

## Biopolymers for materials and coatings

The Biomac Open Innovation Test Bed (OITB) launched an open call in 2023 that selected a series of project proposal that will be upscale from lab stage to Industrial prototypes. In this factsheet, we are looking at the concepts developed by Notpla Ltd.

Notpla is aiming to advance the development of two of its product lines: Notpla Coatings and Notpla Rigid Pellets. Both products are derived from seaweed and are 100% home-compostable and biodegradable. Notpla is at the forefront of using seaweed to create the future of sustainable packaging, with a mission to eliminate plastic packaging.



### The value proposition

#### Notpla rigid material

The demand for sustainable and eco-friendly materials is rapidly growing across various sectors, particularly in packaging. However, the current market lacks high-performance alternatives to more traditional materials like polypropylene (PP) and polyethylene (PE). Seaweed-based materials offer several advantages over traditional materials, being 100% chemical free and home compostable. These properties make them ideal candidates for any single-use packaging/product. Current methods for producing seaweed-based materials are not cost-effective and cannot meet the demands of large-scale industrial production.

The proposed project aims to develop seaweed-based materials reinforced with a new nanometer-sized seaweed fiber and to scale up the production of pellets containing these materials. This project will address the industrial need for sustainable materials in two primary applications:

- Single-use/disposable (especially cutlery)
- Secondary packaging currently made from rigid plastic.
- The main challenges to overcome before the scale-up phase are:
  - Developing a cost-effective and efficient process for the extraction and purification of nanometer-sized seaweed fiber.
  - Optimizing material formulation and process parameters to achieve the desired physical, mechanical, and thermal properties of the materials.
  - Developing a scalable production process capable of meeting industrial demands.



### Notpla coatings

Notpla is also developing a high-water barrier coating for paperboard, to be used in disposable cups. At present day, there are currently no sustainable options for cup producers or consumers. In this sector, traditional polymers, PE and PP, still make up the bulk of the coating landscape. This is a serious end-of-life issue as neither PP nor PE can decompose in the environment, and the mixed nature of the paperboard-polymer composite renders the cups unsuitable for recycling. In recent years, polylactic acid (PLA) has also gained popularity as a coating due to its perceived environmental benefit; however, the industrial composting conditions ( $T > 60^{\circ}\text{C}$ ) required for its decomposition mean that if PLA ends up in nature it is unlikely to biodegrade. Finally, the most recent solution on the market, “water-based dispersion coatings,” are often claimed to be “plastic-free” as they do not use PE, PP or PLA, when in fact almost all use acrylic or styrene butadiene (both synthetic petroleum-derived polymers) binders to achieve their barrier properties.

Notpla has developed a new material, NQ1, which consists of a biopolymer that forms in situ in certain plants. The structure of NQ1 is distinct from most conventional biopolymers due to its highly hydrophobic backbone. While other natural polymers such as polysaccharides (starch, cellulose, chitin, etc.) are made up of water-loving sugar molecules, the building blocks of NQ1 more closely resemble water-hating natural oils. Furthermore, unlike PE, PP or dispersion coatings that use petrochemical feedstocks, or the resource-intensive fermentation required to prepare the feedstock for PLA, rPE and rPET, our NQ1 polymer can be extracted entirely from a non-edible byproduct of a common commercial crop.

Notpla will use the following Biomac Pilot Lines (PL) to be upscale its two product concepts:

- PL9 (by LIST) for the continuous reactive extrusion for thermoplastic polyurethanes
- PL10 (by LIST) to run the mechanical grinding
- PL11 (by AIMPLAS) to utilize the twin screw extruder
- PL13 (by ITENE) for producing the Nanocellulose
- PL14 (by ITENE) for the spray coating

## Wrap-up

The proposed project aims to develop two product lines: Notpla Rigid Material, a biodegradable and compostable alternative to rigid plastic, and Notpla Coatings, a high-water barrier coating for paperboard. The project will utilize various pilot lines to optimize production processes and scale up the production of these materials. The ultimate goal is to create sustainable packaging that can help reduce the environmental impact of plastic packaging.

