Biomaterial Production

We produced a moldable & 3D printable bioplastic by transferring the acetylation machinery from Pseudomonas fluorescens into Gluconacetobacter hansenii. To control the timing of degradation, we used a GFP repressor under the control of a lichenin inducible promoter to control the expression of the acetylation machinery. After a GFP signal was observed, the material was removed.

Cellulose Acetate Production

Cellulose acetate is biodegradable, thermoplastic, and easily processable with typical extrusion equipment. It is produced by acetylating cellulose, typically lignocellulosic materials, with acetic anhydride or acetic acid. This process results in a material that is biodegradable and has a wide range of applications in the industry.

Cellulose Production & Modeling

We produced vacuum-dried biomass from a variety of biomass feedstocks with the Imperial OBH team. We showed protocols for extruding the biomass, transferring them, and curing them in a mold. We performed a 3D print of the material which we used to create a composite part through the extrusion of the cellulose acetate and cellulose mixture. We found that the cellulose-acetate composite part had a higher density than the original material, indicating that the cellulose acetate can be used as a binder in composite materials.

Cellulose Cross-Linking

We designed a two-step process for cross-linking cellulose and attaching bioluminescent and other biological cells to cellulose surfaces. In the first step, we used a protein that attaches to cellulose to cross-link the cellulose. In the second step, we used a protein that attaches to a biological cell to attach the cell to the cross-linked cellulose. This process allows for the creation of composite materials that are biodegradable and have a wide range of applications in the industry.

Material Waterproofing

We biocompatible and water-resistant proteins and bacterial wax esters that prevent water absorption without being toxic. We found that by modifying the proteins and bacterial wax esters, we could create a material that is both water-resistant and biodegradable. This process allows for the creation of composite materials that are both water-resistant and biodegradable.

Amberless Hell Cell

We generated highly radiation, heat, & salt-resistant bacteria that express high levels of the Marker of interest, enabling their detection post-flight. These bacteria can be used in a variety of applications, including enzyme production, biodegradation, and environmental remediation.

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