Bio-Plastic From Waste Newspaper

Sudhanshu Joshi
B. Tech. Student, Department of CSE
JIET Universe (co-ed campus)
NH-65, Pali Road, Mogra,
Jodhpur (Rajasthan), INDIA
joshi.shubham1995@gmail.com

Ujjawal Sharma
B. Tech. Student, Department of CSE
JIET Universe (co-ed campus)
NH-65, Pali Road, Mogra,
Jodhpur (Rajasthan), INDIA
ujjawal2.sharma@gmail.com

Dr. Garima Goswami
Asst. Prof.(Chem.) Department of Applied Sciences
JIET Universe (co-ed campus)
NH-65, Pali Road, Mogra,
Jodhpur (Rajasthan), INDIA

Abstract: **Fossil fuel plastics derived from petroleum are very common in our lives and we cannot think our day without their use. At the same time they are non-biodegradable and produce greenhouse gases, thus causing an environment problem. The solution to this problem is biodegradable bioplastic. Bioplastics are plastics derived from renewable biomass sources, such as vegetable fats and oils, corn starch, pea starch or microbiota. There is a variety of materials that bioplastics can be composed of, including: starches, cellulose, or other biopolymers. In this paper we are dealing with the making of bioplastics from cellulose and for cellulose we will use waste newspapers as our raw material.**

In this process cellulose is taken out from waste newspapers by decomposing them. Then cellulose is decomposed into starch/glucose by process called Cellulolysis which is done with the help of enzymes. Finally, bioplastic is prepared in lab by starch/glucose.

Keywords: bioplastic, starch, cellulose, waste newspapers.

I. Introduction

Bioplastic are plastic derived from renewable biomass sources, such as vegetable fats and oils, starch or microbiota. Common plastics, such as fossil-fuel plastics, are derived from petroleum- these plastics rely more on fossil fuels and produce more greenhouse gas. Some, but not all, bioplastics are designed to biodegrade. Biodegradable bioplastics can break down in either anaerobic or aerobic environments, depending on how they are manufactured. There is a variety of materials that bioplastic can be composed of, including: starches, cellulose, or other biopolymers. Some common applications of bioplastics are packaging materials, dining utensils, food packaging, and insulation.

Polyactic Acid (PLA), the secondmost important bioplastic of the world in regard to consumption in volume. PLA is a transparent plastic produced from corn or dextrose. It not only resembles conventional petrochemical-based mass plastics in its characteristics, but it can also be processed on standard equipment that already exists for the production of some conventional plastics. PLA and PLA blends generally come in the form of granulates with various properties, and are used in the plastic processing industry for the production of films, fibers, plastic containers, cups and bottles. PLA, a plastic substitute made from fermented plant starch (usually corn) is quickly becoming a popular alternative to traditional petroleum-based plastics. As more and more countries and states follow the lead of China, Ireland, South Africa, Uganda and San Francisco in banning plastic grocery bags responsible for so much so-called “white pollution” around the world,

PLA is poised to play a big role as a viable, biodegradable replacement.

Nowadays, bio-plastics are made by corn starch, potatoes starch or banana starch which is used by humans and animals for their living. So my suggestion is that instead of using starch that are excreted from eatable things we should use waste newspaper which are mainly made up of cellulose and these newspapers are dumped into oceans for disposal.

II. PREPRATION OF RAW MATERIAL

The raw material used here is newspaper, which is the most common and easily available household asset. Loads of newspapers are dumped into oceans for disposal which come from 500,000 trees which are cut every week for their production and 88% of that is never recycled. These newspapers can be put to utilization in preparation of bioplastic as raw materials, after undergoing through some simple processing.

Waste newspapers are converted to pulp which can be done using pulp mills. Pulp can be manufactured by mechanical, semi chemical or fully chemical methods. This treatment can also be done using water which gets rejected in other processes (like household rejected water) to minimize water consumption and wastage. The waste newspapers are now segmented into small pieces in the mill and water is added to them to obtain a lignocellulosic fibrous pulpy material which is then grinded to finally obtain what is known as paper sludge. The process removes lignin from paper and leaves cellulose fibers intact which facilitates in the process of extraction of cellulose.

III. PREPARATION OF BIO-PLASTIC

1. Extraction of cellulose from pulp:

Cellulose is extracted from paper sludge after treating it with 1-butyl-3-methylimidazolium chloride which is a good solvent of cellulose. This co solvent addition is kept at appropriate stirring conditions (60^0C).This allows the fractionation of a paper-grade Kraft pulp into a separated cellulose and a regenerated hemicellulose fraction. Both of these exhibited high levels of purity, without any yield losses or depolymerization. Thus, this process represents an ecologically and economically efficient alternative in producing dissolving pulp of highest purity.

2. Conversion of cellulose into dextrose:

The process of breaking down of cellulose is called Cellulolysis.

Cellulolysis is the process of breaking down cellulose into smaller polysaccharides called cellodextrins or completely into glucose units; this is a hydrolysis reaction. Because cellulose molecules bind strongly to each other, cellulolysis is relatively difficult compared to the breakdown of other polysaccharides. However, this process can be significantly intensified in a proper solvent, e.g. in an ionic liquid.

The enzymes utilized to cleave the glycosidic linkage in cellulose are glycoside hydrolases including endo-acting cellulases and exo-acting glucosidases. Such enzymes are usually secreted as part of multi enzyme complexes that may include dockerins and carbohydrate-binding modules.

There is a patented method to convert cellulose into dextrose:

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Cellulose is converted to glucose in a two stage process in which cellobiose is produced from a cellulosic feedstock under the influence of Trichoderma reesei in a first stage and cellobiose from the first stage is converted to glucose in a second stage by the action of purified cellobiase derived from Aspergillus terreus. Cellobiase from A. terreus is purified by contacting a crude aqueous extract of the cellobiase with an ion exchange resin and an anion exchange resin. The purified cellobiase may be immobilized on a suitable substrate.

The present invention relates to a process for the production of glucose from cellulose. In one of its more specific aspects, this invention relates to a process for the conversion of cellulose to glucose wherein cellulose is converted to cellobiose under the influence of Trichoderma reesei and cellobiose is converted to glucose by a purified cellobiase derived from Aspergillus terreus. In another of its more specific aspects, this invention relates to a process for the production of a purified enzyme having a very high activity for the production of glucose from cellobiose.

There is presently tremendous scientific and commercial activity in the quest for economic means to convert cellulose (abundant in the form of wood, waste paper, and agricultural products, e.g. bagasse) to glucose and then to ethanol and other chemicals. Cellulose may be converted to glucose by the action of various enzymes derived from molds.

It is known from the prior art that Trichoderma reesei is a fungus that has the ability to degrade cellulose very rapidly. Currently Trichoderma reesei is the preferred organism for studies in the hydrolysis of cellulose to glucose for industrial purposes. The conversion of cellulose to glucose is not yet economically feasible, due partially to the fact that the cellobiase produced by Trichoderma reesei has a low specific activity. Additionally, glucose, which is the final product of reaction, further inhibits the activity of the Trichoderma reesei enzymes.

We have discovered an efficient method for the conversion of cellulose to glucose in a two stage process. In the first stage, cellulose is converted to cellobiose by the action of a cellulase produced by Trichoderma reesei, and in the second stage, cellobiose is converted to glucose by the action of a purified cellobiase produced by Aspergillus terreus. This is a distinct departure from the prior art processes in which Trichoderma reesei enzymes perform both functions at efficiencies and conversion rates considerably less than those obtained in our process.

3. Preparation of PLA bio-plastic:

To produce PLA, starch is extruded from waste newspaper, which results in a simple starch called **dextrose**. Dextrose is a type of **glucose**, which is a simple sugar that plants produce during photosynthesis. Now dextrose is put through a fermentation process similar to the one used to make beer. Instead of alcohol, however, the dextrose is converted into **lactic acid** -- the same stuff that makes our muscles cramp when we exercise without proper hydration. Heat is applied to the lactic acid polymers, causing them to link together and form a long chain that ultimately becomes the material used to make many bio-plastic products.

IV. ADVANTAGES OF BIO-PLASTIC OVER PETROLEUM-BASED PLASTIC

What sets bio-plastic apart from petroleum-based plastic is that the process used to make it can also be reversed when the plastic finds its way into a compost heap. Fungi and bacteria found in soil get to work breaking down PLA into its basic parts. Under the proper aerobic (oxygen-rich) conditions, with heat and moisture, PLA will compost like any other organic material. The microorganisms found in compost consume the bio-plastic and break it down into **humus**, a nutrient-packed, soil-like substance that acts as natural plant food. The waste products are carbon dioxide and water.

PLA Helps to Reduce Greenhouse Gas Emissions
Proponents also tout the use of PLA—which is technically "carbon neutral" in that it comes from renewable, carbon-absorbing plants—as yet another way to reduce our emissions of greenhouse gases in a quickly warming world. PLA also will not emit toxic fumes when incinerated.

V. ACKNOWLEDGEMENT

It is a great opportunity for us to write about subject like "BIO-PLASTICES". At the time of preparing this paper we had gone through different books and websites which helped us to get acquainted with new topics. We are actually focusing on those topics which are important for us to understand about this subject easily.

We acknowledge with gratitude to Mr. Piyush Dutt Mishra, our respective teacher, who has always have been sincere and helpful in making us understand the different system of research and conceptual problems in our paper.

Apart from us this paper will certainly be immense importance for those who are interested to know about this subject. We hope that they will find it comprehensible.

We have tried hard and put our soul to gather all relevant documents regarding this subject. We don't know how far we will be able to do that. Furthermore we don't claim all the information in this paper is included perfectly. There may be shortcoming, factual error, mistaken opinion which are all our and we all are responsible for those but we will try to give a better volume in future.

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