Abstract

Rapid industrialization and urbanization have resulted in the copious release of wastes into the environment causing more pollution. In this aspect, textile industries are wreaking havoc on natural aquatic habitats as well as human health by polluting water. Traditional physicochemical methods are ineffective in removing all forms of industrial effluents while bioremediation is a cost-effective, environmentally beneficial, and sustainable approach to treat industrial textile wastewater. Many laccase-producing bacterial strains have proved to be very effective in the biodegradation of textile dyes that are considered heterologous biological compounds and are difficult to degrade. Laccases are multicopper-oxidases that have a wide range of biotechnological uses. The present research emphasized the characterization of laccase-producing bacteria from textile wastewater and were used as a promising microbial tool for the decolorization of reactive blue 19 and Dianix Falvine. The laccase-producing bacterial strains were characterized by culture technique using guaiacol as substrate. Out of 20 locally isolates of bacteria, six bacterial strains were identified as laccase producers named i.e. IZ, GY3, T1, AY4, AY1, and AB1. The laccase production cycle of the isolates was investigated and it was discovered that peak production occurred 72 to 96 hours later. Under optimum conditions (37°C, 5mM guaiacol, 100ppm dye concentration, and 2mM copper sulfate) uncharacterized laccase producing environmental strains namely GY3, T1, IZ, AY4, and AB1 showed 68%, 52%, 61%, 71% and 74% decolorization of RB-19 after 96 hours which is also evident by the change in color from blue to light blue and light green color. Likewise, GY3, T1, IZ, AY4 and AB1 showed 93%, 90%, 92%, 88% and 89% decolorization of DF after 96 hours. The increase in dye concentration decreased bacterial growth results in low degradation of dyes. UV-Visible spectroscopy was used to confirm the degradation of RB-19 and DF. A decrease in absorbance in UV-visible spectroscopy of treated RB-19 and DF as compared to control confirmed that biodegradation occurred. Biodegradation of RB-19 was further evident by FTIR spectra, disappearance of peak between 670-870cm^{-1} representing aromatic rings and reduction in intensity of respective peaks suggested that the parent dye degraded into different metabolites. The decolorization assays of textile dyes indicate that laccase-producing environmental strains are very efficient in the decolorization/ degradation of textile dyes.