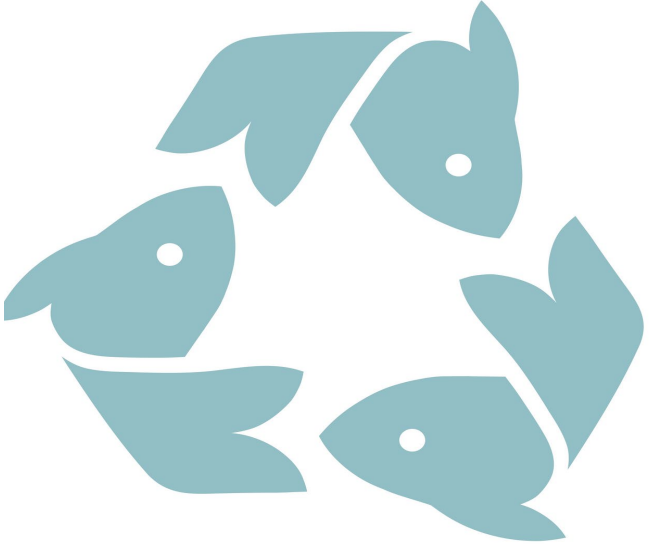


Lost at Sea: Developing Biodolomer® Ocean to Combat Abandoned, Lost, and otherwise Discarded Fishing Gear



R&D Manager
Konrad Rosén



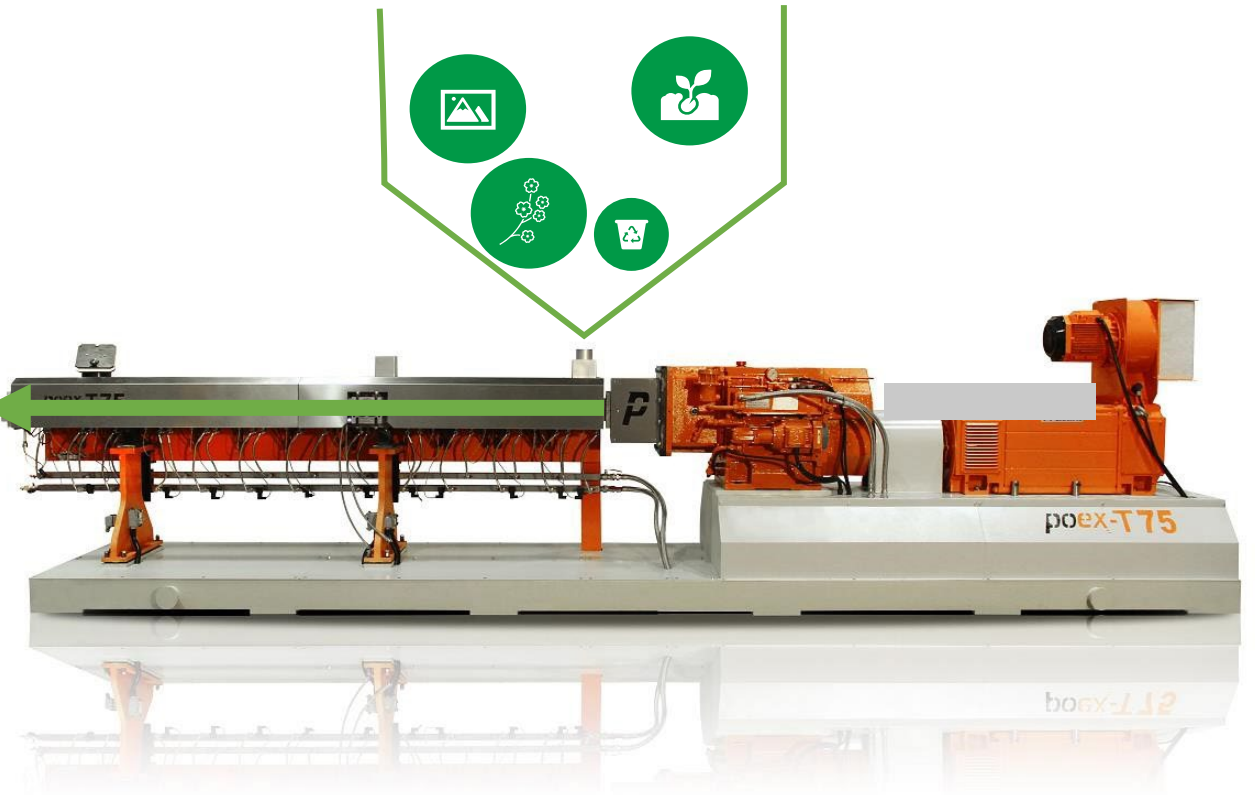
catchgreen
Powered by Biodolomer®

Biodolomer® compounds

Key facts about GAIA BioMaterials

- We make biodegradable compound
- +10.000 tons annual capacity
- Based in Helsingborg Sweden
- 20 employees
- Main business in Europe and the US

 BioDoloMer®



Biodolomer[®] is made from



**CALCIUM
CARBONATE/
TALCUM**



STARCH



**VEGETABLE
OIL**



**BIODEGRADABLE
POLYESTERS**

Biodolomer[®] compounds

	Non biodegradable	Biodegradable
Biobased	Bio-PE, Bio-PA, Bio-PET, Bio-PP	PLA, PHA, TPS, bioPBS, bioPBAT
Fossil-based	PE, PP, PS, PET, PVC	PBAT, PBS



Biodolomer® Compounds

Biodolomer® F

Biodolomer® T

Biodolomer® I



STRATEGIC PROJECTS IN PROGRESS

Infill for artificial turfs (AT).

The installed volume of artificial turfs globally is estimated at around 265 million sqm by 2028, the market can be estimated at around 330000 tons/year, or 1 Bn EUR.

Labels & stickers.

With branding of fresh produce gaining momentum, labels and stickers will continue to play an important part in distinguishing between various sorts of fresh fruits & vegetables. In 2022 the fresh fruit retail segment was valued at around 35 Bn EUR in the US, and around 129 Bn EUR in the EU.

Fiber spinning applications.

The global market for nonwoven materials was worth around 47 Bn EUR in 2020. GAIA's fiber spinning materials will be targeted towards the key segment of hygiene products.

Extrusion coating.

With Europe turning its focus towards paper and cellulose solutions for its packaging needs, extrusion coating will play an increasingly important role for the packaging industry. The global extrusion coating market is currently estimated to about 5-6 Bn EUR annually.

Fishing nets and aquaculture applications.

Ghost nets are one of the major concerns threatening marine life, and the greatest source of microplastics (an estimated 46%). With an estimated 1,5 Mn tons – equivalent of 6 Bn EUR - of fishing nets being lost at sea every year, the industry is desperate for an alternative.

STRATEGIC PROJECTS IN PROGRESS

Fishing nets and aquaculture applications.

640,000 tonnes of ghost gear, including nets, lines, pots, and traps used in commercial fishing, are dumped and discarded in the oceans each year. 27 % of all marine plastic pollution is contributed to the fishing industry.

Ghost gear is particularly harmful because it continues to fish indiscriminately for decades, ensnaring marine life and contributing to plastic pollution.

In the Nordic countries alone the annual loss includes 28 million lures, 11 million sinkers and 140 million metres of fishing line.

Sustainable Manufacturing and Environmental Pollution (SMEP)

And the Catchgreen project



Funding period
Jan 2022–March 2026

Funded activities

- Market and needs assessment
- Branding and marketing
- Material development
- Manufacturing trials and testing
- Piloting - Kenya
- Life Cycle Assessment
- Biodegradability testing
- Advocacy and macro level engagements

Planned activities

- Business model
- Continued material development
- Large scale manufacturing
- Piloting - South Africa
- LCA -results
- Biodegradability test results
- S&E Study Kenya
- Ocean biodegradability study (outside of SMEP)
- Pilots and testing Norway (outside of SMEP)

Road to Biodolomer Ocean



Specification

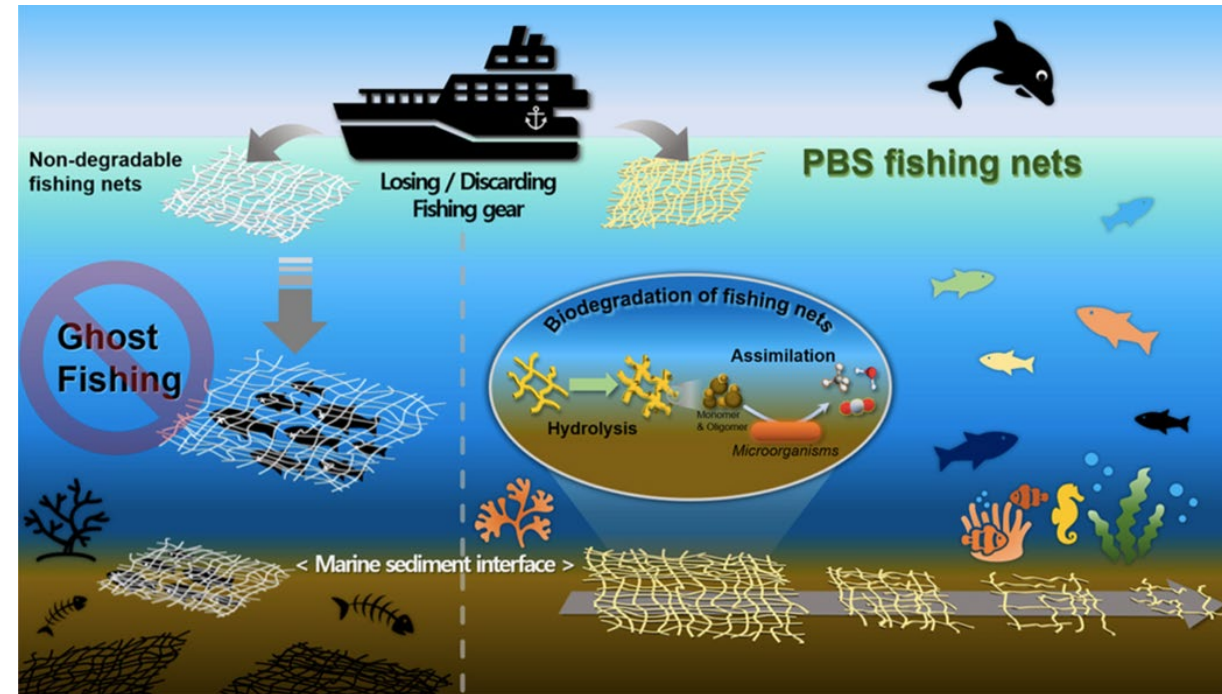
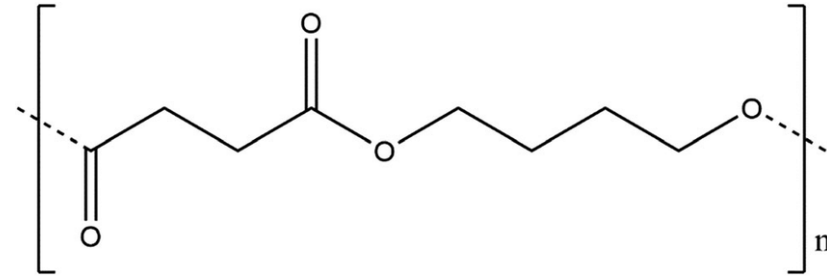
Mechanical properties comparable to HDPE

- Manufactured and processed in existing machinery.
- Reduce energy consumption and maintain manufacturing output.
- Leaning on bio-based ingredients.
- Perform in ocean environments for 2-3 years.
- If lost, fully biodegradable in the ocean sediment.
- Industrial compostable at normal end-of-life.
- Can you make it somewhat affordable?



PBS, a good start

- Polybutylene succinate (PBS) - is a softish-type biodegradable polymer having physical properties analogous to high density polyethylene (HDPE)
- Ranges from 0-100% biobased content
- Shown to biodegrade into water and carbon in multiple environments, including compost and marine sludge/sediments.
- Two-stepped process -the hydrolysis on the surface removes monomers/oligomers which then metabolize in a reaction catalyzed by the naturally occurring enzyme PBSase.
- Previous research shows degradation within 24 months.



Manufacturing trials



Trials at Alnet in June 2023

The good

- We have higher flexibility at the cost of tenacity
- Biodolomer Ocean can be produced without die breaks
- Biodolomer Ocean is suitable for rope and twine

The bad

- Less flexibility to maintain strength after stretching
- Rounder pellets to enable easier startup.
- Anti-static
- Higher tenacity.

Seaweed farming

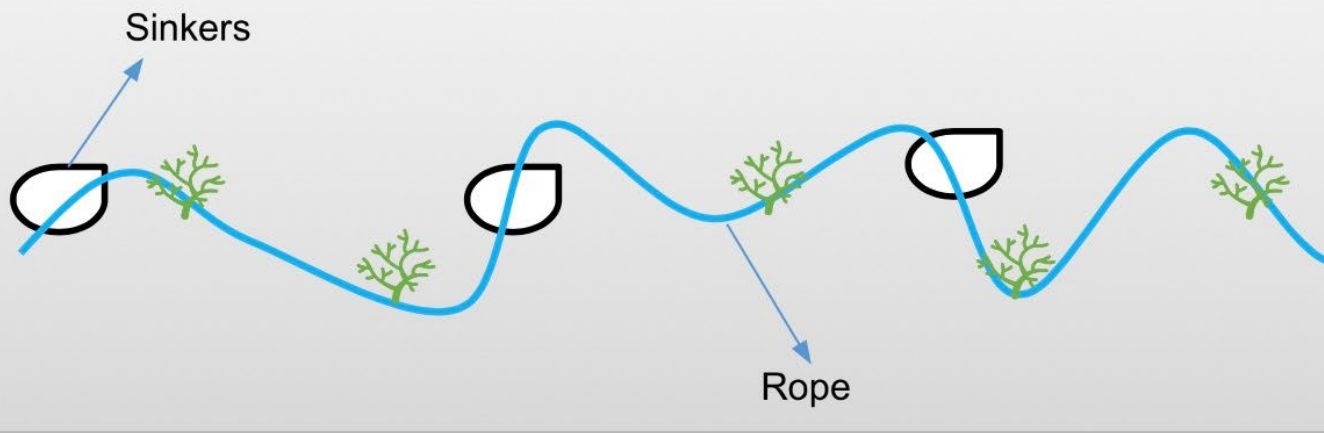


KMFRI has piloted biodegradable ropes for seaweed farming since August 2023:

- Replacing plastic ropes with biodegradable ropes.
- Comparing yield between the two ropes.
- Observing the biodegradation process.
- Measuring microplastics.
- Testing composting on land.

The piloting has demonstrated:

- No significant difference in the loss of seeds or biomass produced on the biodegradable ropes compared to traditional ropes.
- The farmers will continue with the pilot until the end-of-life of the ropes.



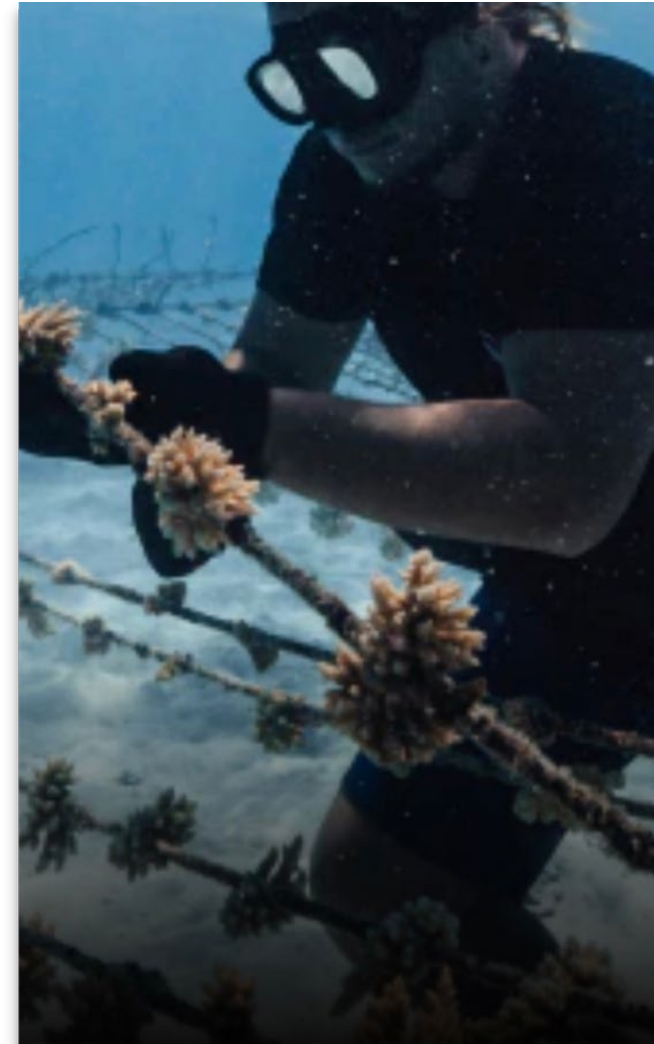
KMFRI
Kenya Marine and Fisheries Research Institute

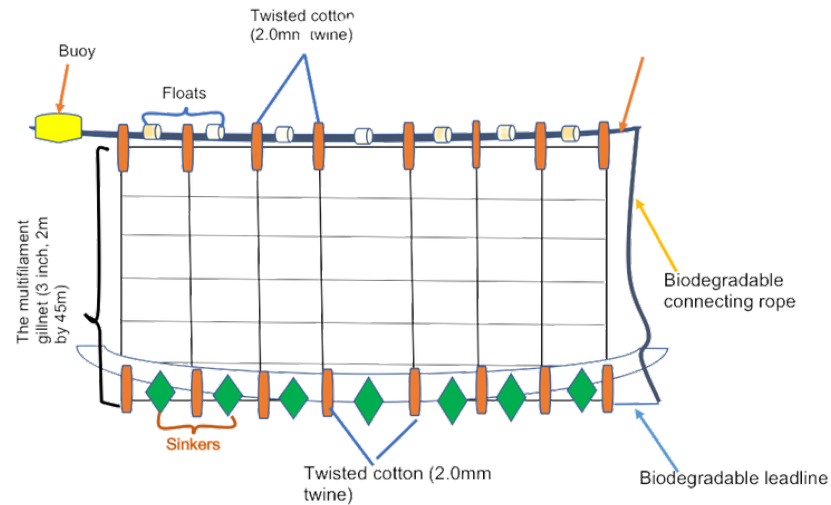


Coral restoration

Biodolomer® Ocean ropes for coral restoration on Wasini Island, Kenya, and on Mo'oera Island French Polynesia.

- Using ropes to provide a safe environment for coral fragments to grow.
- Minimising the environmental impacts by replacing plastic ropes with biodegradable ropes.
- Cost-effective and accelerated coral restoration.





Gill nets

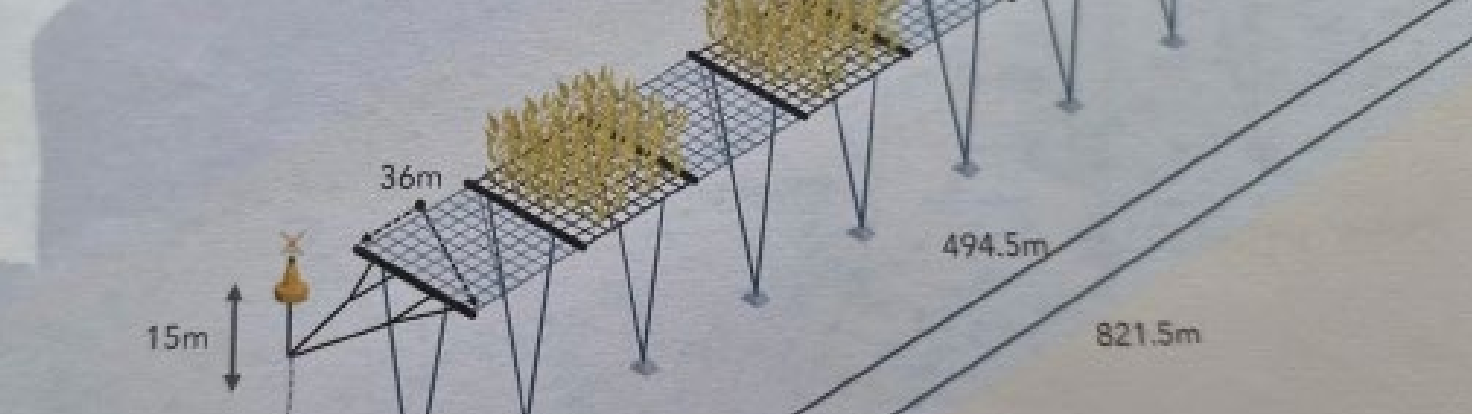
KMFRI has been piloting Biodolomer®Ocean twine for modified gill nets.

- Replacing the headline and leadlines with biodegradable twine
- Replacing 50% of the plastics in the nets
- Reducing plastics on land and in the ocean.

Catchability experiments have demonstrated:

- No significant difference in the fishing efficiency of the biodegradable gillnets and traditional nets in terms of the type of fish caught, the size of fish, or the amount of fish caught.
- Fishermen will continue to fish with the nets until the end-of-life.





Planned piloting

- Basket traps - KMFRI
- Kelp farming - Cape Coastal
- Lobster cages -
- Trawl nets - I&J

Norway

- Underbelly bottom trawls
- Demersal seines
- Chafing mat for bottom trawl
- Net panels for snow crab pots



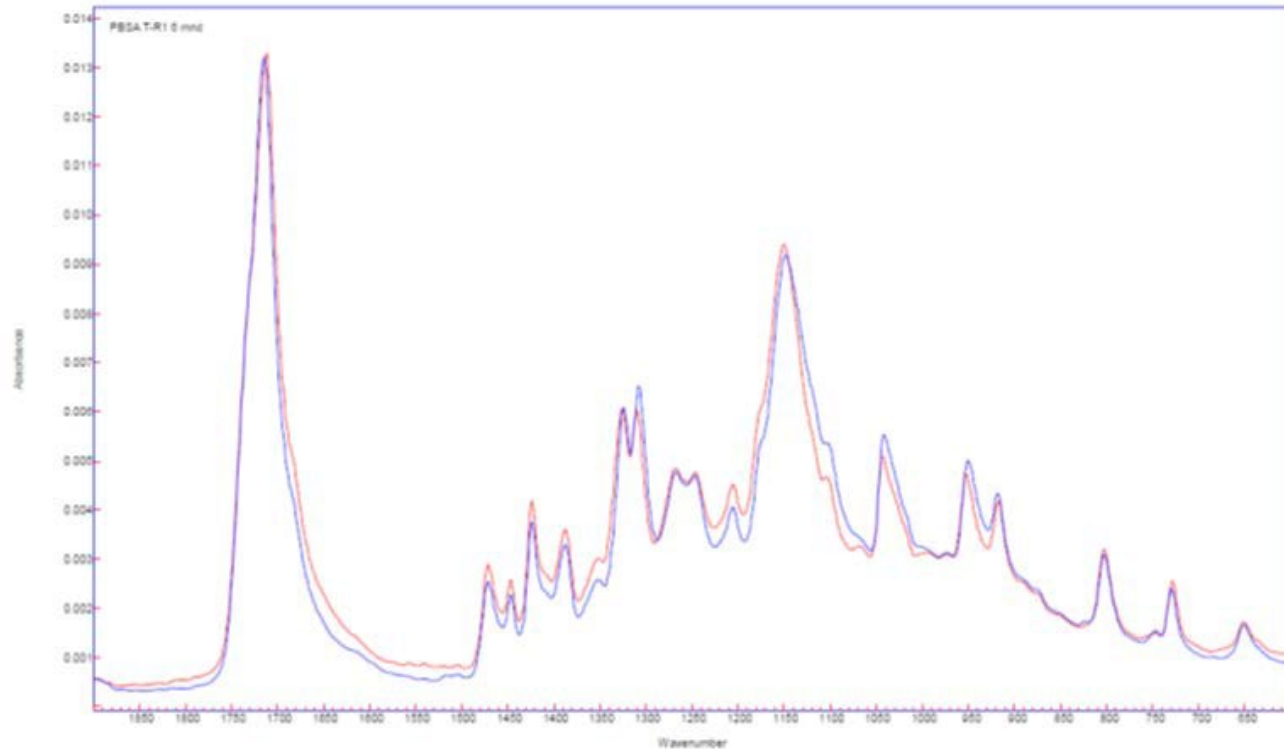
A photograph of two fishermen on a boat in the ocean. The fisherman on the left is wearing a red beanie and a blue and orange striped shirt. The fisherman on the right is wearing a green beanie with a colorful pattern and an orange life vest. They are both handling large piles of orange fishing nets. The background shows the blue ocean and a clear sky.

Biodegradability experiments

6 of 24 month study in
seawater

Results after 6 months: FT-IR: BioOcean-R1 6 mnd vs BioOcean 0 mnd

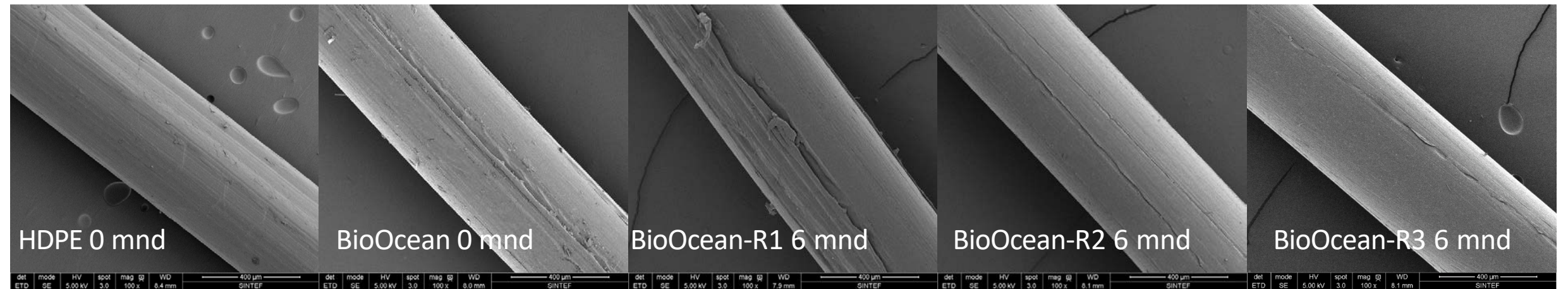
- The FT-IR spectrum of PBSAT-R1 6 mnd is similar to PBSAT 0 mnd, but a small decrease in the peak at 1309 cm⁻¹ is observed.



Name	
PBSATR1 6 mnd	—
PBSAT 0 mnd	—

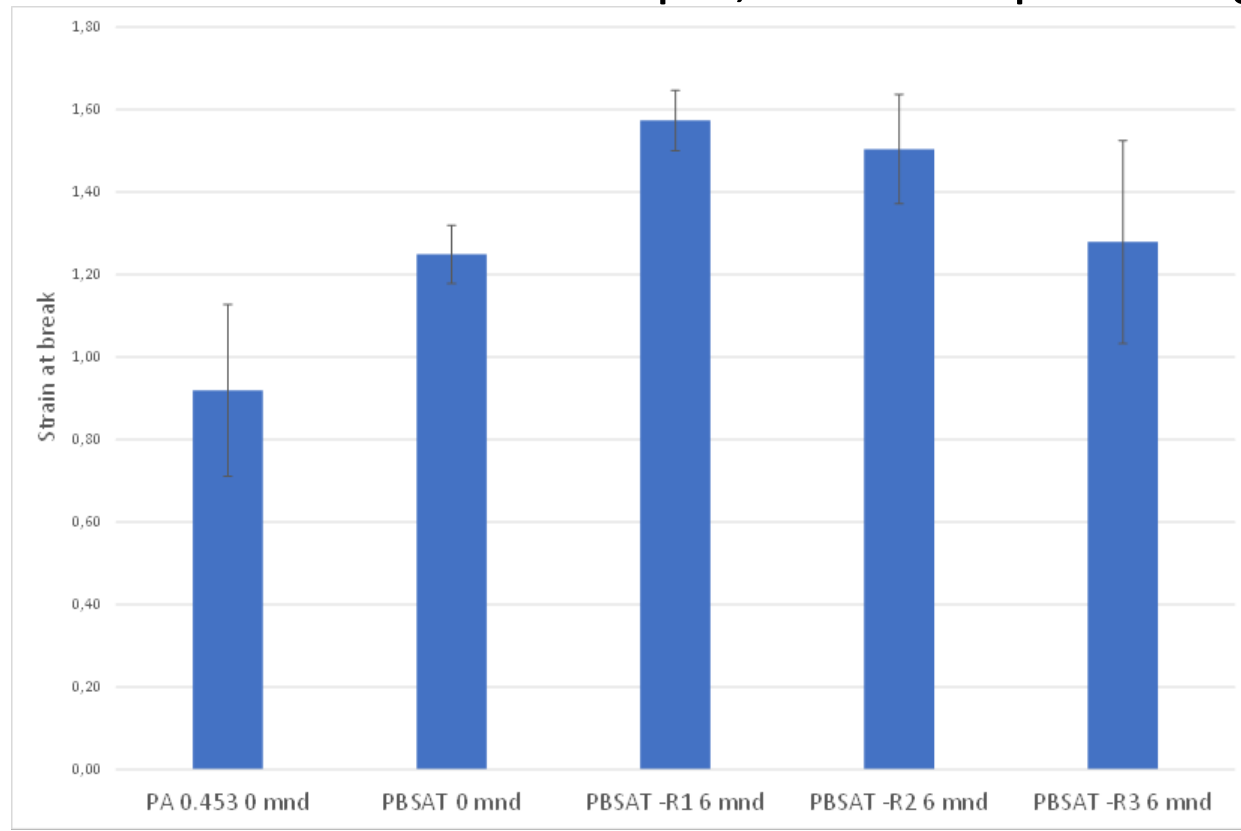
Results after 6 months: SEM

- All samples have areas on the surface that show some roughness. The HDPE 0 mnd and the BioOcean-R1 6 mnd samples have quite rough surfaces and BioOcean-R2 and BioOcean-R3 6mnd samples seem to have smoother surfaces. It depends on where the pictures were taken.



Results after 6 months: strain at break (HDPE/BioOcean)

- The HDPE sample has the lowest value. BioOcean 0 mnd has a lower strain at break than the BioOcean-R1 and BioOcean-R2 samples, the BioOcean-R3 6 mnd has a mean strain at break on the same level as the 0 mnd reference sample, but with quite a high standard deviation.



Biodolomer® OCEAN- What we need to find out

Mechanical properties

What is the maximum tenacity possible for Biodolomer Ocean in a stable monofilament extrusion process?

What rate of decline in mechanical properties is acceptable?

Will density prove a pro or con?

Production optimization

Can we produce Biodolomer Ocean monofilament with the same output as HDPE?

Environmental impacts

Evidence of biodegradation in marine environments

“As of yet, no direct proof of microbial bond breaking or de-polymerization in natural marine systems”.

Price/legislation

Pro-biodegradable legislation or subvention is probably needed for a broad market appeal.



Thank you for listening!



SMEP – Sustainable Manufacturing and Environmental Pollution
Programme (smepprogramme.org)

