

Carbon footprint and processing cost of bio-plastics

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Motivation

Are bioplastics always preferable?

paper bags vs. plastic bags

use more water
deforestation
.....

kill wildlife animals
serve as hatchery for anopheles fly
.....

<i>Zein, SPI PLA, PE</i>	Energy MJ/kg	GHG emissions kg CO₂/kg	Costs \$/kg
Production			
Manufacturing	?	?	?
Disposal			

Because of the increased interest in bio-based products due to ecological concerns, it is important to know about their environmental performance. Bio-based sounds 'green' but might result in more pollution or energy consumption imposing higher costs to the society than conventional petroleum based products. A Life Cycle Analysis has become a very important tool that can be used to identify and quantify all environmentally relevant issues of bio-plastics.

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Bio-plastics:

Plastics whose carbon comes from contemporary (non fossil) sources. The source of carbon is recently fixed CO₂ from the atmosphere [ASTM D 7075].

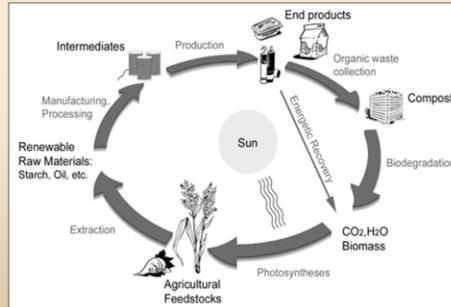
Starch:

PLA (polylactic acid)

Protein:

SPI (soy protein isolate)

Zein (corn protein)



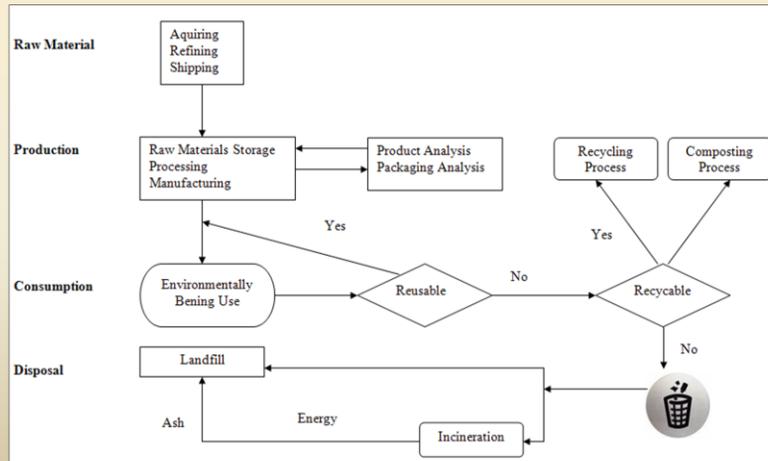
Comp Bio Products Ltd, <http://comp-bio.co.uk/techdata.aspx>

To answer the question: what are bioplastics, that are those plastics whose components come from contemporary sources, which means they are of non fossil origin. The source of carbon is recently fixed CO₂ from the atmosphere. Feedstock material can be for example starch, from which polylactic acid is produced, or plant proteins such as soy proteins that are produced to Soy Protein Isolate or corn proteins, such as Zein.

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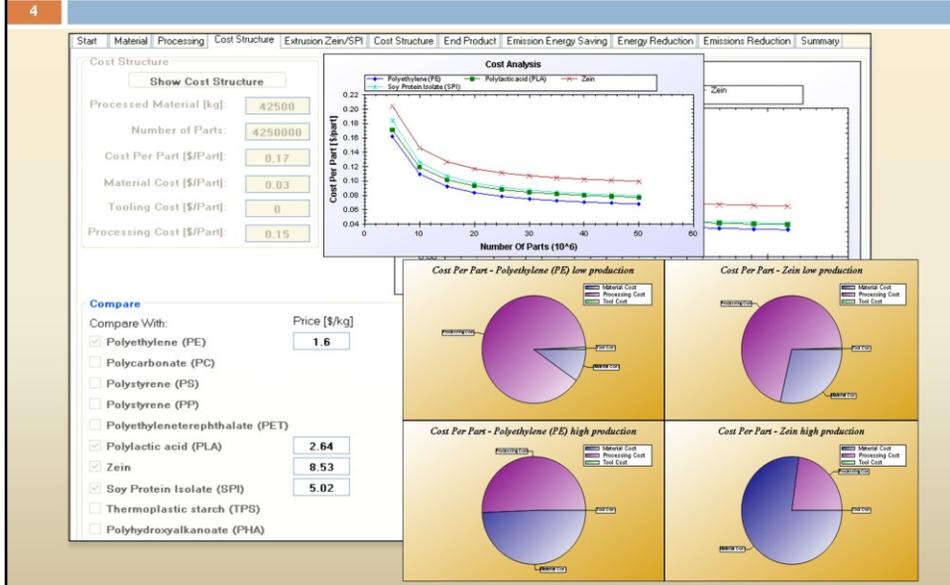
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Life Cycle Analysis – Model



Following the approach of a life cycle analysis according to the ASTM D 7075 standard, a life cycle model for bio-plastics based on corn and soy protein was developed from cradle to grave to be able to predict whether those materials have advantages or disadvantages compared to conventional petroleum plastics.

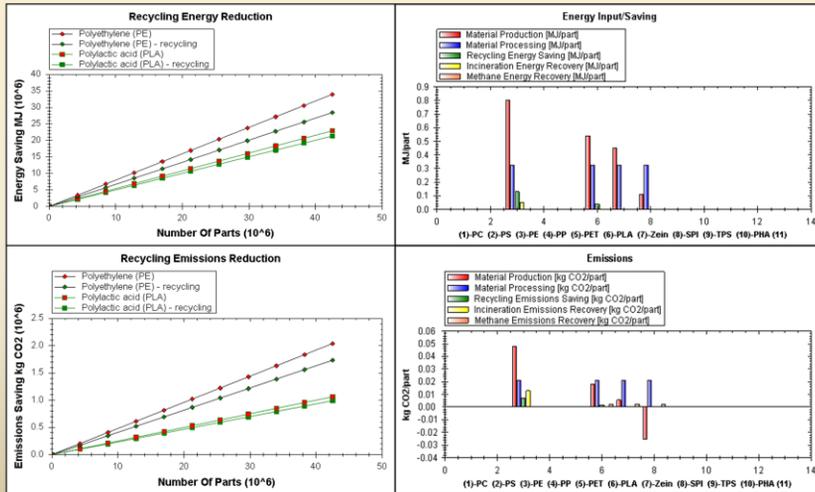
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In addition to that a software was programmed that takes the input of a entire life cycle of a plastic product and calculates the output in terms of CO₂-equivalent emissions, energy consumption as well as the costs of bio-plastics compared to petroleum plastics. Some of the software output is the structures of plastic parts when they are produced on a high and low production capacity.

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In addition to that it also shows the user the beneficial effect of recycling in terms of energy as well as emission savings and finally a direct comparison of bio-plastics and petroleum plastics from an environmental perspective on a per part base.