Investigating a New Approach for Biosynthesis of Green Pesticide 5-Aminolevulinic Acid Using Engineered E. coli and Biomass

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5-Aminolevulinic acid (ALA) can be used as a green pesticide as it is biodegradable and nontoxic to crops, animals, and humans. In addition, ALA has been shown to be an effective growth stimulator when used at low concentrations. Current available methods for ALA production suffer from reaction complexity, low yields, and high costs, limiting its broad applications. To explore an economic way to produce ALA, we investigated ALA biosynthesis by fermentation using lignocellulosic biomass as the raw starting material, specifically wheat straw. In this study, wheat straw was hydrolyzed into its component sugars with sulfuric acid. Then, ALA-producing Escherichia coli bacteria were constructed. Finally, the hydrolysate was directly used for fermentation by the constructed bacteria. A peak concentration of 328 mg/L of ALA was detected 48 hours into the fermentation process. Our result shows that it is feasible to produce ALA from an abundant, inexpensive, and eco-friendly resource. With additional optimization to achieve higher yields with lower costs, this could be a promising approach for efficient large scale ALA production, which would ultimately have a large impact on agriculture as well as the environment.