

## Activity 1

Use the two links below to produce a presentation highlighting the differences between the production of traditional polyethylene and bioderived polyethylene.

### Internet resources:

1. <https://www.polypostalpackaging.com/how-to-make-a-polythene-bag.html>
2. <http://sugarcane.org/sugarcane-products/bioplastics>

## Activity 2

- i) Describe how sugar cane can be used to produce polyethylene.
- ii) Explain why the manufacture of bioderived polyethylene is not carbon neutral and why this process might not be considered environmentally **friendly**.



## Websites Resources

3. <http://www.scienceclarified.com/everyday/Real-Life-Chemistry-Vol-3-Physics-Vol-1/Polymers-Real-life-applications.html>

GCE

## Environmental Technology The Development of Plastics for the Future:

### Bioderived Polyethylene

For first teaching from September 2013

For first award in Summer 2014



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## Ethanol to Ethylene to Polyethylene:

## Bioderived Polyethylene



### Learning Outcomes

#### Students should be able to:

- describe the manufacture of bioderived polyethylene (BPE), a recyclable plastic (chemical equations not required)

of repeating molecular units which gives the material its strength as well as some other desirable properties.

Polyethylene, which is one of the most common plastics, is a polymer of long chains of the monomer ethylene. There are several different types of Polyethylene (PE) but most common types include:

- LDPE – Low density Polyethylene
- HDPE – High density Polyethylene

Polyethylene is not biodegradable, leading to environmental issues associated with its use. Recycling of Polyethylene is relatively straight forward, although it would be considered to be environmentally advantageous to use a biodegradable alternative.

The basic monomer of the polymer polyethylene is **ethylene**. Ethanol which is a very similar chemical product to ethylene can be produced by the fermentation of agricultural feedstocks such as corn or sugar cane - hence the expression **bioderived polyethylene**.



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Low density polyethylene is produced by a process of **addition polymerisation**. Bioderived polyethylene is produced using the same process, the only difference being that, rather than use ethane derived from crude oil distillation it uses ethanol which has been produced by fermenting a biomass material such as corn starch or cane sugar. The ethanol is converted to ethylene which is then polymerised by addition polymerisation into bioderived polyethylene.

### Is this process energy efficient?

It should be pointed out that although the bioderived polyethylene does not directly use crude oil in its manufacture, the energy used in its production will almost certainly come from a non renewable source. Therefore product itself will have a smaller carbon output but will not necessarily be carbon neutral or considered to be environmentally friendly.



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Polyethylene, or as it is called in everyday use, polythene, is probably the most commonly used plastic. Its primary use is for packaging and it is widely used as the material for plastic bags, plastic films and plastic bottles. Its annual production is over 60 million tonnes.

Polythene is a member of a family of materials called polymers which derives from the Greek word meaning "many parts". Essentially it has long chains