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## Production of Bioethanol from Waste Newspaper

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### Abstract

Paper, which is one of the largest constituent of Municipal solid waste, has become a severe problem for disposal in developed and developing countries due to the shrinking landfill capacity. It is very important and challenging task in managing the solid waste. Newspaper, which is a cellulosic feed stock, is emerging as an attractive option for the production of bio-ethanol because of lower feedstock costs, higher potential for fossil fuel displacement and also there will be reduction in greenhouse gas emission as compared to production of ethanol from corn. The main objective of the current project is to minimize the newspaper load on municipal solid waste by efficiently utilizing the waste newspaper in the production of bio-ethanol. Experimental studies have been carried out to optimize the pre-treatment process for increasing the efficiency of bacterial hydrolysis, the efficient conversion of cellulose to sugars from cellulose degrading microorganisms and to convert the sugars released to Ethanol by using Fermentation process. Pretreatment, hydrolysis and fermentation are the steps involved in the production of Bioethanol. In the pre-treatment process, the Lignin, Hemicellulose and Cellulose are separated to enhance the hydrolysis process. The optimized condition for the pre-treatment was found to be 1.5% concentration of H<sub>2</sub>SO<sub>4</sub> at 121°C and 45 minutes. The bacteria *CytophagaHuchnosonni* was used for hydrolysis process, which helped in converting the cellulose to sugars and was analysed using DinitroSalicilicacid. The reducing sugars were fermented to produce Bioethanol using the Yeast *Saccharomyces Cerevisae* and the yield was estimated using specific gravity method and also by using HPLC.

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### 1.0 Introduction

Increase in the population over the last century lead to the increase of the energy consumption worldwide. To

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meet the increased energy demand crude oil has been used as the major resource. The global oil production would decline to 5 billion barrels from 25 billion barrels approximately. Due to this unavoidable depletion of the world petroleum resources in the coming years the worldwide interested aroused in seeking an alternative non-petroleum based energy source, (Zhi Sheng Zu et al.). One of the best alternative fuels in order to beat severely the energy crises is from Biofuel. From biologically carbon fixation the energy is derived from Biomass. The various factors like need for increasing energy security and hikes and gaining the scientific and public attention the biomass are driven. The main contents of ethanol are sugar, starch or cellulose. The Bioethanol is one of the environment friendly fuels, the effects on environment is less because the Ethanol contains oxygen. With comparison to the conventional gasoline the blends of E10 resulted in 12-25% less emission of carbon monoxide, (BibiZainsab et al., 2014).The sugarcane and corn are the first generation bio-fuels. Due to vast increase in the ethanol production using these crops they cause immoderate pressure on the global food supply. The second generation biofuels can be produced by means of different sources like waste chicken feathers, cellulosic biomass food and organic waste. The cellulosic biomass, such as agricultural residue and industrial waste are the most abundant and cheap source of renewable energy in the world.

The second generation biofuels may also include the fuels produced from mixed paper waste which is separated from the municipal solid waste, cash crops *Jatropha*, *Honge*, *Cotton*, *Maize* etc. can be utilized to produce bioethanol. The third generation biofuels can be produced from micro-organisms mainly *Algae*. The fourth generation biofuels produced from vegetable oil, biodiesel. The table shows the summary of classification of the biofuels.

In developed and developing countries municipal wastes have become a severe problem during the last century , (Demitrios H et al. ).The shrinking of landfill capacity resulted in rising of landfill costs which is mainly due to the waste paper from the municipal waste. Because of the above concern the waste paper is used as cheap source for the production of bioethanol. Due to the shrinking landfill capacity, the tighter environmental control exists on their siting operation, construction, and of the unwillingness of communities to have new landfill sites nearby. The tighter environmental regulations are responsible for the premature closure of existing landfills and higher costs for constructing new ones, (Alya L et al., 2012). Among the various components the municipal solid waste consists of food waste, wood, leaf, garden or yard trimmings, rubber, textile, leather, metals (ferrous metals or Non ferrous metals), glass and major of paper and paper boards. About 35% to 40% by weight of the municipal solid waste is made of the paper.

## 2.0 Literature review

Though the earlier combustion powered transportation vehicles were fuelled with ethanol, crude oil derivatives have provided the vast majority of transportation fuels throughout the 20<sup>th</sup> and 21<sup>st</sup> centuries. In 2006, global demand for petroleum and other liquid fuels was 85.0 million barrels oil equivalent per day (Mb/d) and this is forecasted to grow to 106.6 Mb/d in 2030, with the growth in transportation fuel use being responsible for 80% of the higher total crude oil use, (Suhail J C et al., 2013). Despite improvements in the energy efficiency standards in many countries & the dampened demand resulting from the global economic recession experience in 2008-09, global crude oil consumption is expected to increase by over 1% annually driven primarily by the growth in demand in India and China, (Bishnu J et al. , 2011). However, increasing demand of fossil fuels will likely to cause diminishing of world fuels reserve, which may lead to the scarcity of this type of fuels while also cause the price to increase dramatically. The release of carbon dioxide (CO<sub>2</sub>) from vehicle and other industries is one of the largest potential contributors to global warming. Development of alternative energy source such as biofuels becomes important to reduce these problems. The only non-fossil liquid fuel currently of significance on a global scale is biofuels, including bioethanol & biodiesel. Utilization of bioethanol as transportation fuel and as a gasoline supplement has been proved to be more environmentally friendly. Bioethanol is a clean-burning, high octane number fuel that can readily substitute gasoline and its combustion results in significant reductions of toxic emissions such as formaldehyde, benzene and 1-3 butadiene, while blending ethanol with gasoline can increase the octane of the mixture and can reduce carbon monoxide (CO) emissions by 10 ~ 30%, (Sadashivam S M ,2006). When bioethanol is produced from renewable sources such as biomass it can both decrease urban air pollution and reduce the accumulation of carbon dioxide (CO<sub>2</sub>), so called green house gases (GHG). Thus, replacement of

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