Eco-Friendly Polymer Produced by Yeast

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We plan to make an eco-friendly, fire-resistant polymer using itaconic acid and 9, 10 -dihydro-9-oxy-10-phosphaphenanthrene-10-oxide (EDA-DOPO), and a hardener. Itaconic acid is made naturally by the fungus *Aspergillus terreus*. We plan to synthetically produce this compound by isolating the gene that produces it and putting this gene into yeast cells. The itaconic acid would then be combined with EDA-DOPO and a hardener to produce the final product, a novel version of the polymer EADI. Our variant of EADI would be an organic & non-toxic epoxy resin, so it would be much less harmful. It would also degrade much faster than traditional plastics. As a result, this polymer could be integrated in everyday life in place of other fire-resistant polymers that can cause a multitude of health problems for users.

Keywords: polymer, eco-friendly, itaconic acid, *Aspergillus terreus*, plastic, yeast, bio-polymer

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Background

Our team, the Incredibuilders, have endeavored during the past year to discover a non-toxic and environmentally friendly polymer. Nearly all of the fire-resistant resins, polymers, and epoxies available today are toxic and can cause long-term health problems. When these are thrown away, they also wreak havoc on the environment as they can take centuries to decompose. Our team felt that a more natural approach might be key to making fire retardant products more environment- and household-friendly.

Systems Level

Our system would consist of yeast cells that would be able to produce a key ingredient for the creation of our final fire-resistant polymer. In theory we would grow a large amount of genetically modified yeast, which would allow us to produce large quantities of itaconic acid, which would then be used for making the polymer.

Device Level

The genetically modified yeast would be kept in a nurturing environment where it would receive an input of nutrients and elements such as carbon, hydrogen, and oxygen, which it would then use to produce the desired output of itaconic acid.

Parts Level

Itaconic acid is made by a soil-dwelling fungus, *A. terreus,* so we would need to isolate the specific gene sequence that codes for this compound and then insert that DNA into the yeast cells. The resources made available to the yeast in the aforementioned controlled environment would be processed by each cell to produce itaconic acid.

Safety

This experiment seems to be very safe, as many of the substances have already been used or tested. However, the most important concern is the chemical hardener, which can be toxic or have harmful fumes. This would be addressed in a similar fashion to other potentially dangerous chemicals: proper ventilation and appropriate personal safety protection.

Discussions

In conclusion our project will result in a non-toxic, eco-friendly polymer produced using genetically modified yeast cells.

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