Name(s)

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Project Number

J0807

Project Title

What Organisms Other than Ideonella sakaiensis Have the Ability to Digest and Degrade PET? A Bioinformatics Project

Abstract

Objectives/Goals

The objective of my project was to see how widespread the ability to digest and degrade PET (polyethylene terephthalate) is among organisms.

Methods/Materials

I used a bioinformatics approach to answer my question:

1. Search original article by Yoshida et al. for the accession codes to both the PETase and MHETase enzyme (the two enzymes allow Ideonella sakaiensis fully degrade PET)

2. Conduct BLASTp searches for PETase and MHETase in NCBI#s GenBank database

3. Put enzymes/organisms that are close matches for the PETase and MHETase amino acid sequences into spreadsheets for further analysis

4. Research each organism to find what environment they live in; summarize in spreadsheets

5. Identify organisms with enzyme abilities close to PETase and MHETase as candidates for use in PET bioremediation

Results

My results showed there are over 200 organisms (mostly bacteria) that have either an enzyme with an ability close to PETase or an ability close to MHETase. There was one bacterium that had close amino acid matches to both PETase and MHETase.

Conclusions/Discussion

The ability to degrade PET is more widespread than may commonly be assumed. Only one organism (the bacterium Acidovorax delafieldii) was identified in the BLAST search with enzymes close to both PETase and MHETase. This bacterium, like Ideonella sakaiensis may have the complete ability to degrade and digest PET. However, the same effect could be achieved by pairing two organisms, one from the PETase search with another from the MHETase search, that live in the same environment (such as soil). The results of this project could be used to identify candidates for bioremediation of PET plastics in landfills and other sites where PET has accumulated.

Summary Statement

My science fair project used bioinformatics to see what organisms other than Ideonella sakaiensis have the ability to digest and degrade PET.

Help Received

Advice on using GenBank to run BLAST searches from Dr. Mark Wilson, Humboldt State University.