

**Review Article** 

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# Decolorization Potential of *Aspergillus awamori* (MTCC-548) Against Brilliant Green Dye: A Toxic Dye for Digestive System

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**Abstract:** Dyes are most widely used by various industries such as textile, paper, cosmetics, and pharmaceuticals. When these dyes are discharged as a waste in rivers and open environment it creates problem to fauna and flora. Although various physical and chemical methods have been used for removal of dyes from waste but these methods are expensive and sometimes produce secondary pollutants. Biological methods have been used for decolorization of dyes. Various microorganisms such as bacteria, fungi and actinomycetes have been reported to decolorize dyes. Out of these, fungi have shown great potential for decolorization by bioadsorption and biodegradation. Present work focused on decolorization potential of *Aspergillus awamori* (MTCC-548) against brilliant green dye. It was found that this fungus showed potential for decolorization of brilliant green dye.

Key words: Dyes, decolorization and fungi.

#### **INTRODUCTION**

Synthetic dyes are used in several industries such as paper, textile, cosmetics, pharmaceuticals etc.<sup>1</sup>. Out of

these, textile industries use two-thirds of the total dyestuff during the dyeing process and approximately 10% of the dyes or residual part released into the wastewater<sup>2</sup>. Dyes as a waste impart specific color to water and inhibits photosynthetic process in aquatic plants and algae by absorbing light<sup>3</sup>. Also, the dye discharged into wastewater contains various pollutants like nutrients, salts, toxicants, sulphur and organics<sup>4-5</sup>. So effluents generated from textile dyeing units create major problem to environment. This has become issue in public as well as textile units<sup>6</sup>.

Physical and chemical methods such as flocculation, coagulation, adsorption, precipitation and ozonization have been used used for treatment of dye waste water<sup>7-8</sup>. There are some limitations of these methods since these are expensive, ineffective and produce side reactions and also not suitable for all dyes<sup>9-10</sup>. Decolorization and degradation of dyes by microbes has been of considerable interest because of cost effective, eco-friendly and produces a less amount of sludge<sup>11</sup>. Many microorganisms such as bacteria, actinomycetes and fungi have been reported to decolorize dyes<sup>12-13</sup>. Various macrofungus species of the genera *Pleurotus*, *Trametes*, *Bjerkandera*, and *Polyporus* and microfungus species of the genera *Aspergillus*, *Rhizopus* and *Penicillium have* been also investigated<sup>14-17</sup>. Keeping in view importance of fungi in the decolorization of dyes, present study was planned. The aim of the present study was to evaluate decolorization ability of *Aspergillus awamori* (MTCC-548) against Brilliant green dye.

## MATERIALS AND METHODS

**Chemicals:** Brilliant green was purchased from Himedia. Others chemicals such as Sodium nitrate (NaNO<sub>3</sub>), Potassium Chloride (KCl), Magnesium Sulphate (MgSO<sub>4</sub>, 7H<sub>2</sub>O), Ferrous Sulphate (FeSO<sub>4</sub>, 7H<sub>2</sub>O), dipotassium hydrogen phosphate (K<sub>2</sub>HPO<sub>4</sub>), Zinc Sulphate (ZnSO<sub>4</sub>, 7H<sub>2</sub>O), Copper Sulphate (II) (CuSO<sub>4</sub>, 5H<sub>2</sub>O) and sucrose were also purchased from HiMedia.. All reagents used were of analytical grade. Before using, glasswares were washed with tap and distilled water and sterilized in an oven at 180<sup>o</sup>C for 3 hours.

Microorganism: The fungus, *Aspergillus awamori* (MTCC-548) was purchased from Himedia. Microbial Type Culture Collection, IMTECH, Chandigarh and maintained on Czapak agar medium as shown in Figure 1.



Figure 1: Aspergillus awamori (MTCC-548)

**Media composition:** Four stock solutions were prepared for media preparation. Stock solutions were: **Stock-A** containing NaNO<sub>3</sub> 40 g/l, KCl 10 g/l, MgSO4. 7H<sub>2</sub>O 10 g/l and FeSO4.7H<sub>2</sub>O 0.2 g/l **Stock-B** 

containing K2HPO4 20 g/l; **Stock-C** containing ZnSO4.7H2O 1g/100ml; **Stock-D** containing CuSO<sub>4</sub>.5H2O 0.5g/100 ml. Added 50 ml of Stock-A, B, 1 ml of Stock-C,D, sucrose 30g in flask and prepared final volume 1 litre with distilled water. Media was sterilized in an autoclave at  $121^{\circ}$ C for 20-25 minutes. Brilliant green dye was dissolved (100mg/l) in media used required for the growth of fungus. Controlled media was prepared in two parts: Czapak broth and Czapak broth + Brilliant green. The remaining part of media containing dye was divided into 10 parts for determination of decolorization potential of *Aspergillus awamori* (MTCC-548) for period of 10 days at temperature  $25\pm2^{\circ}$ C.

To evaluate the decolorization potential of *Aspergillus awamori* (MTCC-548) against brilliant green dye, Czapak broth medium having 100mg/l of dye were inoculated for shaking conditions for 3 days at 130 RPM at  $25\pm2^{\circ}$ C and in static condition for 7 days at same temperature. After 24 hours of incubation at each day, broth was filtered through Whatman filter paper no. 1 and the optical density of the filtrate was measured at 600 nm in UV spectrophotometer (Elico SL159). Percentage (%) decolorization of dyes in filtrate was determined by using the following formula:

% Decolorization = Initial absorbance - Final absorbance/Initial absorbance X 100

#### **RESULTS AND DISCUSSION**

The decolorization potential of fungus *Aspergillus awamori* (MTCC-548) was assessed in shaking (130 $\pm$ 5 RPM) as well as static conditions at 25 $\pm$ 2°C. Shaking conditions were maintained for 3 days for efficient growth of fungus. This was followed by static conditions for 7 days as shown in **Figure 2**. For first 3 days in shaking conditions, there was slow reduction in color of dye and after that there was sudden increase in decolorization (4<sup>th</sup> day). This was probably due to fungus has acclimatized in shaking conditions and when transferred to static conditions start decolorizing dye. There was continuous rise in decolorization for rest of days. Maximum decolorization was achieved on 9<sup>th</sup> day i.e. 35%. As shown in **Figure 3**, there was change in the color of dye after 10 days of incubation.





#### Decolorization...



(a) Colour of Dye in initial stage (b) After 10 days

Figure 3: Change in the colour of dye a) Initial b) After 10 days

### CONCLUSION

This study was aimed to evaluate decolorization potential of *Aspergillus awamori* (MTCC-548) against brilliant green dye. This fungus was incubated with dye for ten days: 3 days for shaking and 7 days for static conditions. Considerable increase in decolorization potential was found It was found after 3 days in shaking conditions when fungus was put under static conditions there was considerable increase in decolorization. Fungus degraded maximum dye on 9<sup>th</sup> day of incubation. This type of incubation i.e. static after shaking has never been reported till date. It was clear from result that *Aspergillus awamori* (MTCC-548) has decolorization potential against brilliant green dye and could be used in treatment of recalcitrant and complex (inorganic and organic) pollutants.

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