



INNOVATION FUND

Driving clean innovative technologies towards the market

Thermoplastic Lignin Production (TLP): Creating a green industry to replace fossil-based plastics

The Innovation Fund is 100% funded by
the EU Emissions Trading System



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Project summary

The Thermoplastic Lignin Production (TLP) project will develop a first-of-a-kind biorefinery producing a completely new renewable and bio-degradable biomaterial (called RENOL®) from lignin, a by-product of the kraft pulping industry. The biomaterial can be used in bio-composites for producing packaging films, such as wrapping plastics and plastic bags. The innovative solution will replace fossil-based plastics, such as polyethylene, and help avoid 78% of the greenhouse gas (GHG) emissions produced by conventional materials.

COORDINATOR

Lignin Industries AB

LOCATION

Sundsvall, Sweden

SECTOR

Chemicals

AMOUNT OF INNOVATION FUND GRANT

EUR 4 386 624

RELEVANT COSTS

EUR 7 311 040

STARTING DATE

01 April 2021

PLANNED DATE OF ENTRY INTO OPERATION

01 January 2024

Biopolymer RENOL®, a solution to help replacing fossil-based plastics

The project will demonstrate and commercialize the biodegradable biomaterial derived from kraft lignin for bioplastics that has sufficient water resistance and thermoplastic performance as well as a simple and cost-efficient production process to become a real alternative for fossil-based plastics. Kraft lignin is a low-value side-stream of the pulp and paper industry. The new biopolymer represents a strong innovation, as the product is based on a chemical reaction where lignin is mixed with a reagent oil forming a biopolymer with miscibility resulting in 2-4 times better mechanical performance than non-modified lignin. It can be mixed with other bio-based or conventional fossil-based plastics to create new bio-composites that can be used for a wide range of applications, such as plastic bags, packaging films, household items, toys, agricultural films and artificial football turf.

The novel biomaterial production process is based on a chemical reaction created in a, one-step process using an extruder, where lignin is mixed and heated with a non-toxic reagent oil to form RENOL®. The RENOL® may also contain 15% of a polyester bio-plastic component that acts as a binding agent and facilitates processing into pellets, which is the standard and preferred way of handling materials in the polymer industry. The plant will produce 10 000 tonnes per year of RENOL®.

Ending traditional plastic production using a waste stream of the pulp and paper industry

The only sustainable alternative to fossil-based plastic at scale is to increase the use of bio-based and biodegradable materials that are not competing with food production (sourced from corn, sugar cane, etc.) to produce bioplastics. RENOL® is the first biomaterial produced from

RENOL® value chain

lignin that: (1) offers sufficient water resistance and thermoplastic performance; and, (2) uses a simple and cost-efficient production process to become a real alternative for fossil-based materials based on a raw material that already today is processed with large volumes. The new biopolymer can partially substitute polyethylene (PE), which is the most common fossil-based plastic in use today, representing 34% of the total plastics market.

As it is derived from a waste stream of the pulp and paper industry, the project will help avoiding more than 470 000 tCO₂e net absolute GHG emissions in the chemical industry during the first ten years of operation. This represents a reduction of 78% compared to the emissions from the production of a conventional product (PE in this case). The project will also recover and add value to lignin that is currently treated as a low-value side stream of the pulp and paper industry.

Know-how and technology to scale-up an alternative to fossil-based plastics

The project will accumulate first-class technology know-how that can be scaled to create new business opportunities in Europe, both for the plastics industry and the pulp and paper industry. At site-level, the production capacity could be doubled. In further development stages, RENOL® will also replace other types of plastics, such as PP (polypropylene) and ABS (Acrylonitrile butadiene styrene), and help further reduce emissions from other carbon intensive industries.