CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

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Project Number

S1525

Project Title

A Novel Study of the Adaptation of Pseudomonas putida S12 to a Polystyrene Rich Environment

Abstract

Objectives/Goals

Due to the presence of styrene as an industrial pollutant and its toxic and carcinogenic properties, the ability to biodegrade styrene is greatly desirable in the modern world. Even more advantageous is the ability to degrade polysyrene - which makes up Styrofoam and most plasticware. As plastic cups continually take up more and more volume in landfills, waste management resorts to incineration of polystyrene, which releases pollutants and toxins. A bioremedial process of degrading styrene and polystyrene is thus a crucial research area as landfills continue to grow.

This experiment approaches the problem of styrene and polystyrene degradation using Pseudomonas putida S12, a common soil-based bacteria.

Methods/Materials

Colonies of the bacteria were grown in a carbon-restrictive environment. No nutrients were provided to the bacteria other than liquid styrene monomer, small molecular weight polystyrene, agarose, and M9 minimal media salts. Growth on styrene was observed in three conditions: absorbed into an agarose gel with M9 salts, on plates enriched with BHI, and in liquid M9 minimal media. Growth on polystyrene was observed in liquid M9 media with 2500 Dalton polystyrene.

Results

The results of this experiment show that P. putida S12 can utilize styrene as a sole carbon and energy source for growth comparable to that on glucose; however, the strain cannot utilize polystyrene for growth, although it forms a unique complex with polystyrene creating turbidity, an important discovery with implications in hypothetical polystyrene-degrading bacteria. In parallel, luciferase bioluminescence was studied in P. putida in the hopes of creating a bioluminescent strain for better growth measurement in the future. EMS, a random chemical mutagen, is also under study for future experiments toward a polystyrene-degrading P. putida strain.

Conclusions/Discussion

The ability of P. putida S12 to utilize styrene as a sole carbon and energy source in its liquid form suggest that bacteria could be used for the bioremediation of styrene, and the study of P. putida's interaction with polystyrene contributes to future polystyrene bioremediation studies.

Summary Statement

We studied the effectiveness of using soil bacteria to make styrofoam and its components biodegradable.

Help Received

Used lab equipment at Stanford University under the supervision of Drs. Contag and Hardy.