

A European project develops a pioneering technology to biodegrade plastics with enzymes and to recycle aircrafts

- Through protein engineering, Bizente modifies enzymes and resins molecularly, making them suitable for a controlled biodegradation process in a bioreactor. This technology makes possible the recovery of materials to give them a second life
- With 12,000 aircraft about to be retired, sectors such as aeronautics, construction, automotive and wind energy will benefit from this biocatalytic model of controlled biodegradation

Bertinoro, 24th March, 2022. After 18 months running, the Bizente project, coordinated by Aitiip Centro Tecnológico of Zaragoza, and where Biosphere is involved as Partner, continues to develop a pioneering technology that will make it possible to biodegrade thermostable compounds, which until now were not recyclable, using enzymes. The aim is to recover carbon fibers and resins that can be reused. Bizente is an innovative and sustainable solution, which will help reduce by 40% the emissions of non-biodegradable thermoset plastics into the environment, avoiding their current destination: storage in landfills and incineration.

By 2030, it is estimated that around 12,000 airplanes and 12,000 wind turbines will reach their end of life. This is a problem relevant to other strategic sectors as well, such as railway, construction and electronics. Bearing in mind that around 430,000 tons of composite waste are generated worldwide in a yearly basis, Bizente's technology, based on protein engineering, will be capable of decomposing at least 27% of the total amount of this waste. Moreover, by replacing incineration with biodegradation, Bizente's positive impact will also be reflected in a reduction of CO₂ emissions released during incineration. A revolutionary alternative that responds to the circular economy and sustainability challenges which Europe is facing.

Biocatalytic enzymatic degradation model for carbon fiber and resin recovery

Bizente's technology aims to achieve controlled biodegradation of thermoset composite materials through the use of enzymes. The main idea is that the best enzyme candidates are engineered by Directed Evolution to adapt them to the degradation process. The reactions will be scaled-up inside industrial chemical reactors. After this process, the carbon fibers from the composites are recovered and the byproducts from the degradation process will be studied and their revalorization will be developed.

Polymers that can be degraded by enzymes are mainly polyester, polyurethane (PUR) or polyethylene terephthalate (PET). The degradation mechanism is oxidation or hydrolysis. Bizente proposes a novel solution that extends the biocatalytic process to a new type of raw material: three thermoset resins (epoxy, polyester and vinylester) that have not been previously addressed in the plastic value chain. This innovation opens up new markets and opportunities.

Bizente, which involves 10 partners from five countries, is the first project approved by the European Union for the treatment of composite materials once they have reached their end of life. The project is coordinated by Aitiip Centro Tecnológico, and **Biosphere has a key role in the development and optimization of fermentation processes for the production of the customized enzymes used in the degradation of plastics, and in the scale-up of the enzymatic degradation process.**