oplastics - Products from Renewable Resources



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roduction

plastics are not a uniform polymer group but a family roducts with a variety of properties. A generally epted definition of the term does not exist. However, different categories can be distinguished:

plastics based on renewable resources

biodegradable plastics, which can be degraded by microorganisms or higher organisms





tivation for Using Biomass

sil resources

sil resources as crude oil are available in unlimited amounts.

e costs of fossil based chemical ducts are dominated by the de oil price.

e use of fossil resources tribute to the greenhouse ect.



forestry.



ices of crude oil and standard plastics

- Prices of standard plastics like PE, PP and PS depend directly on the price of crude oil
- Price of technical plastics does not
- Rising crude oil prices will increase the prices of standard plastics



Sources: Stat. Bundesamt, KI



gar, Corn and Wheat Price

- In the last 2 years the corn and wheat prices increased significantly.
- The sugar price fluctuated heavily.
- The sugar price is subject to other market criteria than the corn and wheat price.





astics Market

- Vorld production of plastics 2007: 260 m tons
- Annual increase of per capita consumption until 2010: vorldwide 4.1 % n Latin America 4.3 %
- Production in Latin America: 4.0 % of world production (about 10.4 m tons)

(Source: PlasticsEurope)





astics Market

- Nearly 70 % of the demand in Europe are standard plastics. Their prices depend significantly on the oil price.
- The three big fields of applications in Europe are packaging, building and construction, and automotive.

(Source: PlasticsEurope)



Source: PlasticZurope Market Research Group (PEMRG)



orldwide Manufacturing pacities for Bioplastics

- Norldwide manufacturing apacities for bioplastics 2007: about 262 000 tons/year
- ong term potential worldwide: 20 m tons/year
- ong term potential in Latin America:
- ,2 m tons/year
- ange of prices for all types: 1,50 – 4,00 /kg 1 300 – 3 000 chil\$)

ce: European Bioplastics)





orldwide Manufacturing Capacities for Bioplastics 2007

- 2007 main production apacities were in Europe
- Expected greatest ncrease in South America



(Source: nova-Ins



ditional Capacities till 2010

Expected greatest ncrease for biobased Plastics: Bio-PE



(Source: nova-Ins



astics Market









oduction of biobased Plastics





rrent Status of biobased Plastics

-PP	Bio-PA Bio-PBT Bio-PBS Bio-PE, factory planned Bio-PVC, factory plann	^d PHV ^{ed} Other PHA	PHBV PTT, with Bio-PD Bio-PUR TPE, with Bio-PD	 Cellulose acetate PLA Starch-based materia
a	Research	Sample available	Commercial amounts	Large-scale production
Polyamide : Polybuthylene succinate : Polybuthylene terephthalate): Propanediol Polyethylene		HA: Polyhydroxy alkanoate HBV: Polyhydroxybutyrate-co-valerate HV: Polyhydroxyvalerate LA: Polylactic acid P: Polypropylene		PTT: Polytrimethylene terephthalat PUR: Polyurethane TPE: Thermoplastic Elastomers



oplastics in Comparison to PE

- Density of bioplastics is higher
- Mechanical properties are better.
- Heat resistance in general better, PLA slightly lower than PE
- Processability more challenging pre-drying necessary, thermally and shear sensitive)
- Price higher
- Availability of PHA limited



(Own estimation, based on the sources: Albis, KI, producer)



oplastics in Comparison to PP

- Density of bioplastics is higher
- Mechanical properties are better.
- Heat resistance generally worse, PLA especially low
- Processability more challenging pre-drying necessary, thermally and shear sensitive)
- Price higher
- Availability of PHA limited



(Own estimation, based on the sources: Albis, KI, producer)



oplastics in Comparison to PA

- Density of bioplastics is equal
- Tensile stress at break of PLA and PHA ower, modulus of elasticity of PLA and CA higher
- Heat resistance significantly worse
- Processability similarly challenging
- PLA lower price, PHA and CA more expensive
- Availability of PHA limited



(Own estimation, based on the sources: Albis, KI, producer)



oplastics in Comparison to ABS

- Density of bioplastics is higher
- Mechanical properties are worse.
- Heat resistance significantly worse
- Processability similarly challenging
- PLA lower price, PHA and CA more expensive
- Availability of PHA limited



(Own estimation, based on the sources: Albis, KI, producer)



oplastics applications

- Packaging
- Packaging material (e.g. loose-fill)
- Agricultural products (mulch films, plant pot, tree protection)
- Catering articles
- Carrier bags, garbage bags
- Golf tees
- Stationary (e.g. ball pen)





amples for currently used bioplastics

Toyota: First applications based on PLA kenaf composites (2005)

Mazda: Use of PLA specialties (heat resistant tereo complex from L- and D-lactid) as covering material and for interior parts in "Premacy Hydrogen RE Hybrid" (2008)

otus technology demonstrator Eco Elise roadster): parts of the car body, spoiler and different interior parts are from hemp composites (2008)





amples for currently used bioplastics

- oyata technology demonstrator COMS-BP electric compact car): car body is made partly from ramie reinforced lignin compound
- Cooperation Fiat, Polytechnikum, Novamont: car body of the electric car Phylla based on a biodegradable plastic, start of production is scheduled for 2010



(Quelle: Toyota, AutoMotorS



ıtlook

- Presently, bioplastics are available with a wide range of characteristics.
- Bioplastics have shown their potential in many applications.
- Many bioplastics can be normally processed with standard equipment.
- Biodegradability is an important characteristic for many applications but the use of enewable resources is an additional market demand.
- Prices for bioplastics are still higher than fossil based plastics. However, bioplastics ca competitive due to their special properties. In future the prices for fossil and renewable based material will both rise.
- Regulative measures and increased environmental awareness have significantly boost he market for bioplastics.
- New economic synthesis routes for the production of polymers based on renewable esources are under development.
- n the field of technical plastics the development of plastics based on renewable esources, which are not biodegradable, shows a high potential for R&D.



st but not least



The field of »bioplastics« shows a high R&D potential for new processes and products. A quick start of new developments offers chances for a top position in tern of technology.

We have to develop technologies today to be competitive in future.

ny thanks for your attention! men.michels@umsicht.fraunhofer.de

