Welcome.

27/02/20
Group of companies

1. **beologic**
   - Manufacturer of sustainable thermoplastic compounds

2. **innologic**
   - Material science, prototyping & analytical service for sustainable thermoplastics

3. **TECHNIKS**
   - Designer & manufacturer of innovative machinery for sustainable thermoplastic processing

4. **beotool**
   - Designer & manufacturer of customized & innovative extrusion tooling
BIODEGRADABLE COMPOUNDS WITH A MATCHING LOOK
Innologic: Who we are

- Engineering company specialized in project work and pilot line set up
- Innologic is the Research & Development branch of Beologic
- Spin-off Beologic
- Product and technology independent
- Founded in 2013
- Headquarter 34000m² (office & production) based in Belgium
- 9 engineers (2019)
- 100% owned by Managing Director Marc Thometschek
What is our mission?

• Providing our customer partners with the most viable alternative for achieving even their most ambitious innovation objectives at every stage in the development process.

From concept creation to prototype development, internal and external validation to launch and commercialization.
Why are we unique?

• From **small** to **fully** engineered projects
  
  • Contract engineering
  
  • **Fast reaction** time
  
  • **Total solution** for engineering, prototyping and preproduction
  
  • Target: “**90% of the solution within 100 days**”
Machines

- Wild range of lab scale machines:
  - Injection moulding machine
  - Twin screw extruders with underwater pelletizing
    - Physical foaming
  - Mechanical characterization (Tensile, Flexural, Impact)
    - Melt flow index (MFI)
  - Differential scanning calorimetry (DSC)
  - Thermo-gravimetric analysis (TGA)
  - Fourier-transform infrared spectroscopy (FTIR)
  - Accelerated weathering tester (QUV)
  ...
Beologic: Who we are

- Founded in 2000
- Compounding company specialized in the production of natural and mineral reinforced ready-to-use composite compounds
- Spin-off from a wood recycling company with an excellent know-how of the milling, sieving and drying process of natural fibers
- Headquarter 34000m² (office & production) based in Belgium
- 30 employees (2019)
- 100% Private owned by Managing Director Marc Thometschek
What is our mission?

• Our ambition is to replace conventional plastics by less harmful polymers, and it’s driven by our strong belief in a circular economy

• To provide top quality sustainable thermoplastic compounds for most common polymer processes

• Combination excellent R&D with superior technical knowledge

• Our goal is to find the right balance between materials, processes, manufacturaring and support in order to create real added value
Why are we unique?

- Product portfolio contains more than **2000 formulations**
  - Compound customized to **customer requirements**
    - Experience with: PVC, PP, PE, ABS, PLA, …
  - Variety of fillers: **wood**, bamboo, flax, rice, cork, …
Machines

- Compounding
- Dry blending and mixing
- Conventional and cryogenic milling
- Shredding and recycling
- Custom formula processing
- Tolling services
Our sales network

- Germany
- UK
- Spain & Portugal
- Poland
- Scandinavia
- Italy
- France
- The rest of the world

ML Plastics
RGI Services
Policomplex
Plastimo
Alsiano
Arcopolimeri
Omya
Beologic
A logical product range

**beobase**
Compound where at least a part of the content comes from renewable resources.

**beograde**
Compound that is designed to degrade under compost conditions. Containing renewable resources.

**beocycle**
The beocycle family includes compounds based on recycled material.

**beosmart**
Compound that presents features that make them more sustainable, e.g. by reducing the weight or by using eco-friendly additives.

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**BIO-BASED**
Bio-based through filling with wood or other natural fibres, or replacing the fossil-based polymer by a bio-based grade.

**BELOGRADE**
Fossil or bio-based but mainly a blend.
Can be filled with wood or other fillers.

**BIOBASED**
Fossil-based recycled.
No natural filler, but based on recycled materials.

**BEOCYCLE**
Fossil-based smart.
Reduced weight, eco-friendly additives, ...

**BEOSMART**
Fossil-based, but mainly recycled.

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Bio-degradeable
# Key challenges for existing biomaterials

<table>
<thead>
<tr>
<th>PLA</th>
<th>PBAT</th>
<th>TPS</th>
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</thead>
<tbody>
<tr>
<td><strong>Main drawbacks for PLA:</strong></td>
<td><strong>Main drawbacks for PBAT:</strong></td>
<td><strong>Main drawbacks for TPS:</strong></td>
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<tr>
<td>- Low impact strength and brittleness</td>
<td>- Low strength/modulus</td>
<td>- Sensitive to water disintegration</td>
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<td>- Low heat deflection temperature (HDT)</td>
<td>- Opacity</td>
<td>- Low chemical resistance</td>
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<td>- Low crystallinity during processing</td>
<td>- Depend to the oil resources</td>
<td>- Poor mechanical properties</td>
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<td>- Hydroscopic</td>
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<th>PBS</th>
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<td><strong>Main drawbacks for PBS:</strong></td>
<td><strong>Main drawbacks for PHA:</strong></td>
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<tr>
<td>- Expensive material</td>
<td>- Difficult to produce (produced by bacteria)</td>
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<td>- Low biodegradation rate</td>
<td>- Difficult to process (narrow processing windows)</td>
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<td>- High density</td>
<td>- Thermal stability</td>
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</table>
We develop new compounds to improve:

- Mechanical Properties
- Visual Aspect (Wood Fiber)
- Temperature Resistance
- Environmental Impact
- Price Level
- Processability
- Long Term Stability
- Coloration
Visual aspect
wood fiber

What is this made of?

Compostable food trays not always look compostable, so we offer a total solution for a new generation of packaging that is compostable, with a matching look and feel.
### Beograde range

<table>
<thead>
<tr>
<th>Article number</th>
<th>Application</th>
<th>Density</th>
<th>MFI (ISO 1133-1)</th>
<th>Tensile Modulus</th>
<th>Tensile Strength</th>
<th>Elongation at Yield</th>
<th>Elongation at break</th>
<th>Flexural Modulus</th>
<th>Charys Impact strength</th>
<th>Reprocessable contact</th>
<th>Wood fiber</th>
<th>Mineral filled</th>
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Our offer and support

1. YOUR NEED
   Identify product and process needs

2. MATERIALS MATCH
   Match suitable standard Beograde ready to use

3. TRIAL TEST
   With our technical support

4. FINE TUNING
   Optimize formulation and process parameters

5. UP SCALING
   Production and certification final parts

RAW MATERIAL: POLYMER/WOOD
COMPOUNDING
RECYCLING
PROCESSING
USING PRODUCT
COMPOSTING

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RAW MATERIAL: POLYMER/WOOD
COMPOUNDING
RECYCLING
PROCESSING
USING PRODUCT
COMPOSTING
Application

Tensile Strength (MPa)

E modulus (MPa)

10 15 20 25 30 35 40 45 50

500 1000 1500 2000 2500 3000 3500 4000
Polymers where at least a part of the content comes from renewable resources

Ex: PLA, PP/wood fiber

Will degrade under the action of microorganisms

Ex: PLA, PBAT

Capable of undergoing biological decomposition in a compost site.

All compostable polymers are by default biodegradable but not vice versa.

Polymers that are derived from renewable resources, as well as biological and fossil based biodegradable polymers

**STANDARD EN 13432**

1. disintegrate rapidly during the composting;
2. biodegrade quickly under the composting conditions;
3. not reduce the value or utility of the finished compost and the compost can support plant life;
4. not contain high amounts of regulated metals or any toxic materials.
1. TEMPERATURE

- **O₂ - H₂O - UV** Microorganism
- **CO₂ - CH₄ - H₂O** Biomass

2. THICKNESS OF THE PRODUCT

- At least 90% disintegration* within 3 months.
- At least 90% biodegradation** within 6 months

* **Biodegradation** = materials break down chemically
** **Disintegration** = materials break down physically
Beograd examples
Why are we unique?

• Ability to replace fossil based plastics
  • **Sustainability** visualized (by adding wood fiber)
    • Modified and **optimized** material
  • Added value (Environmental benefits – long term investment, …)
    • Technical support
New PLA flexible and transparent

The brittleness of PLA has been a big hurdle for its diverse applications especially in injection molding.

- Melt flow rate MFR (190°C/2.16Kg) (g/10 min) 20 45
- E-modulus (MPa) 3500 2030
- Tensile strength (Mpa) 50 28
- Tensile elongation at break (%) 3 240
- Charpy impact strength (23°C, notched) 2 5
Thank you for listening.