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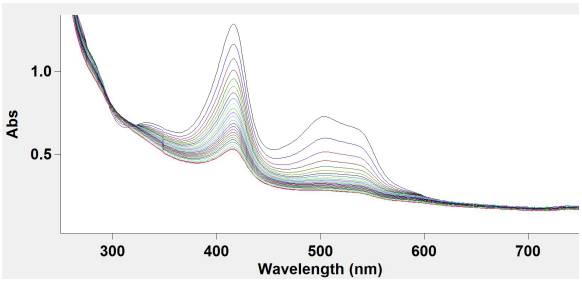

Exploring the Bioremediation Potential of Mammalian Hemoglobin and Myoglobin in the Degradation of Toxic Azo Industrial Dyes

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Industrial dye colorants are widely used in the textiles, electronics, food, paper, photography, cosmetic, and medical industries. Textile dyeing is estimated to release 40-65 liters of wastewater per kilogram of fabric [1]. The resulting wastewater streams, comprised of complex and variable solutions of dyes, heavy metals, pesticides, additives, and derivatives, pose a significant environmental problem even at relatively low dye concentrations [2], and are among the most problematic of all industrial pollutants, given their volume and composition [3], as well as the ever-increasing demand for cheap and disposable textiles.

Azo dyes account for 60-70% of organic dye production. We compared the ability of equine heart myoglobin and equine hemoglobin to degrade the model azo dye ponceau xylidine with hydrogen peroxide using UV-vis spectroscopy. Michaelis-Menten kinetics determined that the k_{cat} value for hemoglobin degradation of ponceau xylidine is 10-fold higher than myoglobin, indicating that hemoglobin is a much faster catalyst for this reaction. In addition, the apparent dissociation constant for ponceau xylidine binding, the K_M, is greater for hemoglobin (270 ±17 µM) than myoglobin (45 ± 1 µM); thus, the catalytic efficiency (k_{cat}/K_M) of degrading ponceau xylidine is 2-fold greater for hemoglobin than myoglobin. This work shows that both mammalian myoglobin and hemoglobin have potential as bioremediation catalysts of azo dyes, although equine hemoglobin is the more promising enzyme catalyst. We will also share the dye degradation products that were analyzed using gas chromatography-mass spectrometry (GC-MS) and liquid chromatography-mass spectrometry (LC-MS), as part of this study to help develop better dye degradation catalysts for use in bioremediation efforts.

[1] Manu & Chaudhari (2002), *Bioresour. Technol.* 82, 225-231.

[2] Andleeb, Atiq, Parmer, Robson & Ahmed (2010), *Environ Monit Assess* 176, 597-604.

[3] Sen & Demirer (2003) *Water Research* 37, 1868-1878.