PRESS RELEASE

New *Nature* publication confirms CARBIOS' leadership in enzymatic degradation of plastic

- CARBIOS and Toulouse Biotechnology Institute (TBI) publish groundbreaking article that presents enzyme optimization work leading to an enzyme-embedded PLA able to disintegrate and biodegrade in home-compost conditions faster than certification timeframe requirements

- This new publication in *Nature*, widely regarded as the most influential scientific journal, comes in addition to the 2020 publication on enzymatic depolymerization of PET, confirming CARBIOS' leadership in enzymatic engineering

- **CARBIOS Active** is the result of the unique know-how developed by CARBIOS' R&D teams by exploiting the properties of the highly specific enzyme to improve the biodegradation performance and lifecycle of PLA products

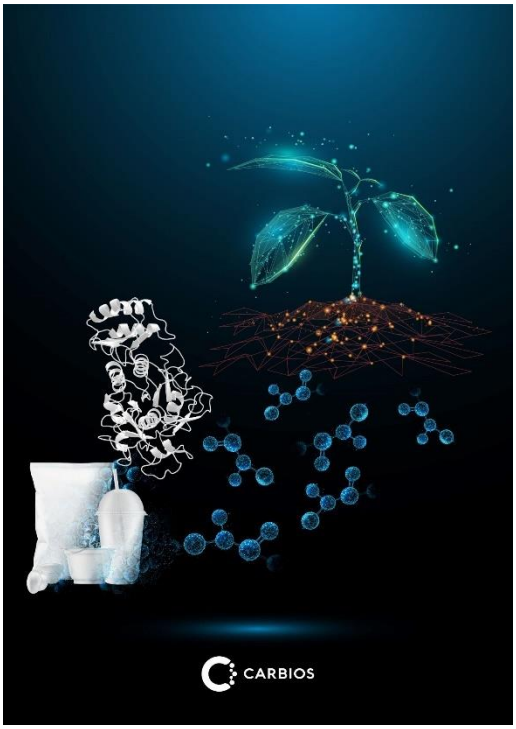

Figure 1: CARBIOS publishes a new article entitled "An engineered enzyme embedded into PLA to make self-biodegradable plastic" in Nature

Clermont-Ferrand (France), Wednesday 17 July 2024 (6pm CEST). CARBIOS, (Euronext Growth Paris : ALCRB), a pioneer in the development and industrialization of biological technologies to reinvent the life cycle of plastic and textiles, announces the publication of a new article entitled **"An engineered enzyme embedded into PLA[1] to make self-biodegradable plastic"** in *Nature*, widely regarded as the most influential scientific journal, and co-authored with its longstanding collaborator, the Toulouse Biotechnology Institute (TBI)[2]. Enzyme-embedded PLA plastic can fully and rapidly degrade in home-compost or methanization conditions. The article describes the optimization process used to achieve an engineered enzyme able to withstand the 170°C[3] temperature required to introduce it in molten state PLA during the plastic production process. The new enzyme-embedded material is proven to fully distintegrate and biodegrade at a much faster rate than the 26-week home-compost certification requirement and is also shown to help produce more biomethane, another source of waste recovery. Moreover, the material

[1] polyactic acid, a biosourced plastic

[2] Toulouse Biotechnology Institute, Bio & Chemical Engineering, joint research unit associating INSA of Toulouse, CNRS and INRAE

[3] 170°C = 338°F

remains intact over long-term storage, the enzyme only being activated under composting or methanization conditions, ensuring compatibility with commercial PLA-based applications, for example, flexible packaging (such as sauce packets and wrappers) and short-life items (such as food containers, yogurt pots and coffee capsules).

CARBIOS Active: CARBIOS' commercial biodegradation solution is the direct result of the unique know-how developed by its enzymology experts

Figure 2: CARBIOS Active, in granule form, integrated directly into PLA-based packaging or products at the production phase, enables compostability at room temperature.

CARBIOS' expertise in enzyme optimization contributed to the development of **CARBIOS Active**'s formula and industrial process. Integrated directly into the plastic material transformation process without any modification to production lines, the encapsulated enzyme **CARBIOS Active** enables the creation of a new generation of PLA products that are 100% compostable at ambient temperature, while ensuring quality compost, free from toxicity and microplastics. **CARBIOS Active** therefore opens up new biodegradation possibilites for PLA at ambient temperatures, including domestic composting conditions. A production line is already up and running at CARBIOS headquarters in Clermont-Ferrand, France, which can produce 2,500 tons/year of CARBIOS Active (required for the equivalent of 50,000 tons/year of enzyme-embedded PLA).

Alain MARTY, Chief Scientific Officer, CARBIOS: *"A publication in Nature is an especially proud moment for all the contributing teams, notably recognition from peers in the scientific community. Developing an efficient enzyme that can withstand the 170°C needed to introduce it into PLA is an outstanding scientific feat! Our previous article published in Nature in 2020 was pivotal in bringing our PET biorecycling technology to the world stage. We are very excited by the enhanced visibility of CARBIOS' unique biodegradation technology brought by this publication, as it offers a practical and scalable approach to various industrial PLA-based packaging applications."*

Figure 3: A production line for CARBIOS Active is already up and running at CARBIOS headquarters in Clermont-Ferrand, France, which can produce 2,500 tons/year of CARBIOS Active (required for the equivalent of 50,000 tons/year of enzyme-embedded PLA).

Emmanuel Ladent, CEO, CARBIOS: *"CARBIOS Active is the real-life application of CARBIOS' expertise in enzyme optimization and polymer science. As CARBIOS expands its portfolio of enzymatic solutions beyond PET, enzyme-embedded PLA represents a major leap forward, addressing a critical gap in the market for compostable plastic. The recognition from the scientific community through this new publication in Nature comes in addition to recent certifications, such as the Food Contact Notification delivered by the*

FDA in North America, to attest CARBIOS Active's performance and support its commercial deployment. Thanks to our long-term and exclusive partnership with Novonesis, we are transforming this scientific breakthrough into reality."

Isabelle André, Research Director at CNRS: *"I am immensely proud that the efforts and dedication of the researchers at TBI and our long-term partners at CARBIOS have been recognized by the journal Nature. This pioneering work on enzyme-embedded PLA to make self-biodegradable plastic is testament to our commitment to developing sustainable solutions with enzyme engineering at the core."*

The article is co-authored by biotechnology researchers from CARBIOS and its academic partner Toulouse Biotechnology Institute (TBI), as well as two eminent professors from University of Mons (Belgium) and Kasetsart University of Bangkok (Thailand). Once again, this collaboration demonstrates CARBIOS' ambition and ability to rally partners together in an efficient ecosystem to bring a collective solution to a major environmental challenge.

To read the *Nature* article online, click here: https://www.nature.com/articles/s41586-024-07709-1

Publication has been scheduled in the 25 July 2024 issue of *Nature*.

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About CARBIOS:

CARBIOS is a biotech company developing and industrializing biological solutions to reinvent the life cycle of plastic and textiles. Inspired by nature, CARBIOS develops enzyme-based processes to break down plastic with a mission to avoid plastic and textile pollution, and accelerate the transition to a circular economy. Its two disruptive technologies for the biorecycling of PET and the biodegradation of PLA are reaching industrial and commercial scale. Its biorecycling demonstration plant has been operational since 2021 and a first industrial plant, in partnership with Indorama Ventures, is currently under construction. CARBIOS, founded in 2011 by Truffle Capital, has received scientific recognition, notably with the cover of Nature, and is supported by prestigious brands in the cosmetics, Food & Beverage and apparel industries to enhance their products' recyclability and circularity. Nestlé Waters, PepsiCo and Suntory Beverage & Food Europe are members of a packaging consortium founded by CARBIOS and L'Oréal. On, Patagonia, PUMA, PVH Corp. and Salomon collaborate with CARBIOS in a textile consortium.

Visit www.carbios.com/en to find out more about biotechnology powering plastic and textile circularity.

For latest news and media assets, visit our newsroom: www.carbios.com/newsroom/en/

LinkedIn: CARBIOS / Instagram: insidecarbios

Information on CARBIOS shares:

ISIN Code:	FR0011648716
Ticker Code:	Euronext Growth: ALCRB
LEI:	969500M2RCIWO4NO5F08

This press release and the information contained herein do not constitute an offer to sell or a solicitation of an offer to buy or subscribe to shares in CARBIOS in any country.

CARBIOS is eligible for the PEA-PME, a government program allowing French residents investing in SMEs to benefit from income tax rebates.

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