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Ca' Foscari
University
of Venice

Department of
Molecular Sciences
and Nanosystems

Production of Customised Petroleum Replacement Chemicals by Synthetic Biology

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ABSTRACT

Microbes such as yeasts or bacteria are integral to the production of bioenergy and biochemicals. The transition away from fossil resources is increasingly urgent; equally so, therefore, is the need to develop biological replacements for petroleum products.

Synthetic biology is a paradigmatic shift in industrial biotechnology to design and construct biological systems that are tailored for specific purposes, products or processes. No longer limited by existing "wild" microbes", synthetic biology can help accelerate the transition to an industrialised bioeconomy by providing advanced fuels, materials and platform/precursor chemicals (PPCs) upon which businesses and consumers rely. We have used the Synthetic Biology framework to design, encode and express new metabolic pathways to produce customised replicas of petroleum-based fuel molecules but from a biological, not fossil, source. Being identical to those that constitute existing petroleum products, these biologically-derived molecules can be used as direct or "drop-in" fuel alternatives.

Fuels, however, comprise only 40% of a barrel of crude oil, the remaining 60% being used for making various products including plastics, PPCs, and synthetic materials. We therefore designed and engineered microbes that generate the monomeric precursors for alternative bioplastics; polylactide (PLA) and polyhydroxy-alkanoates (PHAs). As with drop-in fuels, controlling the monomeric composition of PLA and PHA precursors, as well as the molecular size, is crucial to providing bioplastics with the desired physical properties. The diversity of PHAs, with at least 100 different constituents, and the availability of more than 5 biosynthetic pathways for PHA production provide significant promise for engineering bespoke microbes that produce a range of useful products from biomass or waste.

This presentation describes our use of synthetic biology principles to generate and monitor bespoke microbes that are compatible with existing industrial and recycling processes for the production petroleum replacement chemicals, from hydrocarbon fuels to bioplastics.

evento organizzato dalla
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