**Enhancing Microbial Production of Biofuels through Metabolic Engineering**

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**Background:** The increasing global demand for sustainable energy sources has driven interest in biofuels derived from renewable biomass. Microbial fermentation offers a promising approach to produce biofuels, but challenges such as low product yields and metabolic bottlenecks limit its commercial viability.

**Method:** To address these limitations, we employed rational metabolic engineering strategies to enhance the production of biofuels in Escherichia coli. Specifically, we targeted key metabolic pathways involved in carbon flux distribution and product formation. Computational modeling was utilized to identify potential targets for genetic modifications, followed by the construction of recombinant strains using precise genome editing techniques.

**Results:** Through systematic optimization of metabolic pathways, we achieved a significant increase in biofuel titer and yield. The engineered strains exhibited enhanced tolerance to toxic intermediates and improved substrate utilization efficiency. Additionally, we explored the potential of co-culture fermentation to further enhance productivity and reduce production costs.

**Conclusions:** Our findings demonstrate the power of metabolic engineering to optimize microbial strains for biofuel production. These advancements have the potential to make biofuels a more economically competitive and environmentally sustainable alternative to fossil fuels.

**Keywords:** Can add up-to five (5) keywords.