



MASSACHUSETTS CLEAN TECHNOLOGY AWARDS

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Region III: Southwestern MA

Manasi Malik, Bishop Feehan High School,
Attleboro

*" The Efficiency of Cellulosic Ethanol
Production "*

My name is Manasi Malik. I am 13 years old, and a freshman at Bishop Feehan High School. I live in Attleboro, Massachusetts with my family, my two dogs, and a colony of sagging bookshelves.

Apart from school, some of my other activities are piano, track, and full-time daydreaming. I am also part of my school's concert band, math team, and Academic Decathlon team. In my spare time, I like to read, run, sing, write, and spend time with my family and friends. My favorite author is Terry Pratchett; my favorite composer is Beethoven; my favorite animal is the walrus; and my favorite color is green.

MY PROJECT:

I conducted an experiment to investigate the use of different cellulosic waste products for ethanol production. Fibrous cellulose (control), peanut shells, organic kitchen waste, and paper were saccharified [broken down into simple carbohydrate sugars] with the cellulase enzyme complex from *A. niger* [a common fungus that attacks plants and is used in many food manufacturing processes], filtered, then fermented with Baker's yeast, and finally analyzed by gas chromatography to determine ethanol content. It was predicted that fibrous cellulose would be the most efficient substrate for ethanol production, followed by kitchen waste, peanut shells, and paper.

After 24 hours of saccharification, 2% of the cellulose, 40% of the peanut shells, 93% of the kitchen waste, and 20% of the paper had been solubilized. After 2 hours of fermentation, kitchen waste had the highest ethanol yield (32%), followed by fibrous cellulose (26%), paper (23%), and peanut shells (20%). The ethanol yield of kitchen waste was found to be significantly higher than that of corn, currently the leading source of ethanol in the United States.

These results show that this procedure could provide an effective method of cellulosic waste management. More importantly, the experiment demonstrates that ethanol production from cellulosic waste products can be even more efficient than that from "virgin products" such as corn and prairie grasses.