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Improved lipid biosynthesis in *E. coli* through heterologous expression of a plant thioesterase

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Advanced biodiesel is an alternative fuel prepared from renewable non-food sources of biomass. It is non-toxic, non-flammable, biodegradable, and compatible with current vehicles and infrastructure. Most efforts to develop advanced biodiesel have focused on the metabolic engineering of microorganisms able to efficiently convert lignocellulosic and waste biomass into fuel molecules. The enterobacterial, *Escherichia coli* is well suited for this purpose owing to its exceptional amenability for genetic manipulation. Indeed, it has already been used for commercial synthesis of a wide array of chemicals. This work addresses two key steps for biodiesel production in E. coli: (i) increasing the total yields of free fatty acids (FAA) and (ii) improving FAA length and unsaturation from an applied standpoint. These properties must be carefully optimized in order to obtain optimum engine performance once FAAs are converted into esters or biodiesel. To this end, *E. coli* cells were genetically modified to express in an inducible fashion, a leaderless version of the enzyme thioesterase I (tesA), which cleaves the fatty acyl-carrier protein and deregulates the tight product inhibition typical of fatty acid synthesis, the transcription factor FadR, which down-regulates several genes in the fatty acid degradation pathway and increases fatty acid unsaturation; and a plant acyl-ACP thioesterase (FatA) showing higher hydrolytic activity towards oleoyl-ACP than the endogenous bacterial enzyme. As a result of the above manipulations we report here a 6-fold increase in FAA yield and a significant improvement of one of the most important properties of biodiesel: The cold flow performance.

Biography

David Bolonio is a third year PhD student. He graduated in Mining Engineering at Universidad Politécnica de Madrid (Spain) and holds a Master's Degree in Environmental Research and Modeling and Risk Assessment from the same university. He has performed research at the School of Chemistry of the University of Graz (Austria) and the Joint Bioenergy Institute of the Lawrence Berkeley National Laboratory (USA). His results have been presented in seven peer-reviewed conferences and four research papers published in international journals.

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