Phylogenetically diverse bacteria isolated from tattoo inks, an azo dye-rich environment, decolorize a wide range of azo dyes

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Abstract

Purpose: There has been an interest in the microbial azo dye degradation as an optional method for the treatment of azo dye-containing wastes. Tattoo ink is an extremely unique azo dye-rich environment, which never been explored in terms of microorganisms capable of degrading azo dyes. Previously, we isolated 81 phylogenetically diverse bacteria, belonging to 20 genera and 49 species, contaminated in tattoo inks. In this study, we investigated if these bacteria, which can survive in the azo dye-rich environment, have an ability to degrade azo dyes.

Methods: We conducted a two-step azo dye degradation (or decolorization) assay. In step 1, a high-throughput degradability assay was done for 81 bacterial isolates using Methyl Red and Orange II. In step 2, a further degradation assay was done for 10 selected bacteria with a representative of 11 azo dyes, including 3 commercial tattoo ink azo dyes. Degradation of azo dyes were calculated from measuring optical absorbance of azo dyes at specific wavelengths.

Results: The initial high-throughput azo dye assay (step 1) showed that 79 isolates had a complete or partial degradation of azo dyes; >90% of Methyl Red and Orange II were degraded within 24 h, by 74 and 20 isolates, respectively. A further evaluation of azo dye degradability for 10 selected isolates in step 2 showed that the isolates, belonging to *Bacillus*, *Brevibacillus*, *Paenibacillus*, and *Pseudomonas*, exhibited an excellent decolorization ability for a wide range of azo dyes.

Conclusions: This study showed that phylogenetically diverse bacteria, isolated from azo dye-rich tattoo inks, is able to degrade a diverse range of azo dyes, including 3 azo dyes used in commercial tattoo inks. Some of the strains would be good candidates for future studies to provide a systematic understanding of azo dye degradation mechanisms

Full Text

Due to technical limitations, full-text HTML conversion of this manuscript could not be completed. However, the manuscript can be downloaded and accessed as a PDF.

Figures

Figure 1

Chemical structures of 13 azo dyes used in this study

Figure 2

A phylogeny and degradation of Methyl Red and Orange II of 79 diverse bacteria isolated from tattoo inks. Bar length indicates % azo dye degradation