

優秀創新科技及科研作品

Outstanding Science & Technology Innovation Project

織與織尋－酒精篇 Inedible cellulosic ethanol

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作品簡介 Project Introduction

以不能食用的纖維廢物替代玉米，製造酒精發電，是一個有效解決食物危機的方法，制止食物價格飆升，減少市區垃圾。再者，以酒精發電，是一種潔淨而可再生的能源。在這個研習中，我會研究以不能食用的纖維廢物製造酒精的可行性。

在是次研習計劃中，我從以下各方面作出探究。

- 甲、以 2% 鹼性過氧化氫 (H₂O₂) 去除木質素 (lignin) 的最適環境
- 乙、帶纖維廢物進行酸性水質分解的最適環境
- 丙、製造酒精的最佳含纖維廢物
- 丁、在蒸汽機中燃燒所生之酒精發電

Inedible cellulosic ethanol which is clean and renewable could generate electricity without raising world food prices and reduce municipal waste such as sawdust as heaps of wet sawdust are subjected to spontaneous combustion. (Walker, 1966).

Inedible cellulosic ethanol could be obtained by delignification of paper waste using hydrogen peroxide, acid hydrolysis of cellulose to glucose, fermentation of glucose using yeast and fractional distillation to separate the ethanol produced. Ethanol obtained would be used as fuel in a steam engine for generating electricity.

This project aims at the following:

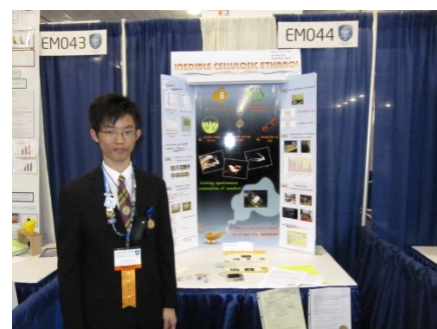
- (a) Investigation of the ideal set of conditions for removal of lignin in cellulosic materials using 2% alkaline hydrogen peroxide
- (b) Investigation of the best set of conditions for acid hydrolysis of cellulose to glucose
- (c) Investigation of the best type of cellulosic waste material for the production of inedible cellulosic ethanol
- (d) Production of inedible cellulosic ethanol to generate electricity

inedible cellulosic ethanol from sawdust

Results: Waste materials in descending order of percentage of glucose produced are as follows. (Acid hydrolysis carried out in 5M H₂SO₄ at 80°C for 2 hours) Percentage of glucose by mass obtained from different paper wastes were as follows.

Paper towel (73.6; 13.2% by moth) Copy paper (47.4) Paper cup (30.6) tissue (21.2) Cardboard box (60.4) cotton cloth (18.3) cotton ball (26.3) sawdust (41.2)

When inedible cellulosic ethanol obtained from paper towel was used as fuel in a steam engine, electricity was generated. Obviously, cellulosic waste materials could be an alternative of fossil fuels to generate electricity.



主要獎項 Major Awards

- 第 9 屆明天小小科學家獎勵活動(2009) - 明天小小科學家稱號
The 9th Awarding Program for Future Scientists -Future Scientist
- 第 24 屆全國青少年科技創新大賽 - 二等獎、英特爾英才獎
The 24th China Adolescents Science and Technology Innovation Contest - Second Place Award、Intel Talent award