CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
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Project Number
J0204

Project Title
The New Fuel: Microalgae

Abstract

Objectives/Goals
Which of the following microalgae produces the best quality and highest quantity biofuel: Nannochloropsis, Scenedesmus, Chlorella or Spirulina?

Methods/Materials
#Obtain equal mass of microalgae culture and grow for 12 weeks to collect sufficient biomass
#Filter microalgae through coffee filter paper and let them dry for 3 days
#Extract cell wall lipids from dried algae via mechanical press
#Convert algae oil into biodiesel through transesterification by preparing methoxide solution by combining 36 ml of methanol and add 1.6 grams of sodium hydroxide
#Heat algae oil to 130 degrees and slowly add 20% by volume of methoxide solution into the algae oil and mix for 5 minutes
#Let solution sit for 24 hours to separate biodiesel from glycerin fats
#Pipette out the top layer of biodiesel and water wash biofuel by adding distilled water to the biofuel and gently flip the test tube slowly for 1 minute
#After 30 minutes remove water from biofuel and repeat process several times till the distilled water is clear and free of visible impurities
#Add equivalent volume of pHLip solution to equivalent volume of biodiesel in a test tube or vial
#Flip vial 10 times gently, then let the two solutions separate and sit for 10 minutes
#Determine the quality of biofuel by evaluating color change of pHlip solution, the interphase between biodiesel and pHlip solution for glycerin precipitates, and turbidity of the biofuel to evaluate for contaminants.

Results
Of the four microalgae species tested, Chlorella produced the highest quantity and best quality biofuel.

Conclusions/Discussion
My hypothesis that Chlorella produces the highest quantity and best quality biofuel, due to its lipid content in the cell wall, was correct. When mass-producing biofuel from algae, Chlorella would be the most economically and environmentally efficient source of biofuel of the four micro-algae I tested. Microalge in general produces more biofuel per acre of land compared to the plant crops. By producing the highest yield and quality of fuel, Chlorella would minimize dependence on fossil fuels, produce 78% less carbon dioxide emissions than fossil fuels and minimize environmental damage through reduced risk for oil spills, water and soil contamination from fracking, and would be carbon neutral.

Summary Statement
Four species of microalgae were tested to determine which would produce the highest quality and quantity of biofuel

Help Received
No help was received while completing this project. I completed the experiment under the supervision of my father.