

VIRTUAL MEETING

BIO-PLASTICS EUROPE



BIO
PLASTICS
EUROPE

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 860407.
BIO-PLASTICS EUROPE project website: www.bioplasticseurope.eu



BIO-PLASTICS EUROPE

Developing and Implementing Sustainability-Based Solutions for Bio-Based Plastic Production and Use to Preserve Land and Sea Environmental Quality in Europe

October 2019 – September 2023



Project kicked-off in October 2019





Prof. Walter Leal
Project Coordinator

Our Team

Ms. Silke Kuehl



Financial Officer

Dr. Jelena Barbir



Lead Project Manager

Ms. Cintia Nunes



Project Manager

Ms. Franziska Wolf



Senior Project Manager

Ms. Caroline Paul



Student Assistant

Ms. Liza Tuladhar



Student Assistant

Ms. Maren Fendt



Student Assistant

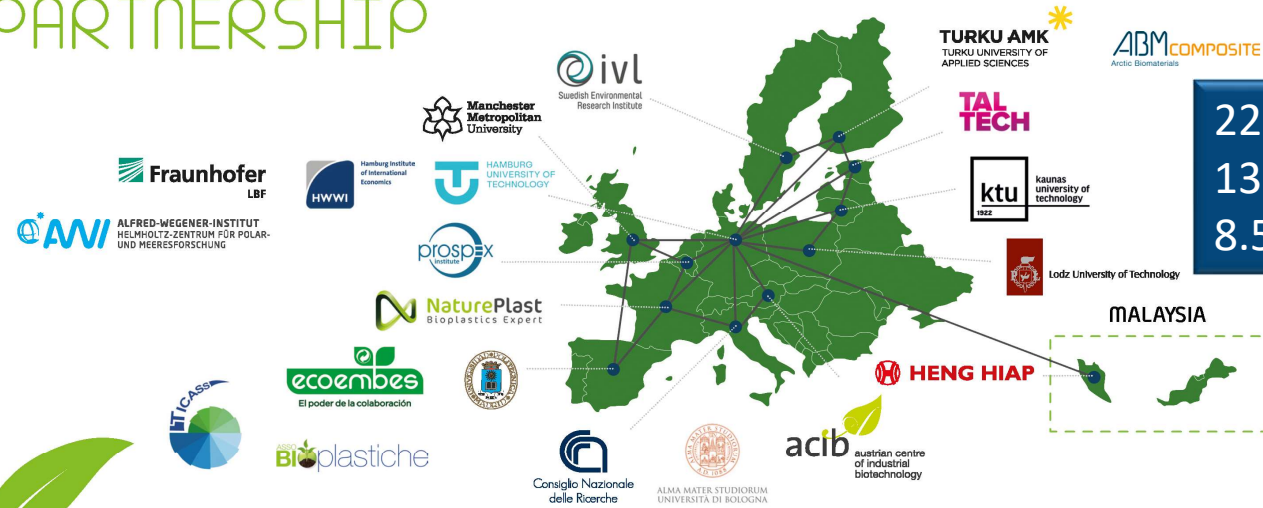
Ms. Marie Hornbogen



Student Assistant



PARTNERSHIP



22 partners
 13 countries
 8.5 million Euros

CONTACT INFO

HAMBURG UNIVERSITY OF APPLIED SCIENCES
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The main objective:

To develop sustainable strategies and solutions for bio-based plastic products, as well as the to develop approaches focused on circular innovation for the whole bioplastics system. These may be deployed to support policy-making, innovation and technology transfer.



Objective 6:
Communication Strategy
+ cooperative knowledge
sharing of Best Practices and
Lessons Learned
WP9

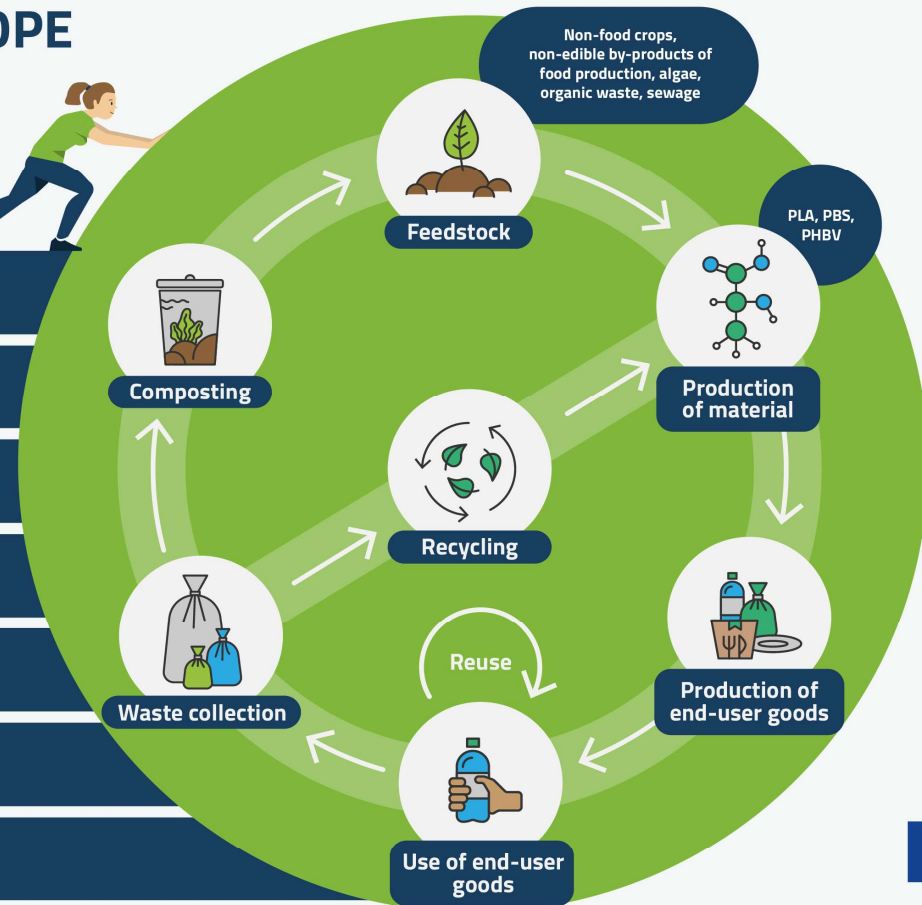


BIO-PLASTICS EUROPE

Pushes towards circular economy



- WP3 Identification and test of innovative product design
- WP4 Plastic waste collection, recycling and littering
- WP5 Prenormative research and field tests
- WP6 Health and environmental safety
- WP7 Replication, policy-making, capacity-building and upscaling
- WP8 Life cycle assessment environmental and economic
- WP9 Information, communication, and dissemination of results





EXPECTED RESULTS

FOCUS

Cutlery, Soft and Rigid Packaging,

Agricultural Mulch Film, Toys and Aquatic Materials

● INNOVATIVE MATERIALS

to foster and encourage deployment of innovative bio-based and biodegradable materials

● STAKEHOLDERS ENGAGEMENT

to ensure strong commitment of producers, politicians, industrial and private consumers

● BUSINESS MODELS

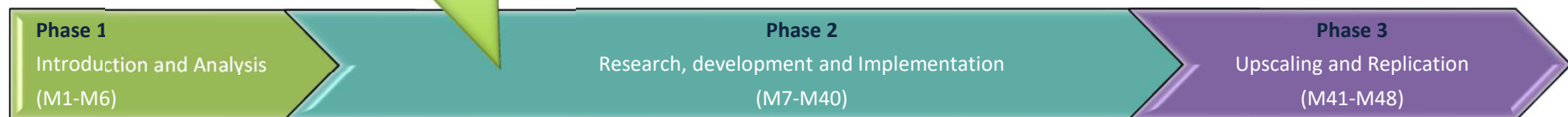
to experiment with innovative business models by incorporating circularity and sustainability to maximize the value of materials along the entire value chain

● SAFETY PROTOCOLS

to ensure the safe use and end-of-life management on innovative bio-based plastics



Where we stand now....



Within the BIO-PLASTICS EUROPE project, the following end-products are experimented:

- **PACKAGING (rigid and flexible)**
- **TOYS**
- **AGRICULTURAL MULCH FILM**
- **CUTLERY**
- **AQUATIC MATERIALS: geo-membrane, fishing baits, fishing cradles**

First group of 5 materials developed

5 MATERIALS:

The materials under investigation are:

1. BPE-FP-PBS
2. BPE-RP-PLA
3. BPE-T-PHBV
4. BPE-AMF-PLA
5. BPE-C-PLA

From this list mainly PLA is already commercially in use and well available according to very recent application notes from various companies.

SENT FOR LABORATORY AND FIELD TESTS

- Samples prepared-received
- Test Protocols finished
- Tests started 1st of September
- First preliminary results obtained

**MODIFICATION of the materials after 1st round tests****2nd round of TESTS**

Besides focusing on research....



NETWORKS

2nd event
4th of
November



BIO PLASTICS EUROPE

SUSTAINABLE SOLUTIONS FOR
BIO-BASED PLASTICS ON LAND AND SEA

**EUROPEAN BIOPLASTICS
RESEARCH NETWORK**

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 86407

LinkedIn: over 200 members
Preparing events
Foster communication
Share experience

2nd event
15th of
December

Connect cities
Preparing events
Exchange experience
Offer solutions



BIO PLASTICS EUROPE

SUSTAINABLE SOLUTIONS FOR
BIO-BASED PLASTICS ON LAND AND SEA

**HISTORIC CITIES AGAINST
PLASTIC WASTE**

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 86407



STAKEHOLDER ENGAGEMENT

12 ONLINE
STAKEHOLDER
PROMOTION EVENTS

September – December
2020

PROMOTE PROJECT
CLUSTER stakeholders
FUTURE INVOLVMENT



THANK YOU FOR ENGAGING WITH US.....

HAMBURG UNIVERSITY OF APPLIED SCIENCES

Research + Transfer Centre „Sustainability & Climate Change
Management“ (FTZ-NK)

Ulmenliet 20 / 21033 Hamburg / Germany
T +49 40 428 75 6362 (Mon - Fri 8AM-3PM)

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Website: <https://bioplasticseurope.eu/>

..... THANK YOU FOR YOUR ATTENTION!



HAW Hamburg



Horizon 2020



BIO
PLASTICS
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... ..

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Modifitseeritud bioplastide kompostimine



<https://www.surfrider.org/>

- Argo Kuusik
- Vee-ja keskkonnatehnika uurimisrühm
Inseneriteaduskond
Tallinna Tehnikaülikool
- argo.kuusik@taltech.ee

Uuritavad materjalid

| Materjal | Kasutusvaldkond | Uuritava materjali kuju |
|-----------------|------------------------|--------------------------------|
| PHI 002 | Mänguasjad | Graanulid |
| PLA-Fi | Söögiriistad | Graanulid, lehed |
| PLE 005-A | Peenrakile | Graanulid, film |
| PLA-Mi | Jäik pakend | Graanulid, lehed |
| PBE 003 | Pehme pakend | Graanulid, film |

Graanulid



PLA-Mi based plastic



PLA-Fi based plastic



Lehed



PLA-Mi based plastic



PLA-Fi based plastic



Film



PBE 003 based plastic



Aeroobsed kompostimiskatsed

- Katsed põhinevad standardil ISO 14855-1
- *“Determination of the ultimate aerobic biodegradability of plastic materials under controlled composting conditions — Method by analysis of evolved carbon dioxide”*



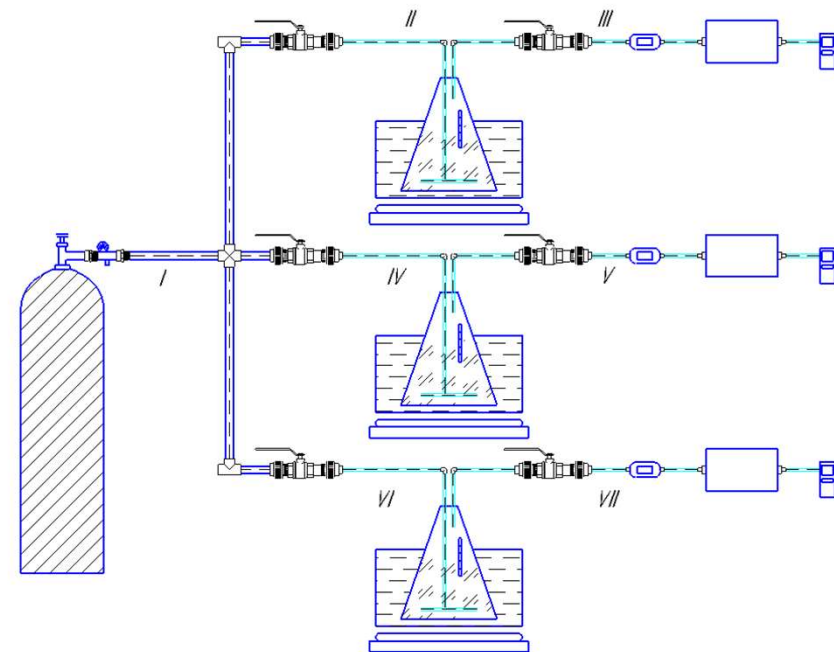
Aeroobsed kompostimiskatsed

Katse tingimused:

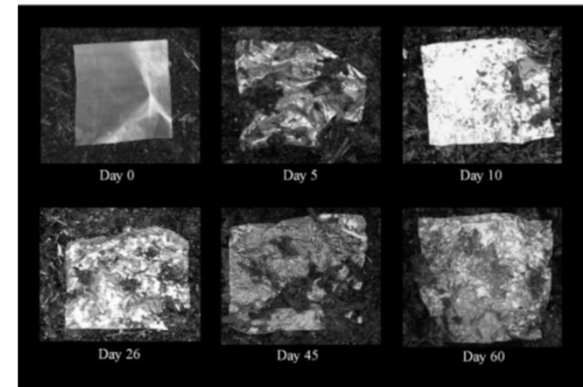
- Temperatuur 58 ± 2 °C
- O₂ sisaldus vähemalt 6%
- Uuritaval materjalil 3 paralleeli
- Katsekeha suurus 2x2cm max
- Katse periood kuni 6 kuud

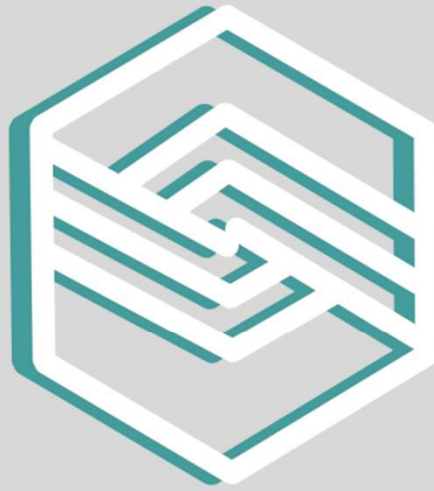
Jälgitavad parameetrid:

- KA, LA, TOC, pH
- O₂, CO₂,
- katsekehade kaal ja kuju



TÄNAN KUULAMAST!





EESTI PLASTITÖÖSTUSE LIIT
EST 1997



Plastitööstuse väljakutsed ja võimalused

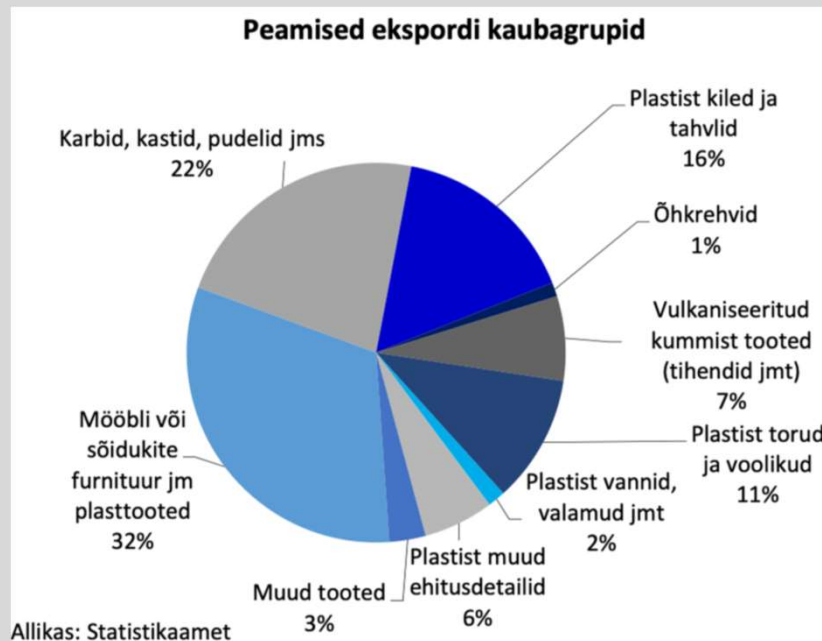
Pilleriin Laanemets

Seminar "Bioplasti võimalused Eesti turul" 12.11.2020

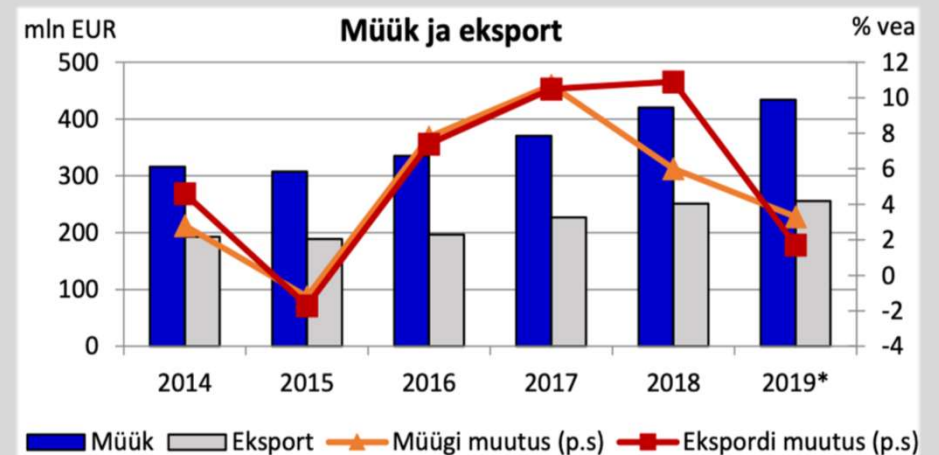


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Eesti plastitööstus (2019)



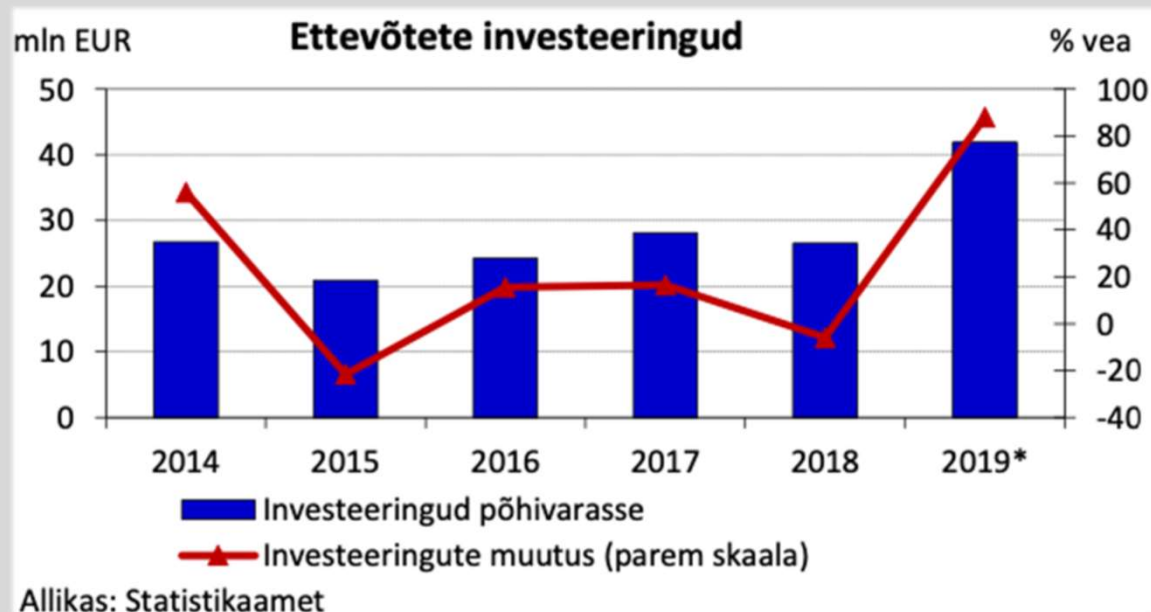
- Hõivatute arv sektoris: 3700 inimest.
- Sektoris 200 ettevõtet.
- **EPTL liikmeid: 46 ettevõtet.**





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Plastitööstuse investeeringud (2019)



- Tööstuse automatiseerimine ja digitaliseerimine.
- Ressursitõhusus.
- Investeeringud kinnisvarasse.

Euroopa Liidu rohepöörde võimalused



EESTI PLASTITÖÖSTUSE LIIT
EST 1987

Paradigma muutus plastitööstuses: kestlikkus ja digitaalsed lahendused.

Plastmaterjal säästab energiat, vähendab CO₂ heidet: transpordis; rohetehnoloogiates jn

Plastmaterjali funktsionaalsus on ringmajanduse juurutamise aluseks.

Vastavuses EL rohepöörde toote kestlikkuse printsiibiga.

Keskkonnamõjude hindamine ja madalsüsiniku majanduse suunas liikumine.



Euroopa Liidu rohepöörde väljakutse



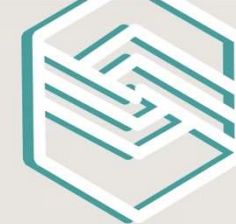
EESTI PLASTITÖÖSTUSE LIIT
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FRAGILE
HANDLE WITH CARE

OHT: süsinikuheite koguse
ülekandumisele ja EL globaalsele
konkurentsivõimele.



SUP-direktiiv: pakendite plastmaterjali kvantitatiivne vähendamine



EESTI PLASTITÖÖSTUS
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TOIDUOHUTUS

TOIDU SÄILIVUS



"1/3 maailmas toodetud toidust juba raisatakse"





Biodegradable



Recyclable



EESTI PLASTITÖÖSTUSE LIIT
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ORIENTEERUMINE ROHEPESU LABÜRINDIS



Compostable

Sünteetilise plastmaterjali kvantitatiivne vähendamine – millised on alternatiivid?



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EST 1997



100% taastuvast toorainest.



Juhul kui intensiivpõllumajanduse arvelt, siis on oluline jälgida keskkonnakoormust.

Investeeringutega kaasnev hinnatõus ületab tarbijate maksevõime.

Ringlusse võtmine täna raskendatud.

Komposteerimine tööstuslikes tingimustest.

Lagundamine tekitab metaani.

Paber & kartong



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Enamus massist taastuval toormel.

Ei ole ringlusse võetav,
v.a. kile & kartongi
eraldamise võimalikkusel.



Vetthülgavate omaduste
saavutamiseks:

- kilekihiga kaetud;
- liimi või keemilise ainega töödeldud.

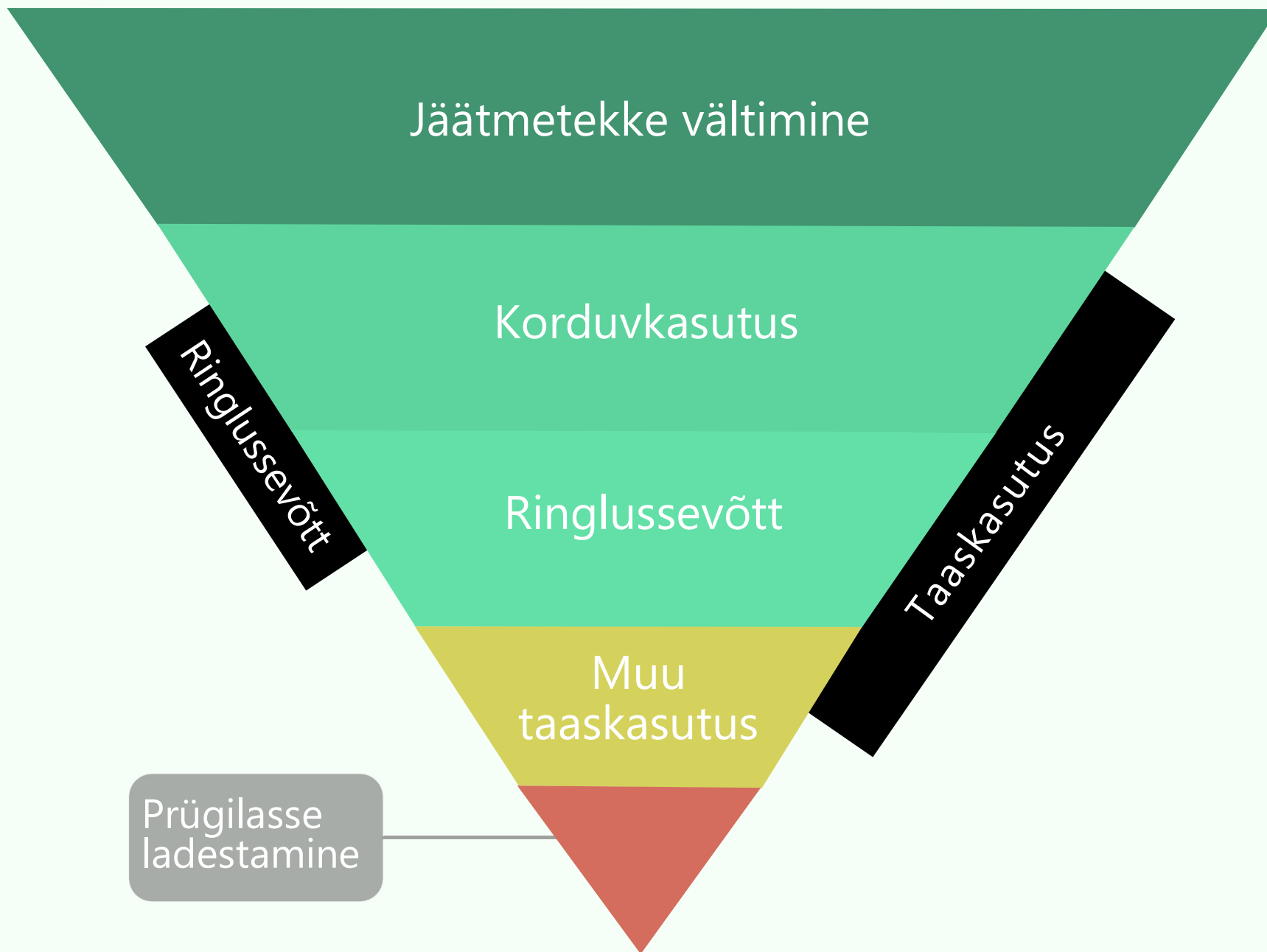
Toiduga vahetul kokkupuutel
veel vähe teadusuuringuid.



TARBIMINE MUGAVUSELT VAJADUSPÕHISEKS!



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PAKENDI ELUTSÜKKEL RINGMAJANDUSES

Mehaaniline ümbertöötlus



EESTI PLASTITÖÖSTUSE LIIT
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Toiduga kokkupuutes pakend



Transpordipakend



Toore ehitusmaterjalides



Energiatootmine

Väärtuse langus

PAKENDI ELUTSÜKKEL RINGMAJANDUSES

Keemiline ümbertöötlus



EESTI PLASTITÖÖSTUSE LIIT
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Toiduga kokkupuutes pakend



Toiduga kokkupuutes pakend



Keemiline ümbertöötlus



Materjali omaduste ja kvaliteedi säilimine



EESTI PLASTITÖÖSTUSE LIIT
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Jäätmete liigiti kogumine ja plasti keemilise ümbertöötamise arendamine on vältimatu EL plastimaksu koormuse leevendamiseks.

Plastimaks

Ringlusse võtmata mahult 0,8 eurot/kg

Probleemi tuum:
segaolmest tulenev
jätmeplast

Plastijäätmete keemilise ümbertöötamise arendamine
Enefit tehastes Ida-Virumaal.

Roheleppest
tulenev uus väljund
Ida-Virumaale

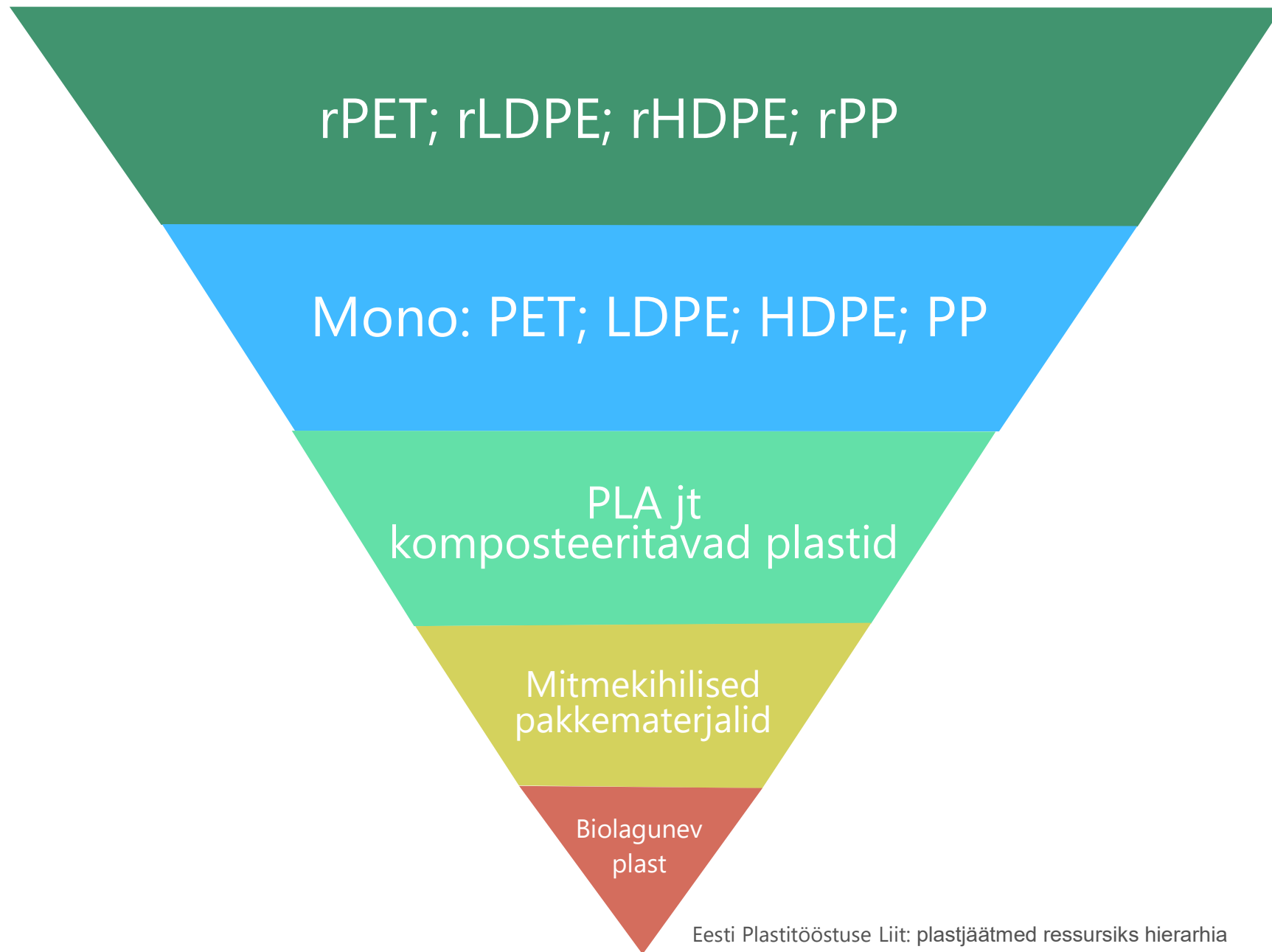
Ringmajanduse
nüüdisaegne
tehnoloogia

Sotsiaal-
majanduslik
mõõde

Ringmajandust soosivad valikud plastmaterjalide lõikes



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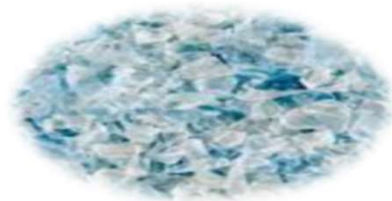
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Ringmajandus ja toiduohutus

Väljakutse, mille julgevad vastu võtta vaid üksikud tootjad Euroopas.



100% taaskasutatavast materjalist rPET kile ja toidupakendid.





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EST 1997

Lokaalne kasutegur

4000 tonni/a

Eestis tekkinud plasttaara kogus aastas



>5000 tonni/a

EstPak Plastik AS rPET tootmisvõimsus aastas

ORKOS ESTONIA OÜ – katab Eesti kilejätmete ümbertöötlusvajaduse

- Üle 6000 tonni kõrge kvaliteediga rLDPE regranulaati aastas.
- Skandinaavias hinnatud koostööpartner.
- Tehas Maardus töötab täisvõimsusel.



orkos



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Kas kilekoti vältimine on keskkonna-sõbralik?

BBC World News



Trükised & etiketid



EESTI PLASTIÕÖSTUSE LIIT
EST 1997

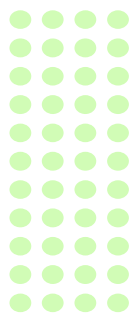
Rootsi kredo "Dare to be colorless"



Trükised & etiketid



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Väärtusahela iga lüli vastutab



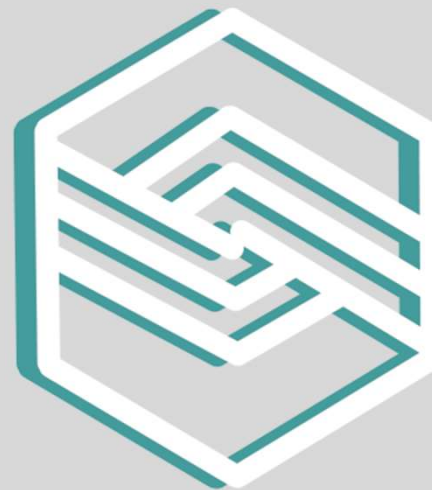
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Pakenditootja:
tark disain.

Pakendaja:
funktsionaalsus
minimaalse
keskkonnamõjuga.

Kaubandus:
tarbijakäitumise
suunamine.

Lõpptarbija:
jätmete
liigiti kogumine.



EESTI PLASTITÖÖSTUSE LIIT
EST 1997

Täna!

Pilleriin Laanemets
Tegevjuht/Partner
Eesti Plastiöstuse Liit
M: +372 5621 0648
pilleriin.laanemets@plast.ee

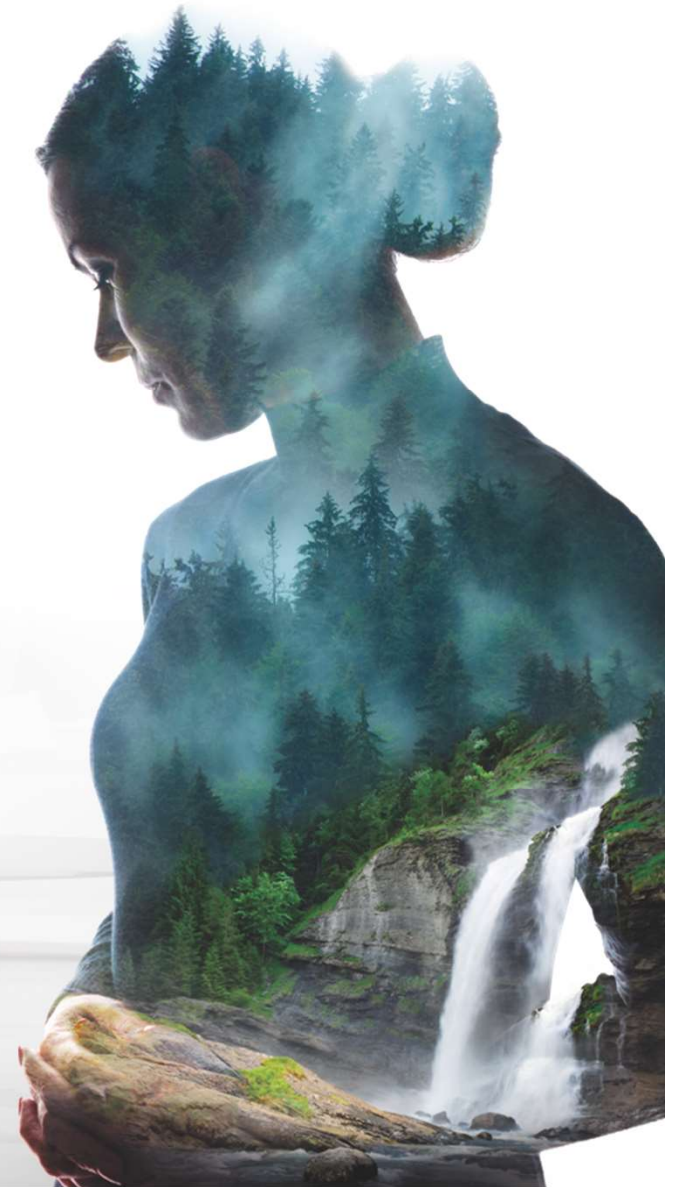


“Applications and opportunities of PLA-based materials”

R&D Director, ABMCOMPOSITE
Associate Prof. Åbo Akademi University
Ari Rosling



"Bioplastics Europe" on-line seminar, 12th of November 2020, Estonia



General Company info

- **Arctic Biomaterials (ABM)**
- Company founded in 2014
- 60 specialists with extensive biopolymer experience
- Medical & Technical product manufacturing and R&D sites at Tampere, Finland + new manufacturing site in Asia

HQ



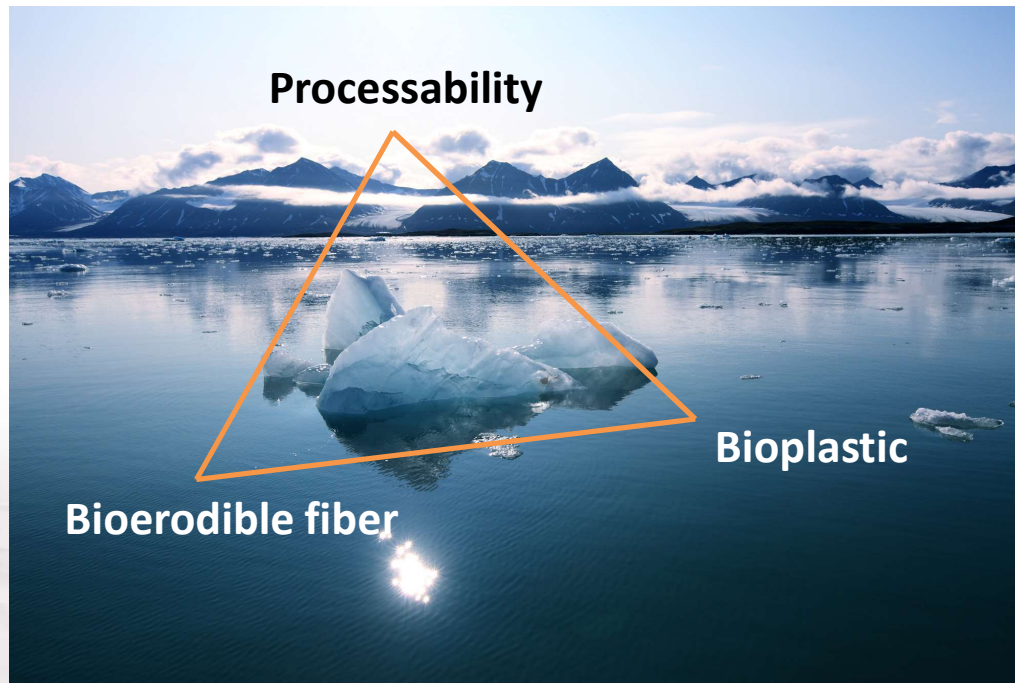
Tech
site



NN



New Era of Biodegradable Composites



- *Bioerodible reinforcing glass fiber made from "bioactive glass"*
- In-house functionalized compounds from commercially available biodegradable *bioplastics*
- Can be processed as current glass fiber reinforced polymers

Why biodegradable bioplastics from renewable resources?

- ***Decoupling from oil resources***
 - Depletion of oil resources, potential price increase
 - Improved biotechnological process for biomass conversion -> more efficient monomer production -> price reduction
- ***Environmental impacts***
 - Carbon neutral & reduced global warming potential (GWP)
 - Biodegradation a solution to waste from un-intentional littering (soil/marine)
- ***Positive image***
 - Today sustainability is of high priority in company policies
 - A willingness for accepting increased costs (to a certain level)
- ***Legislation/governmental actions/strategic***
 - Proposals & Directives for reduced use of fossil based plastics
 - Actions promoting use of bio-based resources for biofuel and bioplastics



Bioplastics - Challenges



Availability

- limited availability (competition with biofuels and use in food and cosmetics)
- uncertainty in increased production volumes -> obstacle for big players to jump on the bioplastic train

Feedstock

- ethical issues (food; 1st generation vs non-food; 2nd & 3rd generation))
- GMO free

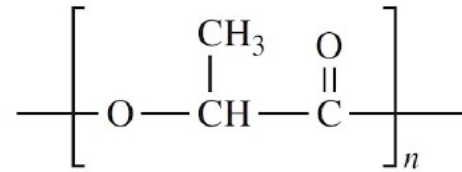
High price

Development of appropriate infrastructure for recycling->Sustainability &circular economy

Define the most optimal use and application of eg. PLA (functionality match and where the value proposition overcomes price issues)

Need to go for more demanding (semi)durable applications instead of disposables => Need for better material performance => alternatives to fossil-based technical plastics

Poly lactide-PLA

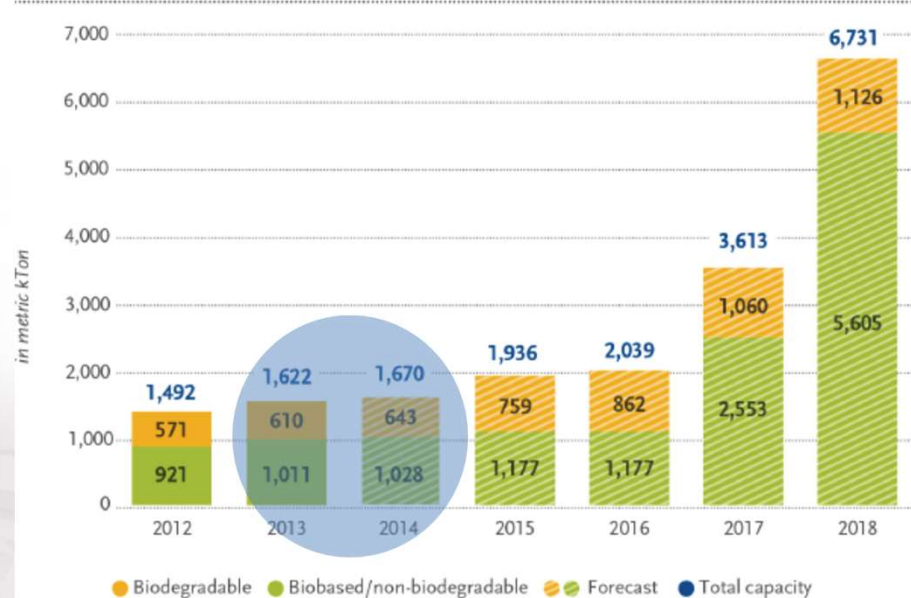


- Not a new kid on the block!
- Lactide monomer was described already 1912
- Polylactide was produced 1932 by W.H. Carothers
- NatureWorks LCC started commercial production 2001/2002
 - Today announced 140.000 T/year capacity
- Since then several companies have enter but also left the market
- Total Corbion launched a 75.000 T/year plant 2019
- Total PLA production ~240.000 T/year (ABS ~11 miljon tonnes)

Bioplastic production capacities Past – present -future

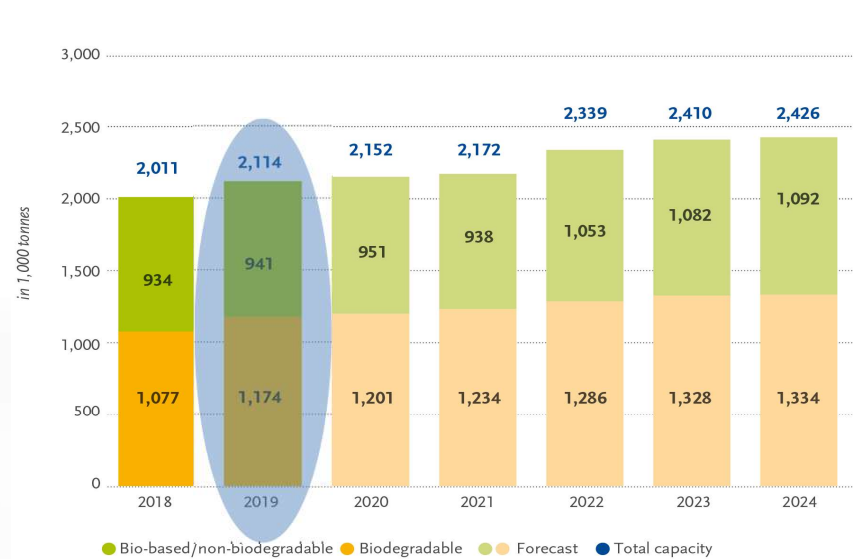


Global production capacities of bioplastics



Source: European Bioplastics, Institute for Bioplastics and Biocomposites, nova-Institute (2014)
More information: www.bio-based.eu/markets and www.downloads.ifbb-hannover.de

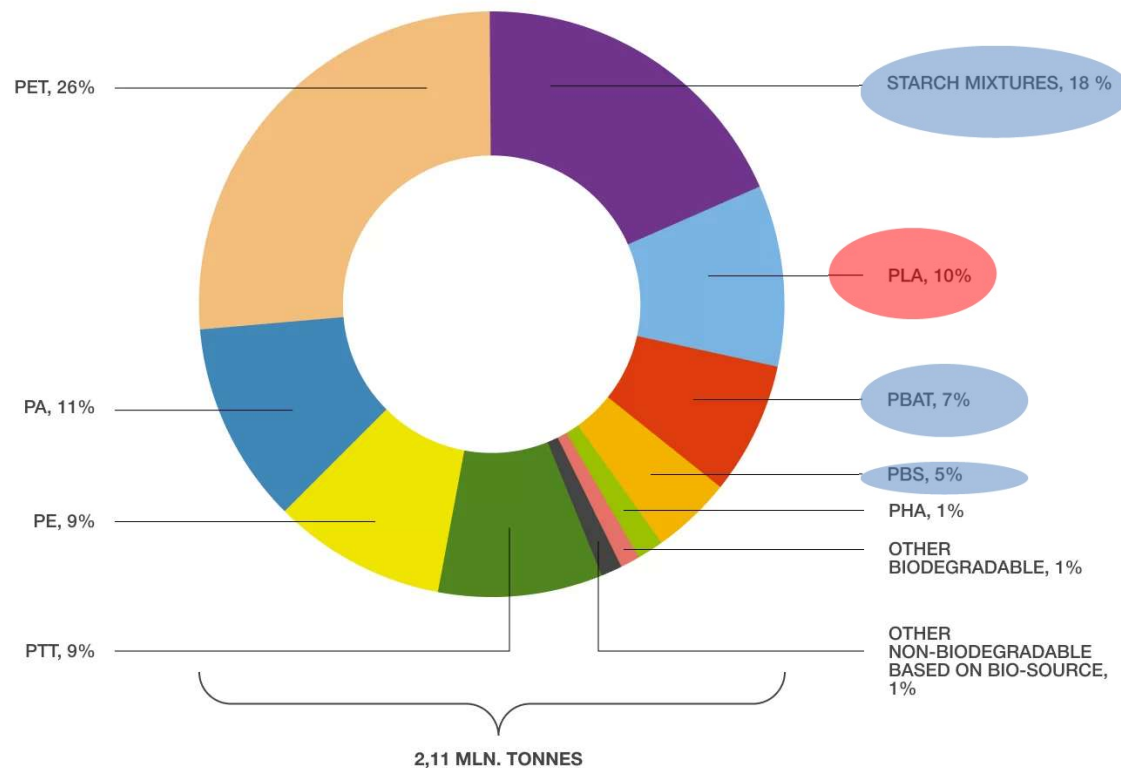
Global production capacities of bioplastics



Source: European Bioplastics, nova-Institute (2019)
More information: www.european-bioplastics.org/market and www.bio-based.eu/markets

Source: [European Bioplastics](http://www.european-bioplastics.org)

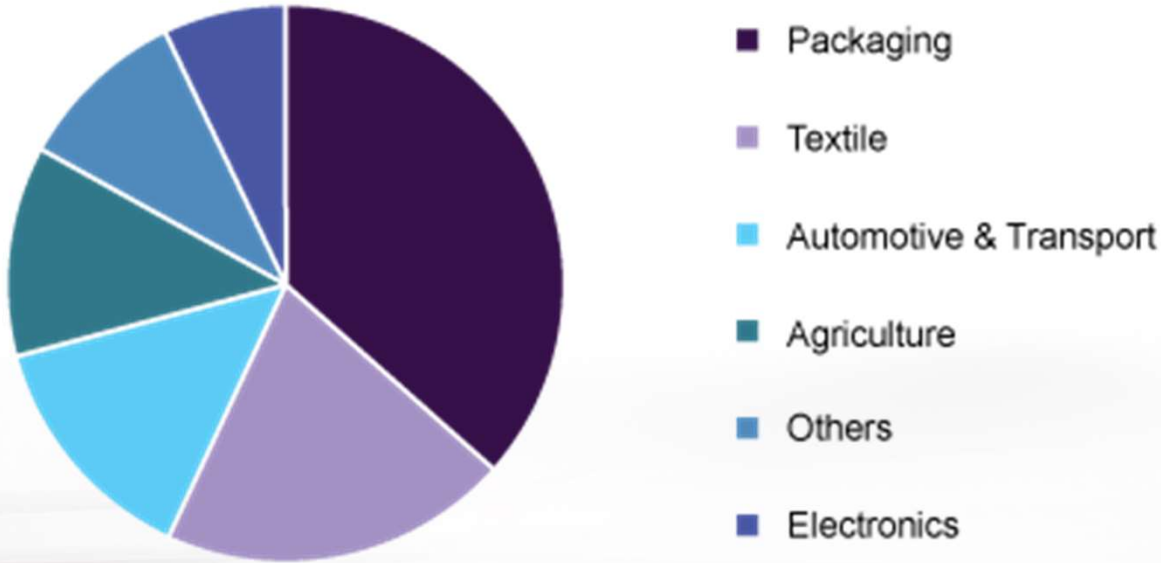
Bioplastics



Global production capacity of bioplastics in 2018–2019, thousand tons (by type of material)

Source: [European Bioplastics](#)

Global PLA market share, by end use, 2019 (%)



Source: www.grandviewresearch.com

Specific PLA-grades available for different processing methods and end applications

Poly-L-Lactide (PLLA) properties

PROS

- From renewable sources
- Reduction in carbon footprint
- Barrier properties (grease, aroma)
- Stiffness, strength
- Compostable/Biodegradable

CONS

- Low elongation
 - **Low impact resistance** ☹️
 - **Low heat resistance** ☹️
 - **Slow crystallization**
 - Injection molding =>
- } brittle

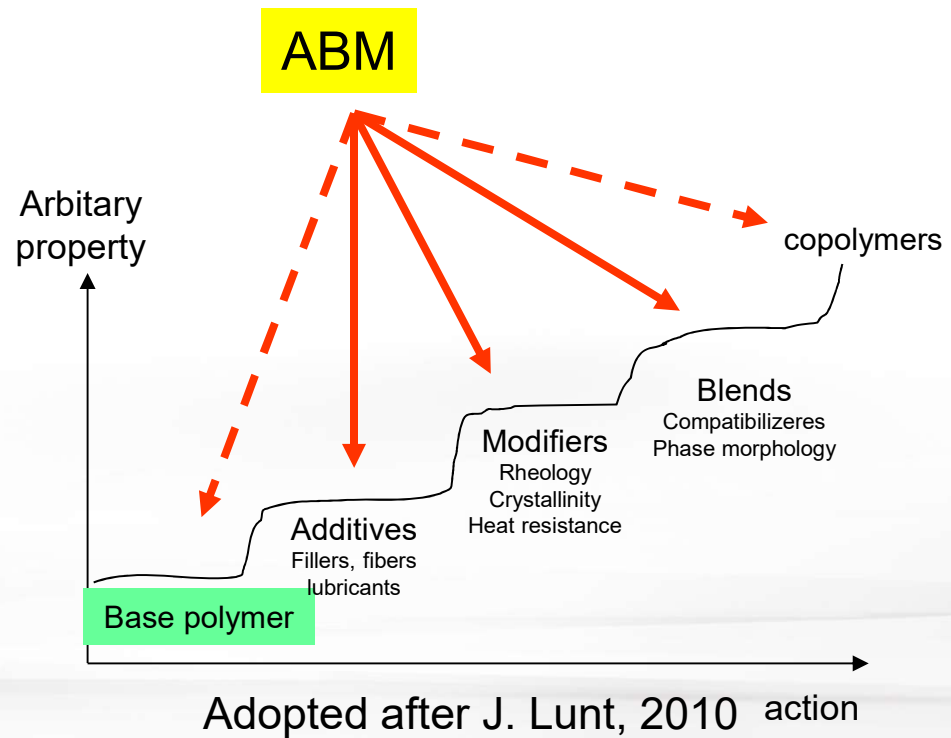
General properties

| | Neat PLLA | ABS | PC |
|------------------------------|--------------|-------------|---------|
| Tensile strength MPa | ~50 | ~40 | 60 |
| Tensile Modulus MPA | 3500 | 2200 | 2350 |
| Elongation at break % | 2-5 ☹️ | 25 | 120 |
| IZOD unnotched Notched KJ/m2 | 15-20 (2) ☹️ | 10-15 (10) | NB (65) |
| HDT B, 0.45 MPa | 55 ☹️ | 90 (anneal) | 127(A) |

Requires high mould temperatures and long cycle times ☹️

Improvement of PLLA properties

- Hydrolytic Stability
- Distortion Temp/heat resistance
- Morphology
- Impact Resistance
- Melt Strength/processability



Non-reinforced PLA Products

Comparison between ABM PLA-formulations and typical fossil-based technical plastics

| | Neat PLA | ArcBiox* HEAT | ArcBiox * IMPACT | ArcBiox ** Injection | PP | ABS | ABS-PC |
|-----------------------------|-----------|------------------|---------------------|-------------------------|--------|------|--------|
| Impact Izod Notched (KJ/m2) | 2 (8) | 12 😊 (60) | ~20 (80) 😊 | 20 😊 (100) | ~10 | 22 | 40 |
| Tensile strength MPa | ~50 | 60 | ~50 | 33 | 32 | 47 | 55 |
| Youngs modulus MPa | 2500-3500 | 4000 😊 | 3600 | 2400 | 1300 | 2300 | 2300 |
| HDT B (C°) | 55 | 130 😊 | 110 😊 | 75 😊 | 90-100 | 90 | 126 |

Injection molded; * mold temp 110°C; cycle time 50-70 s

** mold temp 90°C; cycle time 25-30 s

Degradable Glass Fiber Reinforced Products

Comparison between ABM biodegradable GFRP (LFT) and typical fossil-based GFRP

| | BGF40-X* | BGF40-MN** | PA12-GF30 | PA6-GF30 |
|-----------------------------|----------|--------------|-----------|----------|
| Impact Izod Notched (KJ/m2) | 12 | 30 😊 (60) | 20 | 18 |
| Tensile strength MPa | 126 | 130 😊 | 105 | 155 |
| Youngs modulus MPa | 14500 | 10800 😊 | 5500 | 8800 |
| HDT A ; 1.8 MPa (C°) | 160 | 106 👍 | 160 | 207 |

Injection molded; * mold temp 110°C; cycle time 50 s

** mold temp 30°C; cycle time 30 s

ABM TECHNICAL TARGET SEGMENTATION



Personal Care & Home

Cosmetic packaging, personal care



Food

Packages, kitchen utensils

Industrial

Explosives,ammunition

Agricultar, forestry



ABM – World's strongest biodegradable composite materials
abmcomposite.com

ABM Composite
Arctic Biomaterials



Bio
Or
Not to Bio...????

If Bio..
What Bio...

BIO
PLASTICS
EUROPE

Contact details



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Illustration by David Simonds

Ringmajanduse pakendilahendused



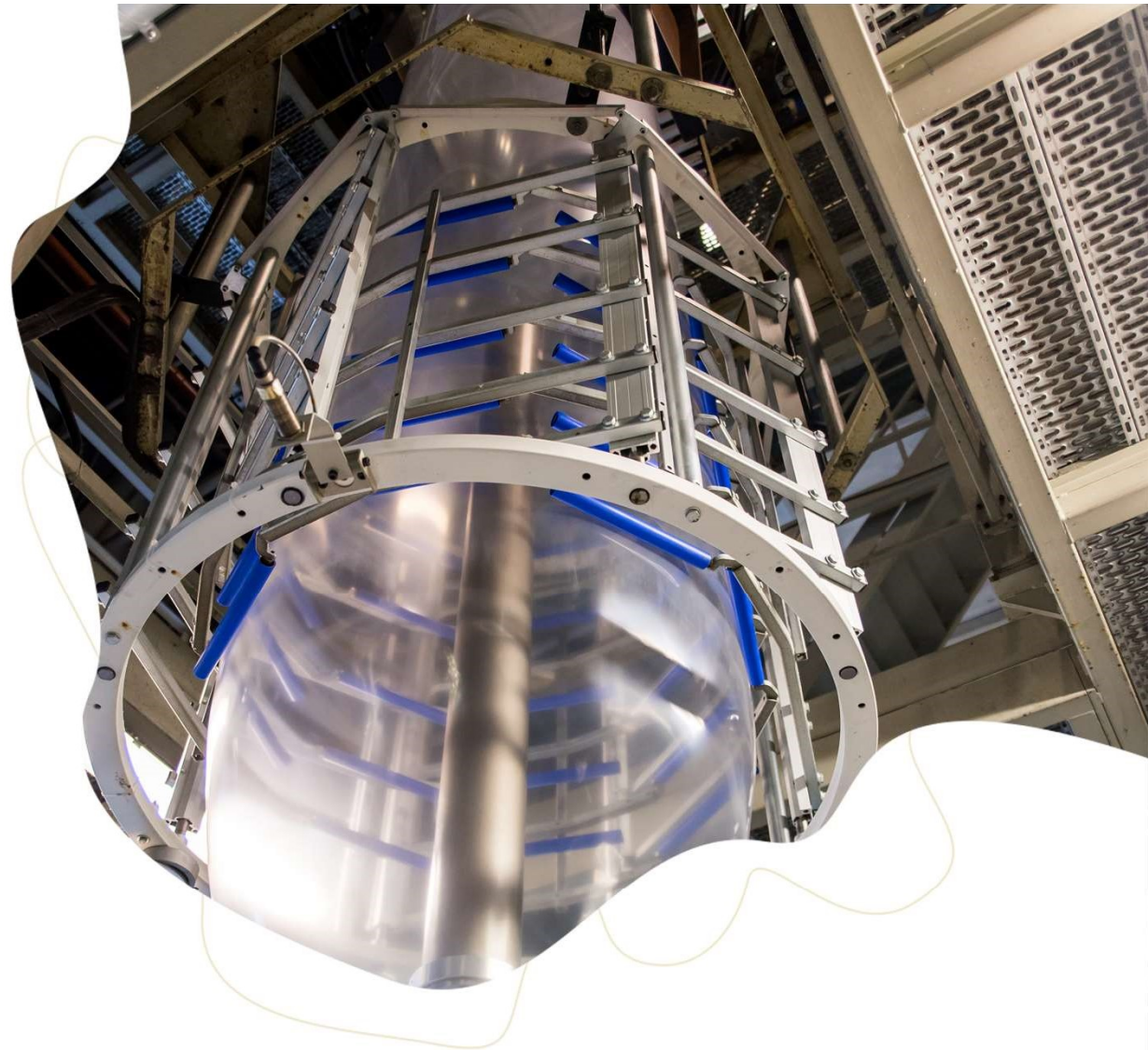
Meelis Jürgens

Juhataja

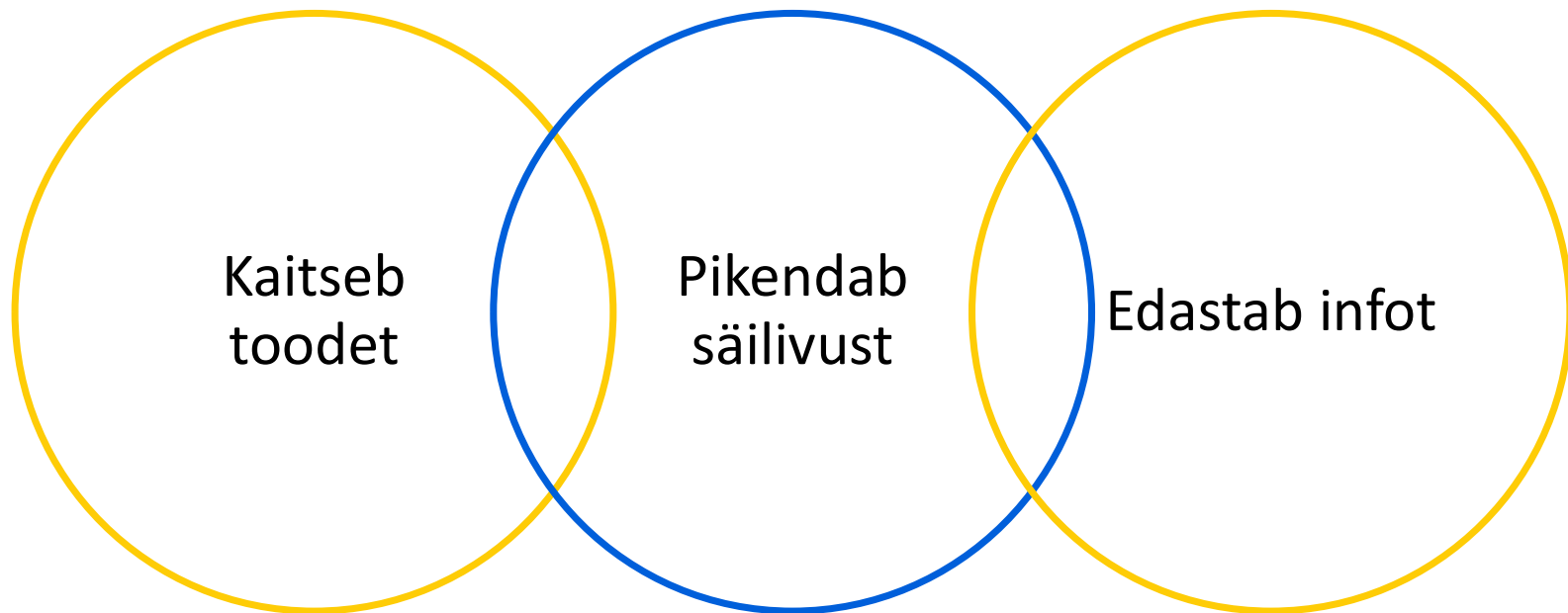
AS Estiko-Plastar

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meelis@estiko.ee



Milleks pakend?



Plastpakendi väljakutsed

Vastavus
toidu-
ohutusele

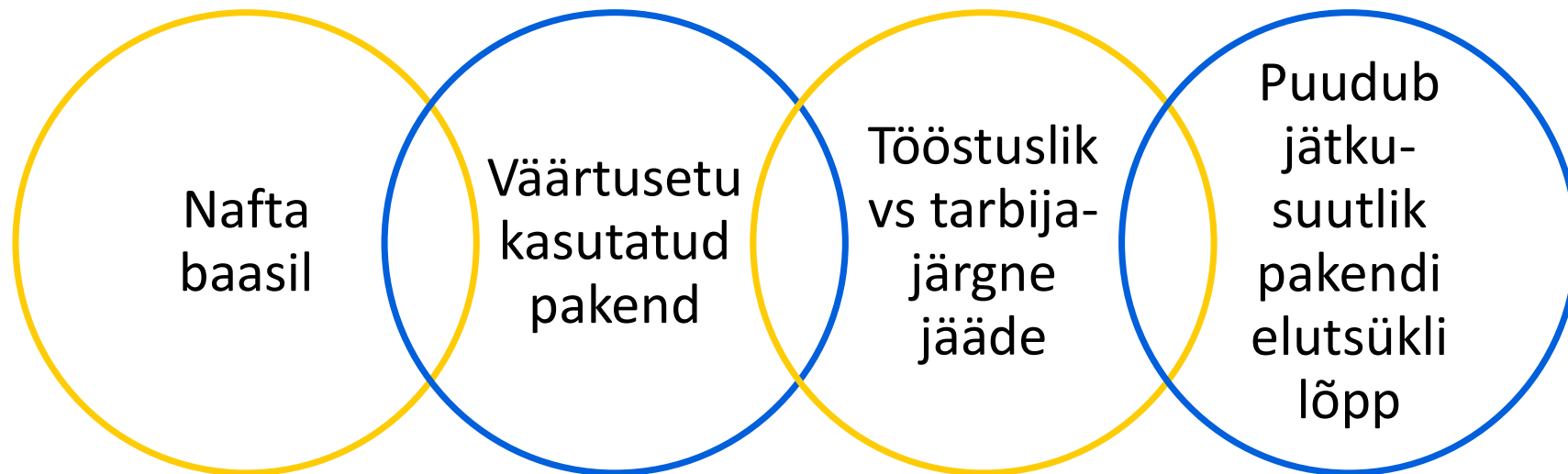
Vastavus
pakendaja
nõuetele

Kasuta-
tavus

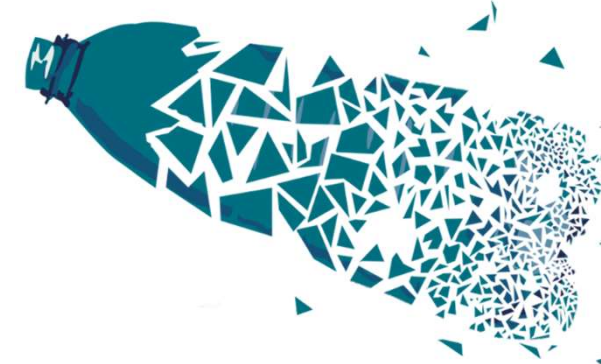
Vaikiv
müügi-
mees



Plastpakendite jätkusuutlikkuse väljakutsed



Jätkusuutlike pakendilahenduste olukord turul



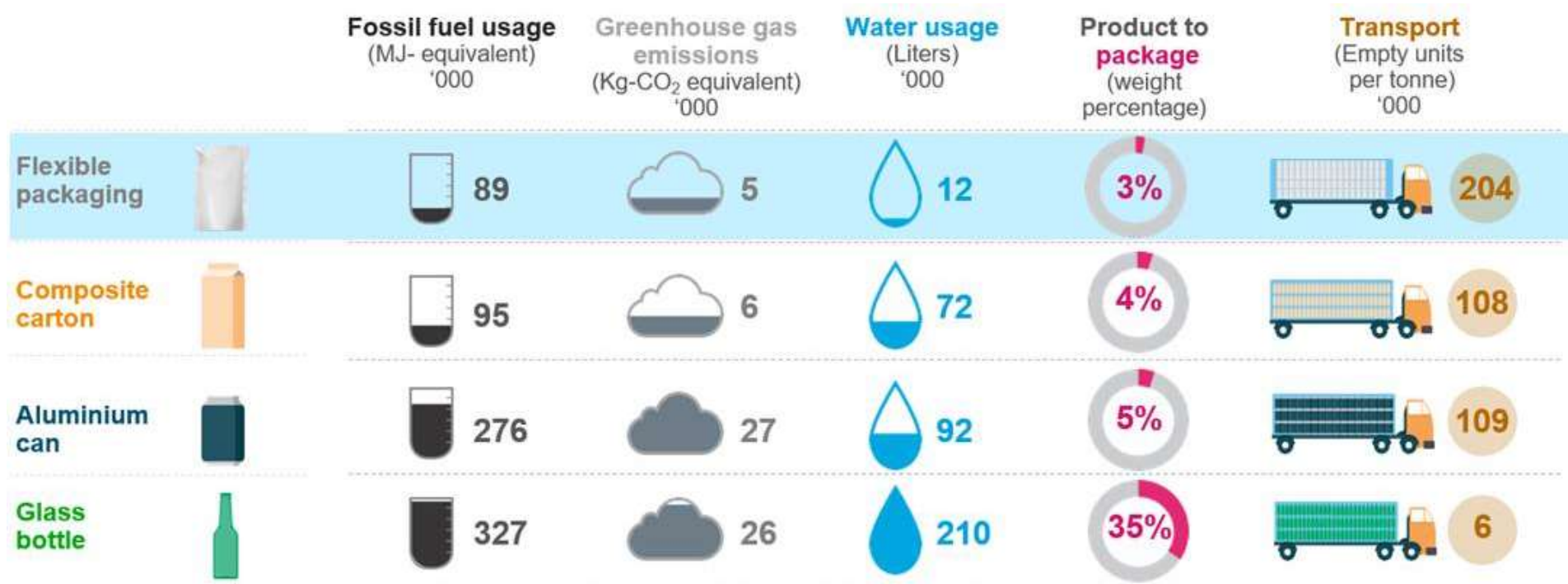
Lagunevad:

- Oksolagunevad = mikroplast
- Biolagunev – umbmäärane väljend
- Komposteeritav
 - Tööstuslik komposteerimine
 - Kodus komposteeritav

Paberlahendused:

- Hermeetiliseks pakendi sulgemiseks polümeer siiski vajalik
- Paberlaminaat – kõrge polümeeri osakaal
- Pinnakattena – madal polümeeri osakaal

Plastpakendil on üldjoontes madalam keskkonnajalajälg









Allikas: Flexible Packaging Association

Pakkematerjalide võrdlus

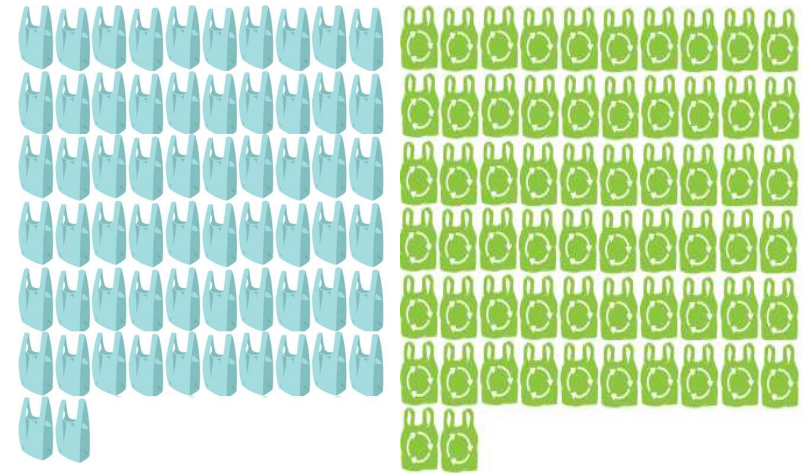
Allikad:








- Polüetüleen ja paber: Taani keskkonnakaitseagentuur (<https://eng.mst.dk/>)
- Green PE (suhkruroo baasil PE): <http://plasticoverde.braskem.com.br/site.aspx/Im-greenTM-Polyethylene>

| |  |  |  |
|---|---|---|---|
|  | 3,73 kg | 290 m ³ / t | 2,2 MJ/t |
|  | 2,08 kg | 2 m ³ / t | 1,3 MJ/t |
|  | -3,09 kg | 4,9 m ³ / t | 2,27 MJ/t |

Poekoti näitel

1 kg toormaterjali kohta:



| |  |  |  |  |
|---|---|---|---|--|
|  | 55 g | 204 g | 15,05 L | 120 kJ |
|  | 16 g | 33 g | 0,032 L | 21 kJ |
|  | 16 g | -50 g | 0,078 L | 36 kJ |

*“By 2030, all plastics packaging placed on the EU market is either reusable or **can be recycled in a cost-effective manner.**”*

Euroopa Komisjon, 2018

Senised lahendused

Jätkusuutlik tooraine:

- **Bio-baasil:** tselluloos, suhkruroog jne
- **Ümbertöödeldud** plastmaterjal (peamiselt tööstuslik jääde)

Jätkusuutlik elutsükli lõpp:

- **Mehaaniline ümbertöötlus** – kaotame kvaliteedis, pole võimalik kasutada toiduainepakendites = madal nõudlus ja ümbertöödeldud materjali väärtus

Ümbertöötuse uus tase

Keemiline ümbertöötus – tagasi algosakesteks



Kvaliteet ei
muutu

Ei eelda
polümeeride
sorteerimist

Sobib nii
tööstuslik kui
tarbijajärgne
jääde

Sama
süsteemi
võimalik
kasutada bio-
baasil
toormega

Tooraine

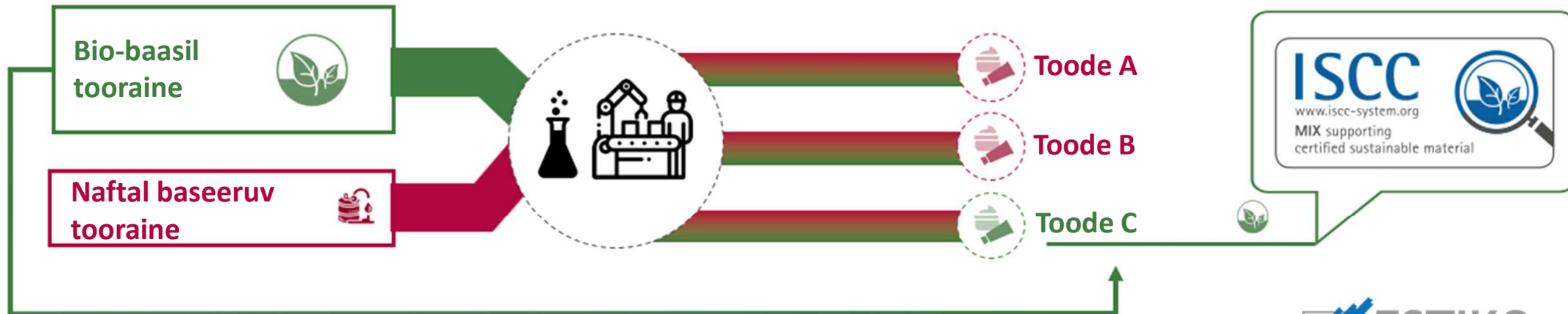
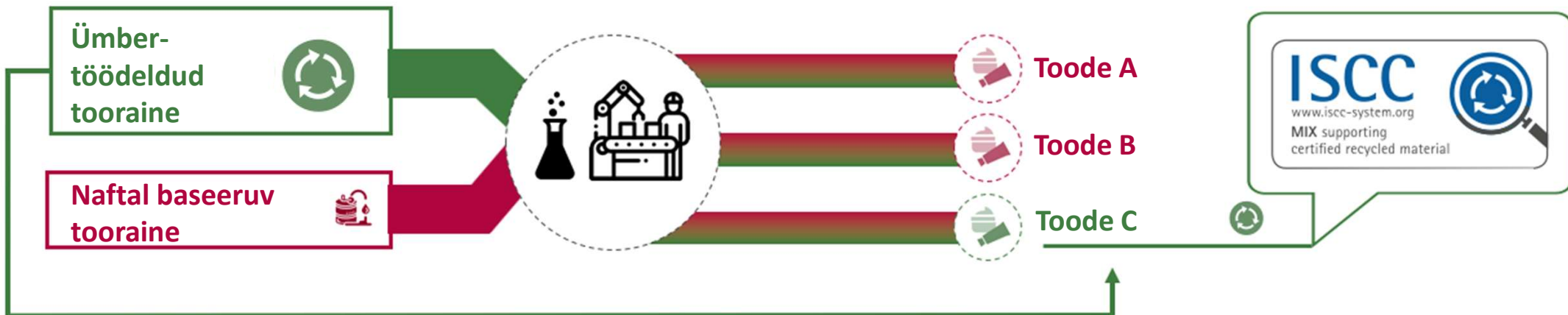
- **Bio-baasil** – jääkrasvad ja –õlid (ei konkureeri toiduainetööstusega)
- **Ümbertöödeldud** – pürolüüsiõli, toodetud plastijäätmetest

Bio-baasil tooraine



Ümbertöödeldud tooraine





Jätkusuutlik osa on võimalik määrata ühele või mitmele tootele!

Meie valik jätkusuutlikke tooteid

| | Barjäär | Külmutatav | Steriliseeritav | Ümber- töödeldav | PIR/PCR | ISCC Bio/ Circular | Green PE | Pakendi tüübid |
|---------------------------------------|---------|------------|-----------------|---------------------|-------------------|-----------------------|----------|------------------------------|
| Mono-kiled (OPP/PET/PE) | L; H | Y; N | | | PCR (PET) | Peatselt | | ÜLARADA; VFFS; HFFS |
| PP-baasil laminaadid | L; M; H | Y; N | | | PIR; ISCC- PCR | | | ÜLARADA; VFFS; HFFS; KOTT |
| PE-baasil laminaadid | L; M; H | Y | | | PIR; ISCC- PCR | | | ÜLARADA; VFFS; HFFS; KOTT |
| PP-baasil alarajad | M; H | Y; N | | | PIR; ISCC- PCR | | | ALARADA |
| Alarajad külmutatud toodetele (PE) | L | Y | | | PIR; ISCC- PCR | | | ALARADA |
| Tööstuslikud kiled | L; H | Y; N | | | PIR; ISCC- PCR | | | KILE; KOTT; VFFS |
| Termokahanevad kiled | L | Y | | | PIR; ISCC- PCR | | | MÄHITUD; 2- RULLIGA |
| Pinnakattega paber | L; H | Y | | | | | | ÜLARADA; VFFS; HFFS; KOTT |

Täna kuulamast!



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