CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

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Project Number

34536

Project Title

The Effects of Various Extraction Methods of the Antioxidant EGCG on Biofuel Production in Nannocholoropsis Salina

Abstract

Objectives/Goals

The purpose of this project is to develop a cost effective method for increasing biofuel yields from algae by investigating how different extraction methods of the antioxidant Epigallocatechin Gallete (EGCG) from common green tea affect Biofuel(Fatty Acid) Production in Nannochloropis Salina. Recently, researchers at UC Davis discovered that EGCG can increase biofuel production by up to 85% using a pure form of EGCG at a cost of $1,200 per gram, making this technique uneconomical.

Methods/Materials

The Nannochloropsis was grown in five groups of 32 test tubes per group; 1) Control, 2) Ultrasonic, 3) Grinding, 4) Boiling, and 5) Microwave. The Control Group was made up of only sea water and algae. The other groups had an even amount of algae and green tea was placed into each tube at a per group concentration of 5.4 grams of green tea. The EGCG, was extracted using four methods:

1. Ultrasonic: Used ultrasonification to extract EGCG from green tea in an ultrasonic cleaner.
2. Grinding: Used a pestle and mortar to crush and grind the green tea leaves.
3. Boiling: Used a hot plate to boil the green tea.
4. Microwave: Heated the green tea in a microwave for three minutes.

The algae was cultivated for three weeks, exposed to grow lights 12 hours a day. The Fatty Acids were extracted using a centrifuge and ultrasonification

Results

Biofuel (Fatty Acid) Yields:

Control: 1.6 mL
Ultrasonic: 2.3 mL - increase of 43%
Grinding: 1.4 mL - decrease of 12.5%
Boiling: 1.6 mL - no increase
Microwave: 1.7 mL - increase of 6.3%

Conclusions/Discussion

Results showed algae has the highest biofuel production rate when in a medium with EGCG extracted by Ultrasonic-Assisted Extraction(UAE). This method achieved a 43% increase in biofuel production at a cost of $0.15 per liter vs. the UC Davis approach at a cost of $2.20 per liter. For equivalent biofuel production, using EGCG extracted from common green tea by UAE costs only 13.5% of the total cost as compared to the UC Davis pure form approach. This project shows that using EGCG from common green tea to increase biofuel should be used to improve algae's economic feasibility as a biofuel source.

Summary Statement

43% increase in Biofuel Production from Nannochloropsis Salina can be achieved when grown in a medium with EGCG extracted by Ultrasonic-Assisted Extraction from common green tea, resulting in a cost effective approach to algae biofuels.

Help Received

Father helped print out slides for board. Mother and Father proofread abstract