



# MASSACHUSETTS CLEAN TECHNOLOGY AWARDS

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## Middle School Clean Tech Awards:

Region II: Central MA

Recognition to:

Justin Delgado, Advanced Science and Math Academy, Marlborough

*"What Feedstock Makes a Good Biofuel?"*

Justin Delgado is a seventh grade student at the Advanced Math and Science Academy Charter School in Marlborough. He has a deep interest in chemistry which started in the first grade; he has always been doing experiments of one kind or another. Besides chemistry, he is an accomplished pianist. He enjoys 20<sup>th</sup> century history and current events. He loves weird trivia and old sci-fi movies with bad special effects (i.e. *Voyage to the Bottom of the Sea*). His favorite book is *Lord of the Rings*. Everywhere he goes he promotes recycling and canvas bag usage. He loves the environment and the planet. He hopes to become a chemist focusing on alternative fuel science.

He writes: "I became interested in biofuels when I did a persuasive speech on banning plastic bags. I learned how much oil people waste from throwing away plastic bags. I'm concerned about the politics on being dependent on foreign oil from the Middle East. I hope our country will change its energy policy to encompass solar power, wind farms, hydrogen fuel cell cars and biofuels like vegetable oil, biodiesel, and ethanol."

### MY PROJECT:

In America the feedstock we tend to use the most for biofuels is corn, which is used to make ethanol, but is corn really the best feedstock? My objective was to find what feedstock makes a better biofuel. In order to find what feedstock is a better biofuel, I must calculate how much ethanol is made.

However, since I was not allowed to use ethanol, I decided to use vinegar. The reason is that the process for ethanol and vinegar production is extremely similar. Both ethanol and vinegar have four steps that are the same; preprocessing, cooking, malting, and fermenting. However, the last step is different. For ethanol that last step is distillation, and for vinegar it is oxidation. Even though I cannot use ethanol I can obtain a theoretical estimate on how much ethanol is produced via measuring how much vinegar was produced.

The feedstocks that I tested were cornmeal, potatoes, cornstarch, cotton, sugar, and a mixture of cornstarch and cornmeal.