Ganodermalucidum Utilization For Textile Dye Waste Water Degradation Process

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Abstract

Synthetic dyes are widely used in several industries such as textile, paper, printing, cosmetics, pharmaceuticals, colour photography and petroleum (Marmion 1991). Dyes are classified into acidic, basic, disperse, azo, diazo, anthraquinone and metal complex based on their structure. On the basis of the dyeing process, textile dyes are classified as reactive, direct, disperse, acid, basic and vat dyes (Campos et al. 2001). Textile industries utilize large amounts of water during processing and also generate substantial amounts of wastewater (Hutton 1972). About 10–15 % of the dyes are lost in the wastewater during the dyeing process (Zollinger 1987). Coloured wastewater from the textile industries is one of the most obvious indicators of water pollution. Coloured dye wastewater causes severe effects on aquatic environment even in small amounts. Apart from the colour, the dischargeable dye wastewater also contains other pollutants like degradable organics, nutrients, pH altering agent, salts, sulphur, toxicants and refractory organics (Somasiri et al. 2008; Haroun and Idris 2009).

Introduction

In general, physical, chemical and biological methods are used to treat the textile industry wastewater. Physical and chemical methods include adsorption, chemical precipitation, flocculation, photolysis, chemical oxidation and reduction, electro-chemical treatment and ion-pair extraction (Azmi et al. 1998; Moreria et al. 2000; Rajeshkannan et al. 2010, 2011). These methods are mostly ineffective, expensive, produce side reactions, high sludge and by-products, not suited to degrade all dyes, etc. (Krull et al. 1998; Verma and Madamwar 2003). Hence, researchers have focused on biological treatment as the best alternative. The operational cost is relatively low when compared with conventional technologies (Arutchelvan et al. 2003; Jadhav and Govindwar 2006). Many microorganisms, including bacteria, fungi and actinomycetes, have been reported for their ability to decolourize dyes (Chang et al. 2001; Khehra et al. 2005). Among these microorganisms, white rot fungi are the most intensively studied dye decolourizing microbes. These fungi produce large quantities of extracellular enzymes that help to remove dyes from industrial effluent and also have the ability to resist unfavourable environmental conditions (Pointing 2001; D'Souza et al. 2006).

In this study, a white rot fungal strain, *Ganodermalucidum*, was examined for its ability to decolourize the textile dye in industry wastewater. The effect of process variables on textile dye industry wastewater degradation was studied and optimized using response surface methodology (RSM).

Materials and Methods

Textile dye wastewater

The textile dye wastewater was collected from a private small-scale industry located at Erode, Tamilnadu, India. The wastewater was analysed for various parameters as per the procedure given in APHA (1999), as given in Table 1. The wastewater was stored at 4 ± 1 °C in airtight plastic containers.

Ganodermalucidum (MTCC- 1039) is a stock of the Microbial Type Culture Collection Centre (MTCC), Chandigarh, India. It is well preserved in the laboratory. The strain is maintained on solid medium at 4 °C. The media composition and process conditions were: agar 20 g/l; malt extract 20 g/l; temperature 25 °C; pH 6.5; incubation time 10 days.

Decolourization of textile dye wastewater

In this study, a white rot fungi, *Ganodermalucidum*, was utilized to treat the textile dye wastewater. RSM was applied to optimize the process parameters. From the results, it was found that a maximum of 81.4 % colour removal and 91.3 % COD reduction occurs at the optimized condition. The UV spectrum confirms the decolourization. Various models were tried to study the kinetics of textile dye degradation. From the results, it was found that the degradation of textile dye wastewater follows first-order kinetics. Hence, it was concluded that *Ganodermalucidum* could be utilized for the effective treatment of textile dye wastewater.

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