

SeaBioComp

Development and analysis of durable bio-based thermoplastic composites for marine applications

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SeaBioComp Partnership



Part of the Interreg 2 Seas programme which is part financed by the European Regional Development Fund



SeaBioComp is cofinanced by



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Programme information

- Interreg 2 Seas 2014-2020 is a European Territorial Cooperation Programme covering England, France, the Netherlands and Belgium (Flanders). The Programme is part-financed by the European Regional Development Fund
- The overall objective is to develop an innovative, knowledge and research based, sustainable and inclusive 2 Seas area, where natural resources are protected and the green economy is promoted
- SeaBioComp comes under the Technological and Social Innovation priority 'to increase the delivery of innovation in smart specialisation sectors'
- Project duration: March 2019 – August 2022
- Project Budget: € 4,129,325.35 (ERFD: € 2,477,595.21 (60%))



Technological
innovation

Challenge



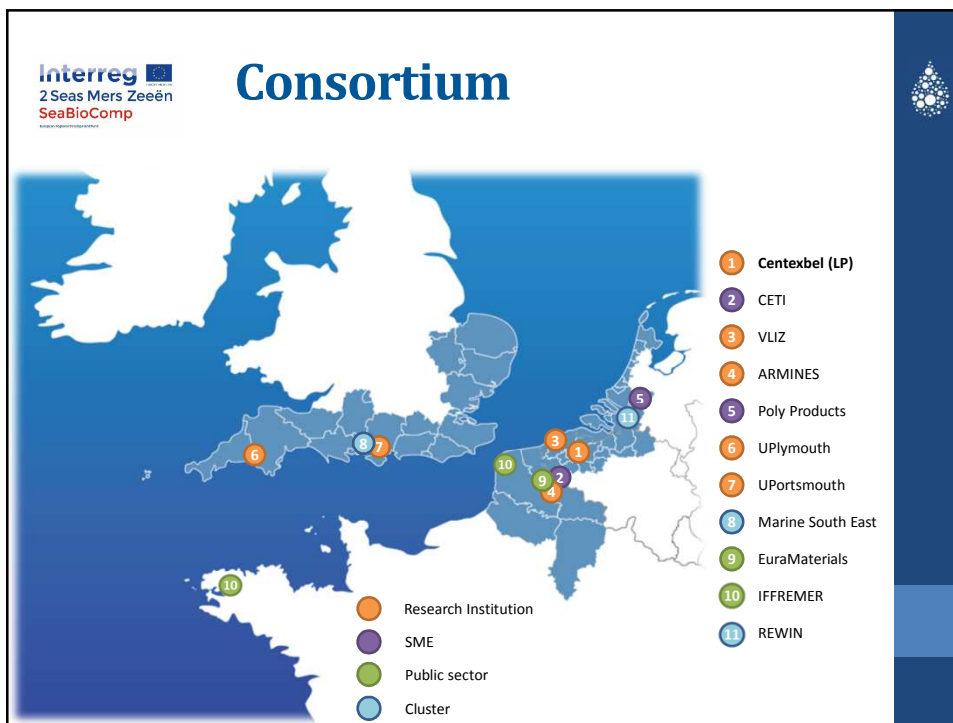
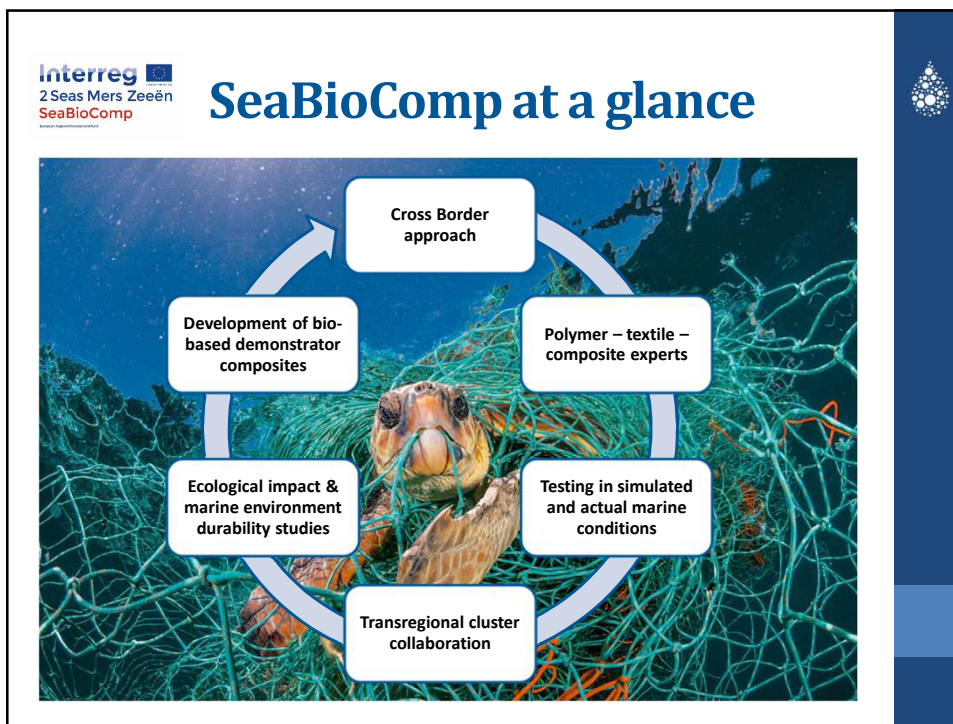
- Increasing world production of plastics (350 Mtonnes in 2017 *Plastics – the Fact 2018) including **polymer composite market for maritime industry** (200 ktonnes *MARTEC 2016)
- **Growing concern in public opinion** regarding plastic materials in the marine environment
- Drive for new **innovation in composite materials** and **strengthen local marine economy**
- **Reduce the environmental impact** of composite maritime industry components by substituting oil-based composites with **bio-based alternatives from renewable resources** to reduce greenhouse gas emission
- Evaluate **durability** and **long-term ecological impact** from μ plastics through novel protocols

SeaBioComp Objectives

SeaBioComp will develop and deliver demonstrators using innovative bio-based thermoplastic composite materials with the following characteristics:

Bio-based thermoplastic composites demonstrators

- At least equivalent mechanical properties compared to oil-based
- Reduced CO₂ emission by 30% through the use of renewable resources
- Demonstrated recycling ability of the used materials
- Reduced ecotoxic impact on marine environment due to μ plastics
- Tailored durability (2 to >20years) depending on the application in marine environment



Advisory Board

- Represents the relevant industry
 - Entire value chain from natural fibre suppliers, textile processing to composite end-users
 - Completes the triple helix including academia-industry-governments



Outputs: Biocomposites



Self-reinforced biopolymer composite
compression moulding/lamination



Natural fibre/biopolymer hybrid
Compression moulding



Long natural fibre/biopolymer hybrid
Monomer injection using RIFT



Continuous and/or short fibre / biopolymer hybrid
Additive Manufacturing

Outputs: Analytical protocols



Long-term **durability**
Simulated and real-life seawater



Ecotoxicological effect
µplastic formation and **leachates** identification



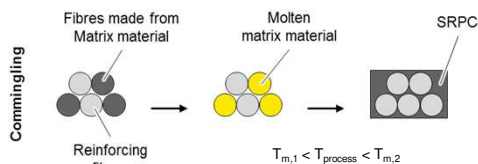
Life-cycle analysis of selected formulations

Planned durability testing

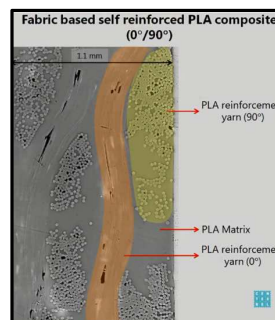
- **Mechanical testing** (at different environmental conditions):
 - Tensile (U Portsmouth)
 - Flexural (3-point bending) (U Portsmouth) and four-point bending tests (Ifremer)
 - Low velocity falling weight and Charpy impact testing (U Portsmouth and Ifremer)
 - Vibration testing (dampening) covering cyclic loading scenario (U Portsmouth and Ifremer)
- **Long-term durability testing** (at different environmental conditions) (service, durability):
 - UV testing at different time and temperatures (change in the structural, physical, and chemical properties) (U Portsmouth)
- **Moisture uptake and hydrothermal degradation studies** (seawater ageing tests: room temperature, accelerated ageing, different humidity conditions) (morphology and properties (interfacial bond strength etc) (Ifremer) (U Portsmouth)
- **Degradation process investigation** (abiotic and biotic), followed by mass loss, bio-degradation in soil, what are the impacts? Number of days against discolouring, morphology changes etc., following by DSC, TGA? (U Portsmouth), (Ifremer)
- **Characterisation techniques** to measure the effects: It was discussed that commonly used techniques such as SEM, Optical Microscopy, X-ray Micro CT and nanoindentation would be used whenever appropriate (U Portsmouth, Ifremer)

H2020 – Bio4Self

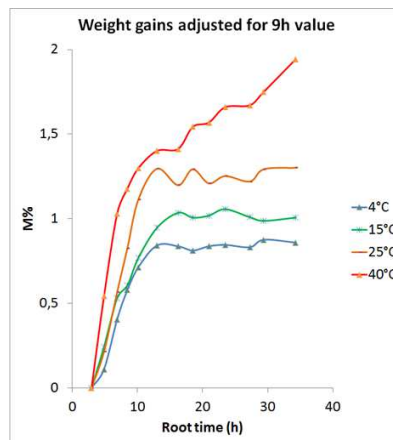
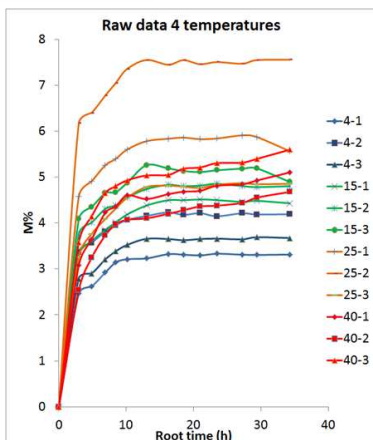
- Aims at fully bio-based, self-reinforced polymer composites (SR-PC)



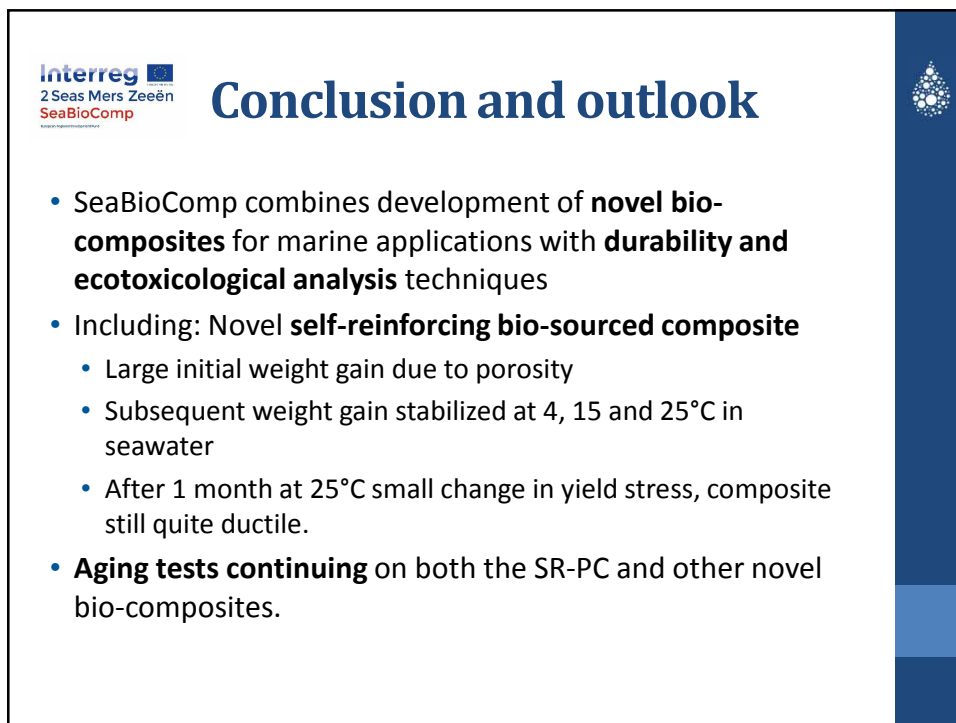
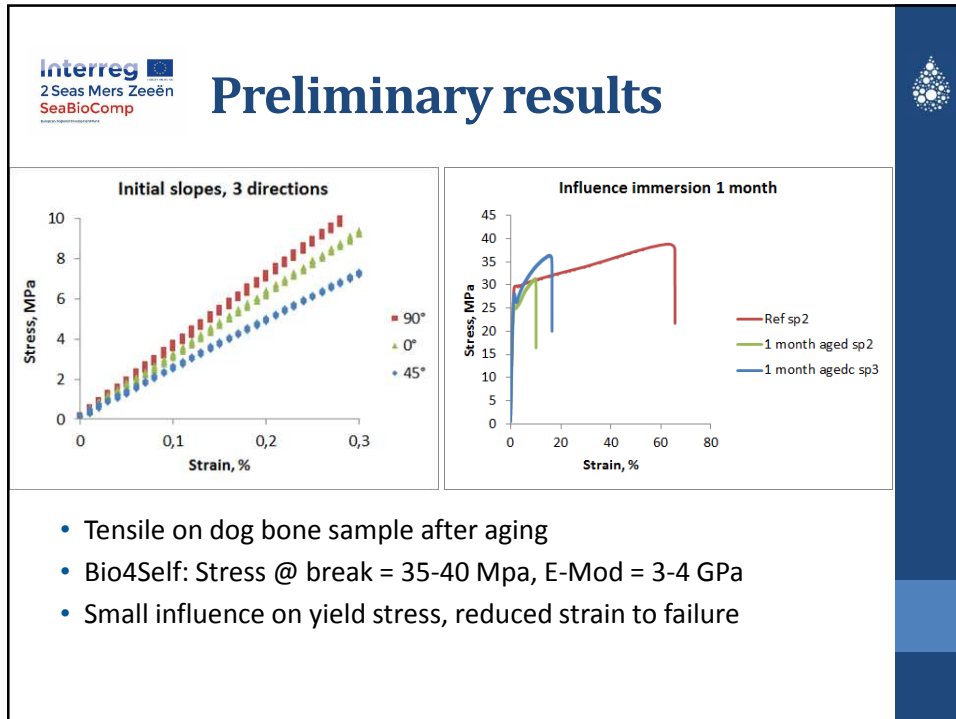
- Lamination in both 0°/90° direction
- Tensile modulus of self-reinforced PLA (4GPa) comparable to commercial SR-PP
- <https://www.bio4self.eu/>



Preliminary results



- Gravimetric determination of water absorption at diff. T in natural seawater from Brest Estuary
- Very large increase in first hours → voids
- Small weight at 40°C → indication of hydrolysis?



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2 Seas Mers Zeeën
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 **SeaBioComp**



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Please visit our website and subscribe to our interest group to receive regular updates

Project Website: www.SeaBioComp.eu

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