The Role of Feedstock Pricing in **Bioplastic Production Costs**

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Introduction

The introduction of bio-based plastics (BBPs) to the market is slowed down mainly due to price competition with current fossil-based plastics. There is still a drastic need for application development as bioplastics account for less than 1% of yearly plastic generated worldwide. A large driver for the production cost of BBP is the carbon source (feedstock), making up to 10-60% of the final cost. This project focuses on the BBPs polylactic acid (PLA), bio polyethylene (bio-PE), and polyhydroxyalkanoates (PHAs) created from firstgeneration feedstocks (sugars, starches & oils), which is biomass derived directly from food crops.



Feedstock pricing:

Feedstock	Feedstock cost	Feedstock	Final cost
(1 st & 2 nd	(in %)	cost (in \$)	(in \$)
generation)			
Corn grain	23.0%	0.27\$	1.17\$
(PLA)			
Triticale	35.0%	0.42\$	1.20\$
(PLA)			
Potato	38.4%	0.70\$	1.81\$
(PLA)			
Corn stover	33.3%	1.92\$	5.77\$
(PHA)			
Wheat straw	33.2%	1.25\$	3.75\$
(PHA)			
Waste cooking oil	29.5%	1.18\$	4.00\$
(PHA)			
Corn grain	61.3%	1.41\$	2.30\$
(bio-PE)			
Sugar beet	59.1%	1.36\$	2.30\$
(bio-PE)			
Sugar beet pulp	65%	1.69\$	2.60\$
(bio-PE)			
Table 1. Feedstock d	cost		



Bio-based plastics are made from **a wide range** of renewable **BIO-BASED** feedstocks.



Figure 1: Main feedstock types

Methodology

Data Gathering:

This chapter involves researching relevant data points for the three bioplastics and their respective feedstocks. This includes:

- sugar content
- conversion rate of feedstock to product
- feedstock cost in % and \$ per kg of product - Final cost of BBP



Sensitivity analysis:

The One-at-a-Time (OAT) sensitivity analysis will be used

OAT Sensitivity analysis:

To reflect real-world variability, feedstock prices are assigned realistic ranges based on corn price variance in the last decade. The price of corn has varied from 0.103 \$/Kg to 0.271 \$/Kg, giving an average price of 0.187 \$/Kg throughout 2015 and 2025. Each feedstock price will be varied across its defined range while all other model parameters remain fixed. The variance will be +/-20%, +/-40%, +/-60% for this analysis.

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to assess the influence of individual input variables on a model's output by systematically varying one parameter at a time and keeping all others constant. The feedstock cost per kg of bioplastic (PLA, PHA & bio-PE) is the parameter in question.

The analysis aims to quantify the extent to which fluctuations in feedstock price occur, possibly resulting from market changes, sourcing strategy or overall availability.

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