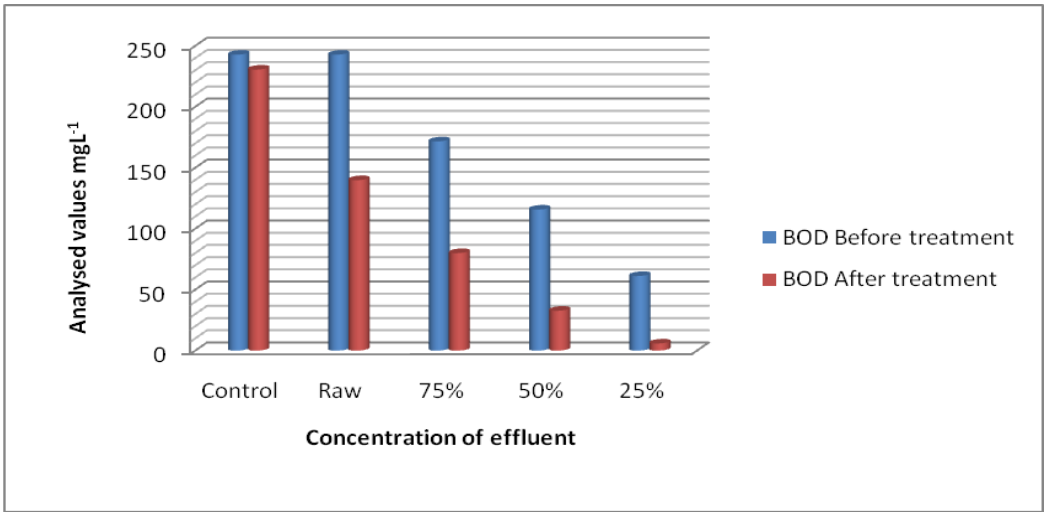

Fig. 4: Reduction of BOD in effluent by *Aspergillus niger* at different concentration

4. CONCLUSION

In the present investigation four concentration of effluent *i.e.,* 75%, 50%, 25% and raw were studied to compare the reduction potential of *Aspergillus niger*. The result revealed that the isolated fungal strain *Aspergillus niger* has showed a remarkable potential in reducing the concentration of BOD of textile industry effluent. However, in lower effluent concentration (25%), maximum reduction was observed because lower effluent concentration enhances the growth of organisms and improves the organism efficiency in effluent treatment. From the above result, it is evident that BOD concentration reduces with dilution of the effluent. Hence *Aspergillus niger* is recommended for reduction of BOD in textile industry effluent.

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