

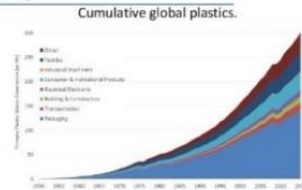
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BIOSMART – Business Decision Support System

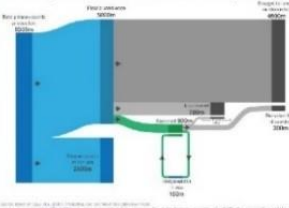
Plastic food packaging has a huge environmental and economic impact

The Problem with Plastic Packaging

We produce ~335 million metric tons of plastics annually, 40 % go into packaging and only a fraction is recycled



Global plastic production and its fate (1950-2015)



Plastic waste in numbers

- Total of 4900 Mt since 1950
- 9% recycled, 12% incinerated, rest is landfill
- Total of 400 Mt annually
- 141 Mt, roughly 40%, from packaging alone
- 8 Mt leak into the oceans

Smart solutions for the ever growing market and the subsequent waste have to be found

BIOSMART – Bio-based smart packaging for enhanced preservation of food quality

Develop active and smart bio-based and compostable packages to meet the needs of both fresh and pre-treated food applications

- Improve packaging properties
- Ensure biodegradable or compostable packaging for fresh and processed food
- Reduce packaging cost
- Increase shelf life of food products
- Reduce food residuals in packaging
- Sensor assisted shelf life surveillance

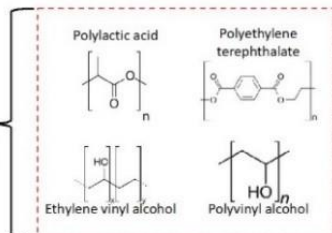
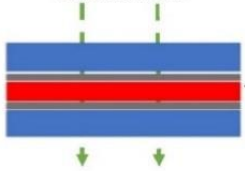


Multi-Layer Packaging Design and Properties

Food packaging is a set of superposed layers with different physical and barrier properties.

- Barrier properties against gases and moisture
- Brittleness
- Tensile strength
- Biodegradability
- Environmental impact
- Cost per square meter

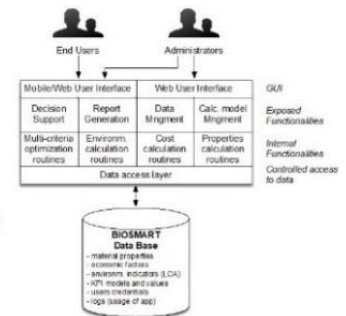
Transmission rates?



Assistant for Packaging Design and Management

Industrial web and mobile application for economic and properties prediction of food packaging

- Software analysis and design for a complex context
- Secure and scalable storage of packaging data
- Design of multi-layer packaging
- Computation important parameters of package designs
- Display and compare package properties



Property Calculator and Package Optimization

BIOSMART – Business Decision Support System to calculate, predict and optimize package design

Computer Assisted Package Design

Polymer Database

Material	Chemical Name	Structure	Modulus (GPa)	Strength (MPa)	Elongation (%)	Thermal Tg (°C)	Thermal Tm (°C)	Thermal DSC (J/g)	Biodegradability	Other
PE	Polyethylene	[-CH2-CH2-]n	0.1-0.2	10-30	100-1000	-	-	-	Yes	
PP	Polypropylene	[-CH2-CH(CH3)-]n	0.8-1.0	20-30	10-100	-	165	-	Yes	
PS	Polystyrene	[-CH2-CH(C6H5)-]n	0.3-0.4	60-70	5-10	100	240	-	No	
PC	Polycarbonate	[-O-C6H4-CO-C6H4-CO-]n	2.4-2.5	60-70	10-15	160	-	-	No	
PLA	Poly(lactic acid)	[-O-CH(CH3)-CO-]n	0.3-0.4	60-70	5-10	150	-	-	Yes	
PVA	Poly(vinyl alcohol)	[-CH2-CH(OH)-]n	0.2-0.3	30-40	10-100	-	-	-	Yes	
PET	Poly(ethylene terephthalate)	[-O-C6H4-CO-C6H4-CO-O-]n	0.7-0.8	60-70	5-10	-	260	-	No	

Evolutionary Computation Constraint Optimization



Manual Design

Property Calculator and Package Optimization – Future Work

BIOSMART – Business Decision Support System and this Future Work.

- Calculate environmental impact factors
- Improved optimization routines with additional constraints (UV-Barrier, layer sequence, physical properties)
- visual representation of the interaction between parameters and cost
- work temperature prediction

Mobile Barcode System



Information for the End User

- Get Information About the Packaging
- Show the correct disposal of the polymers
- Show environmental impact of packaging