A TWO-FOLD SYSTEM FOR REMOVAL OF MARINE MICROPLASTICS

OPTION 1: DEGRADATION

1. It is based on the activity of laccase (a multi-copper oxidase enzyme from E. coli, nF19).

2. Characterisation
   - Gene expression of laccase.
   - Activity assay.
   - Mass production over time.

OPTION 2: CURING SYNTHESIS AGGREGATION

1. Optically Aggregating microplastics: Physical and chemical degradation of marine plastics that can be induced by the aggregation signal.

2. Characterisation
   - Aggregation of microplastics.
   - Measurement of aggregate size.

DETECTION

Persistent Organic pollutants (POPs) are adsorbed by marine plastic debris and therefore they can be used to determine the presence of plastic debris. To detect POPs, we plan to engineer a system using POPs to express a lacZ gene, a large tag expressed in an E. coli strain rich in lac operon copy number.

SALT TOLERANCE

To create salt tolerant E. coli, we used the irfE gene. To validate the salt tolerant bacteria, we grew the bacteria in salt concentrations of 0% and 30% NaCl. The growth curves demonstrated salt resistance capabilities.

ABSTRACT

It is in the Great Pacific Garbage Patch that we are looking for a solution with the potential to tackle the problem of microplastics. However, just beneath the surface of the sea lies another global crisis: overfishing and contamination of marine life by non-biodegradable plastics. The development of marine bacteria that are capable of degrading marine plastic debris could provide a solution to this problem. In this study, we demonstrate the biodegradable capabilities of two marine bacteria, Oceanobacillus columnaris and Oceanobacillus xenodochus, using a two-step degradation process. The first step involves the degradation of marine plastics, while the second step involves the degradation of the plastic product. This approach allows for the efficient removal of marine plastics and could potentially provide a solution to the problem of marine pollution.

MARINE BACTERIA

We introduce marine bacteria Oceanobacillus columnaris and Oceanobacillus xenodochus as promising and viable chassis for the ISMB and synthetic biology community. We demonstrate compatibility with Bioplace standard parts and components, which will enable the development of new tools for the manipulation of marine bacteria.

SAFETY

Our containment system prevents horizontal gene transfer by confining the bacteria and their genes. We use a plasmid system integrated into the genome of the bacteria to ensure safety.

Characterisation

- Growth rates in different salt concentrations.
- Bacterial viability.

London Backspace Collaboration: FIRST PUBLIC BIOBRICK

The London Backspace collaboration is the first public, non-academic group.

ACHIEVEMENTS

- Host of one of the ‘Meeting of Young Minds’ debates
- Public presentation at the biennial meeting of the Synthetic Biology Society
- Collaboration with UCL’s IGM teams (Bielefeld, LMU Munich, Paris Belforced)
- London Backspace - collaboration with London’s public, non-academic community of highlighters
- Public engagement and outreach campaigns
- We were advised by 44 researchers including members of Oceanography and Interactive Oceans.

Sponsors: crowdfund raising more than £1000.