Optimization and enhancement of textile reactive Remazol black B decolorization and detoxification by environmentally isolated pH tolerant Pseudomonas aeruginosa KY284155

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Abstract

Azo dyes are complex derivatives of diazene used in food and textile manufacture. They are highly recalcitrant compounds, and account for severe environmental and health problems. Different strains of Pseudomonas species were isolated from textile wastewater effluents. The bioconversion of Remazol black B (a commonly used water soluble dye) by Pseudomonas aeruginosa was observed in static conditions. The bio-decolorization process was optimized by a multi factorial PlackettïBurman experimental design. Decolorization of 200 mg Lī1 reached 100% in 32 h. Interestingly, the presence of yeast extract, magnesium and iron in the culture media, highly accelerated the rate of decolorization. Moreover, one of our isolates, P. aeruginosa KY284155, was kept high degradation rates at high pH (pHĵ=ĵ9), which represents the pH of most textile wastewater effluents, and was able to tolerate high concentration of dye up to 500 mg Lī1. In bacteria, azo-dye degradation is often initiated by reductive azo compound cleavage catalyzed by azo-reductases. Three genes encoding azo-reductases, paazoR1, paazoR2 and paazoR3, could be identified in the genome of the isolated P. aeruginosa stain (B1). Bioinformatics analyses of the paazoR1, paazoR2 and paazoR3 genes reveal their prevalence and conservation in other P. aeruginosa strains. Chemical oxygen demand dramatically decreased and phyto-detoxification of the azo dye was accomplished by photocatalytic post treatment of the biodegradation products. We suggest applying combined biological photocatalytic post treatment for azo dyes on large scale, for effective, cheap decolorization and detoxification of azo-dyes, rendering them safe enough to be discharged in the environment.

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