



ZERO EMISSION BIOCHEMICAL AND RENEWABLE ADDITIVES

D3.2. PILOT PLANT [DEM]



Co-funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or CINEA. Neither the European Union nor the granting authority can be held responsible for them.

PROJECT INFORMATION

GRANT AGREEMENT NUMBER	101074460
PROJECT TITLE	Zero Emission Biochemical and Renewable Additives
PROJECT ACRONYM	LIFE21-ENV-ES-ZEBRA-LIFE
FUNDING SCHEME	LIFE Programme
PROJECT START DATE	November 1st 2022
DURATION	48 months
CALL IDENTIFIER	LIFE-2021-SAP-ENV
PROJECT WEBSITE	ZEBRA LIFE

DELIVERABLE INFORMATION

DELIVERABLE NO.	3.2
DELIVERABLE TITLE	Pilot Plant [DEM]
WP NO.	WP3
WP LEADER	CENER
CONTRIBUTING PARTNERS	
AUTHORS	Clara López-Aguado, Ibai Funcia; Alberto Clemente, Raquel Baigorri
CONTRIBUTORS	Inés del Campo
REVIEWERS	Vicente López
CONTRACTUAL DEADLINE	30/04/2025
DELIVERY DATE	04/11/2025
DISSEMINATION LEVEL	PU

DOCUMENT LOG

VERSION	DATE	AUTHOR	CHANGE DESCRIPTION
V1.0	03/11/25	Clara López-Aguado, Ibai Funcia, Alberto Clemente, Raquel Baigorri	Draft for revision
V1.1	04/11/25	Clara López-Aguado, Ibai Funcia, Alberto Clemente, Raquel Baigorri	Final version
V1.2	26/01/26	Inés del Campo	Final version with video link



DISCLAIMER

Co-funded by the European Union

“Co-funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or CINEA. Neither the European Union nor the granting authority can be held responsible for them.”

TABLE OF CONTENTS

1. Executive Summary	5
2. ZEBRA-LIFE Pilot Plant.....	6

LIST OF FIGURES

Figure 1. Detail of ZEBRA-LIFE Pilot plant (top). ZEBRA-LIFE partners in BIO2C (bottom).....	7
--	---

1. EXECUTIVE SUMMARY

The main objective of work-package 3 is the design, construction, and commissioning of a pilot plant (TRL 6) in continuous operation mode processing/converting of 20 kg/h of technical lignin, lignin liquor or black liquor into ZEBRA products (ZEBRA-LMW and ZEBRA-MMW). The pilot plant has completed its construction and commissioning in April 2025 (M30), as previously defined in WP3 workplan. However, the official reporting and therefore this deliverable (D3.2) and Milestones 6 and 7 have been postponed from M30 till M36, once production has been stabilised (through 4 campaigns) and the first sample batches been produced (WP4) and shared with the partners.

This deliverable takes the form of a press release announcing the start-up of the pilot plant of the ZEBRA LIFE project after a successful operation with 840 cumulative hours of real production.

The pilot plant is located at CENER's Biorefinery and Bioenergy Centre (BIO2C) in the town of Aoiz (Navarra), Spain.

2. ZEBRA-LIFE PILOT PLANT

ZEBRA-LIFE FROM LIGNIN TO ANTIOXIDANT: PILOT PLANT IS UP AND RUNNING

This pilot plant was developed within the framework of the European innovation project ZEBRA-LIFE and has been officially commissioned after successful 840-cumulative operating hours.

Aoiz – October 31, 2025 – After 30 months of design, construction and testing, the ZEBRA-LIFE pilot plant has been officially commissioned following 840 cumulative operating hours achieved across several continuous-processing campaigns.

The pilot plant converts lignin, a by-product of the pulp and paper industry, into bio-based antioxidants for use in food, cosmetics, fuels and lubricants. In doing so, it offers a sustainable alternative to conventional fossil-based additives.

Located at [CENER's BIO2C](#) (Biorefinery and Bioenergy Centre) in Navarra, Aoiz, northern Spain, the pilot plant runs continuous-processing campaigns, at approximately 20 kilograms of lignin per hour to produce two ZEBRA-LIFE antioxidant products. The facility is placed near a pulp and paper mill (Smurfit Westrock-Sangüesa), creating an innovative-local circular economy loop.

The lignin, currently a by-product used mainly for energy, is upgraded through CENER's proprietary OHRIGINS technology, which integrates depolymerization, fractionation and purification to obtain high-performance antioxidant molecules.

In a proof-of-concept run, the plant treated about one tonne of kraft lignin over 50 hours of continuous operation, verifying the complete conversion pathway and system integrity. Commissioning was then completed through three structured, multi-week campaigns, each consisting of preparation, operation and cleaning, culminating in a total of 840 cumulative operating hours across WP3 and WP4 activities. A fourth campaign begins next week to expand product validation with end-users

In the next phase, samples from the pilot campaigns will be sent to the different end-users for validation. These include applications in food (chorizo, cookies, and beef burgers), cosmetics, lubricants, engine oils, and rubber products. Each partner will evaluate the physicochemical properties of the antioxidant products and test their performance in real formulations. This validation will help confirm the effectiveness of ZEBRA-LIFE additives in replacing fossil-based ingredients while maintaining product quality and safety.

The pilot's commissioning confirms the technical feasibility of producing bio-based antioxidants from lignin at pilot scale and provides a foundation for further scale-up of the ZEBRA-LIFE products.

For a more detailed description of the plant a video has been recorded and is available on [ZEBRA LIFE - Zero emission biochemical and renewable additives](#)

About ZEBRA-LIFE

ZEBRA-LIFE is a project co-funded by the European Union under the LIFE Programme. It focuses on developing lignin-based antioxidants as sustainable alternatives to fossil-derived additives. The consortium brings together CENER (project coordinator), Smurfit Kappa Navarra, ASINCAR, Centro Tecnológico Riojano, Roka Furadada, Repsol, Bioquochem and Inveniam Group.



Figure 1. Detail of ZEBRA-LIFE Pilot plant (top). ZEBRA-LIFE partners in BIO2C (bottom)