

Bioplastics – Challenges and Facts

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Market Development

FKuR - Who we are

- Founded in 1992 as Forschungsinstitut Kunststoff und Recycling
- Since 1998 cooperation with the Fraunhofer Institute UMSICHT, Oberhausen, Germany; mutual development and material research of Bioplastics
- Since 2003 operating as **FKuR Kunststoff GmbH**, privately owned company with the commitment to produce sustainable materials
- Since September 2009 operating in Cedar Park, Texas, as **FKuR Plastics Corporation**
- Produced resins (Brands):
Bio-Flex®; Biograde®; Fibrolon®; Terralene®

Overview

- Basics
- Successful Market Placements
- Challenges and Facts
 - Raw Material Sources
 - Green Washing
 - Composting Program Infrastructure
- Outlook

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Basics

- **Biodegradable Plastics (Either Fossil or Renewable Carbon Source)**
 - ▶ Biodegradation doesn't depend on the origin of the raw material, but on the chemical structure of the polymer chain
 - ▶ “Biodegradation is a biological process of organic matter being degraded by micro-organisms (fungi, bacteria) and ultimately converted to water, CO₂/methane, energy and biomass.”
 - ▶ There is no defined time frame for biodegradability as well as no generally accepted definition
- **Compostable Plastics (Plastics that are Biodegradable under Composting Conditions)**
 - ▶ The common US Standard to test compostability for packaging is ASTM D 6400 standard (EU equivalent EN 13432):
 1. Inherent Biodegradation: 90% of the organic carbon must be converted to carbon dioxide by the end of the test period (180 days);
 2. Disintegration: After 12 weeks no more than 10% of its organic dry weight remains after sieving on a 2 mm sieve;
 3. Safety: The plastic product can demonstrate terrestrial and aquatic safety (amount of heavy metals, germination rate not less than 90%)

Basics

Degradation process at 65°C (Bio-Flex Multilayer Film)



0 days



10 days



18 days

Basics

■ Biobased Plastics (Renewable Carbon Source)

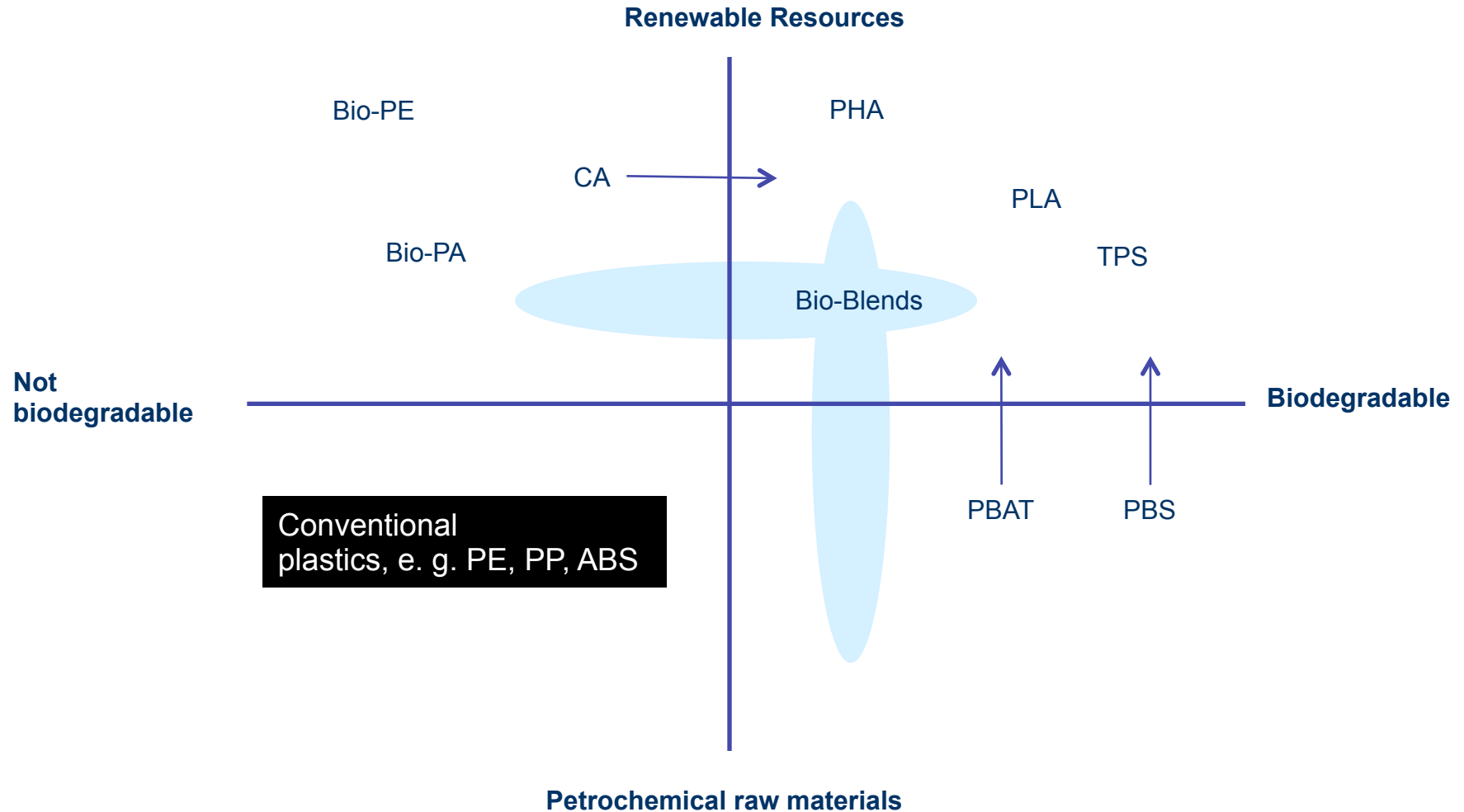
- ▶ Biobased Plastics are plastics that are made from renewable or reproducible sources such as plant based products/feedstock, e.g. bio-ethanol made from sugar cane, or PLA
- ▶ Biobased Plastics are not automatically biodegradable
- ▶ Bio-PE made of bio-ethanol for instance is a regular plastic and can also be recycled

■ Oxo- or Photodegradable Plastics/ Additives

- ▶ Oxo- or Photodegradable Additives are incorporated in conventional plastics such as PE, PP, or PS at the moment of conversion into final products. These additives can be based on organic materials, like starch or transition metals like cobalt, nickel and zinc. Organic additives can biodegrade in few weeks. The key point is nevertheless that the remaining 95% - 99% of traditional polymers would only fragmentize to hardly visible polymer particles.
- ▶ Additives based on transition metals foster oxidation and chain degradation in plastics, especially when exposed to heat and light (photo degradable). Results of this chain degradation are small, hardly visible polymer particles that do not biodegrade, but move through our eco compartments

Basics

The Variation of Biopolymers has increased!



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Successful Market Placements

Deep-Freeze Packaging – FKUR resins for McCain



Successful Market Placements

Back Sheets for Baby Diapers – FK uR Bio-Flex



Successful Market Placements

Computer Keyboard and Mouse – FKuR resins for Fujitsu



Successful Market Placements

Danone Bottle and Yoghurt Cup – Green HDPE and PLA



Successful Market Placements

Sun Chips Bag – PLA and PBAT



Successful Market Placements

Compostable Food Service Ware – PLA and Cellulose Acetate



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Raw Material

Challenge

Biobased Plastics are mainly based on first generation feedstock* and therefore a potential competition with food and animal feed

*Sugar, starch, plant oil and natural rubber

Facts

- Most of the arable land is used for animal feed (69%), followed by food (17%), material use (7% including bioplastics) and finally bioenergy (3,5%)
- 2010 about 724,000 tons of bio-based plastics were produced; 2.5 tons of biobased plastics can be produced per hectare and per year= crops for biobased plastics were grown on 290,000 hectares (0,02% of global arable land)



Raw Material

- To substitute all 250 million tons of plastic in the world with biobased plastic will demand 100 million hectares or 7% of the global arable land
- According to the Nova Institute 0.6 to 1.6 billion hectares could be added to the current 1.4 billion hectares of crop land, if political reforms (e.g. eliminate export subsidies) and investments in agro-technologies take place
- Other measures that could be taken: switch to more vegetarian food (protein from cattle demands 40-50 more times biomass than soya), reduce food losses (one third of the worldwide food produced for human consumption is lost or wasted), switch from bio- to solar energy (which is 40 to 50 times more land efficient)
- Also: Strong efforts are being undertaken by the Bioplastics industry to develop Bioplastics from agricultural residues (potato skin) and other waste streams. There are also a range of Bioplastic materials that already use second generation feedstock (e.g. wood).

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Green Washing

Challenge

Bioplastics and related terms are being misused by various manufacturers to place their products more attractively on the market

Facts

- “eco safe”, “environmental friendly”, “essentially non toxic”, “earthsmart”, or “degradable” – these are examples of slogans used by manufacturers to trick the uninformed and overwhelmed consumer
- Consumers are often willing to pay more money for sustainable products, but don’t have the time to study and check different labels and claims, that often grow faster than education can catch up with.



Green Washing

- There is no legislation at the federal level that requires a label to be backed up by scientific tests. However the *Federal Trade Commission's Green Guides* specify guidelines for the use of environmental marketing.
- Public education about labeling, standards as well as bioplastics in general has to be increased to avoid frustration of the consumers and misuse of manufactures
- Examples for labels that are based on commonly acknowledged standards and corresponding certification processes:



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Composting Program Infrastructure

Challenge

The lack of an infrastructure for the appropriate disposal compostable Bioplastics

Facts

- Apart from marine degradation, anaerobic digestion and recycling, the most suitable end of life option for compostable bioplastics are industrial composting facilities
- There are approximately 350 food and yard waste composting sides in North America (Germany: 980) – but few of these facilities accept compostable bioplastics. Composting sides that accept bioplastics often have differing composting standards (e.g. decomposing duration)



Composting Program Infrastructure

- A few US cities accept compostable plastics in their “bio bins”, also a few chains, like Whole Foods, or closed loop events (London 2012 Olympics), collect compostable plastic trash, but in general the consumer doesn’t know where to dispose the sustainable sandwich box certified compostable.
- Canada established a well functioning composting infrastructure: Almost all of the Canadian composting facilities accept correct labeled compostable plastics. Cities and retailers work hand in hand to offer and distribute compostable plastic bags.
- Recyclability seems to be the new sustainability trend in North America, still just 28% of all recyclables actually get recycled. Compostable plastics cant compete with recyclables, but some biobased plastics, like Bio-PE can.
- Signs of hope for compostable plastics: Increasing amount of industrial composting facilities as well as anaerobic digestion plants; \$ 3/ton tipping fee for landfills; Plastic bag bans; rising petroleum costs, USCC Compostable Plastics Task Force

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Outlook

- Global demand for biodegradable and biobased plastics will more than triple to over one million metric tons in 2015, valued at \$ 2,9 billion
- Excellent growth is forecast for the two leading biodegradable plastics, starch based resins and PLA. But non-biodegradable and renewable resins, like Bio-PE, will be the primary driver of bioplastics demand through 2015 and beyond
- Bioplastics can become a valuable component in a closed loop system and make a remarkable contribution to a sustainable development, if the industry and the government are willing to invest in education and conversion.

Thank you very much for your attention!

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