MOJITO - DECARBONIZED LIME PRODUCTION THROUGH ENHANCED JOINT DIELECTRIC HEATING AND WASTE CARBONACEOUS MATERIAL ADDITION

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Deliverable D2.1:

Report on Feedstock Supply

Dissemination Level		
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Document Type		
R	Document, report (excluding the periodic and final reports)	x
DEM	Demonstrator, pilot, prototype, plan designs	
DEC	Websites, patents filing, press & media actions, videos, etc.	
DATA	Data sets, microdata, etc.	
DMP	Data management plan	
ETHICS	Deliverables related to ethics issues.	
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OTHER	Software, technical diagram, algorithms, models, etc.	

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MOJITO consortium

Short	Beneficiary	Role
UNIBO	Università di Bologna	BEN
FRA	Fraunhofer UMSICHT	CO

CO…Coordinator, BEN…Beneficiary, AP…Associated Partner

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Executive Summary

Two carbonaceous feedstock categories were sourced and screened, and two PCM candidates have been selected. Carbonate materials and biochar are procured from specified suppliers and are available at Fraunhofer. The project's biochar is sourced from commercial wood and plant charcoal as well as low-cost residues like digestate and sewage sludge, with the selected materials available at Fraunhofer Samples have been sent to the University of Bologna for tan δ and chemical analyses, thereby completing Milestone M1. With M1 achieved, Task 2.2 can proceed without delay and will not impede project progress. Task 2.2 will carry out a comprehensive characterization (ICP-OES for major and heavy metals, TGA for proximate analysis, CHNS, XRD, particle size and surface area measurements, plus dielectric loss and permittivity) to ensure compliance with standards and support the final material selection

1 Introduction

This Report outlines the sourcing, screening and analytical steps completed for the project's carbonaceous materials, and confirms readiness to proceed with subsequent characterization work. It highlights the selection of two PCM candidates, the availability of materials at Fraunhofer, and the submission of samples to the University of Bologna.

2 Report for D2.1

The selected biochar for this project will be produced primarily from commercially available wood and plant charcoal as well as from low-cost waste streams such as digestate and sewage sludge. Wood and plant charcoal serve as reference feedstocks because they possess well-established product properties and an existing market infrastructure, which facilitates technology transfer and quality assessment.
Digestate and sewage sludge are deliberately included because they are often locally and continuously available at low cost; in particular, sewage sludge is generated in large quantities at municipal treatment plants and therefore offers potential as a scalable raw material base. Utilizing these residual streams reduces disposal costs and creates additional value.

To allow flexibility within a particle size range of 10–300 µm, coarser starting materials are initially selected and, if required, milled and sieved to the desired particle size. For the plant charcoal, a market-available, certified product from Carbon Cycle with a particle size of 3–5 mm was chosen; the charcoal produced from digestate by Fraunhofer UMSICHT shows a similar particle size (see Fig. 1 and Fig. 2). The charcoal is on hand at Fraunhofer in the amount needed for the project.



Fig. 1: Biochar produced from digestate (TCR 30 experiment);



Fig. 2: - Plant biochar supplied by Carbon Cycle

In the future, the range of carbonaceous feedstocks will be expanded to include biochar derived from sewage sludge. The existing char has been submitted to the University of Bologna for further analyses, in particular for tangens-loss measurements (tan δ) and chemical analyses, the measurements and corresponding results are expected to be available within the first twelve months after project start, as planned. Supplementary analyses of the biochar produced from digestate,

carried out at Fraunhofer UMSICHT, are summarized in Table 1. The values reported there refer to the original material and represent average values from two trials.

Average loss on ignition (LOI)	61,72	%
Average ash content	38,28	%

Table 1: Analysis of biochar derived from digestate

3 Future Steps

These next steps go beyond the current Milestone M1 and will proceed under the subsequent work Tasks. The next steps begin with Task 2.2, which involves a comprehensive chemical and physical characterization of the selected carbonaceous and carbonate feedstocks to verify conformity with standards (e.g., UNI EN 459-2:2021) and to exclude materials with unacceptable contaminants or unsuitable dielectric properties. Analyses will include ICP-OES for major and trace elements and heavy metals, TGA for proximate analysis, CHNS elemental analysis, XRD mineralogy, particle-size distribution, physisorption for surface area, and dielectric loss and permittivity measurements. The resulting dataset will confirm material suitability and identify the most promising samples for further processing. Task 2.3 then covers feedstock pretreatment and mixture preparation: materials will be milled and sieved to defined size fractions (including 500, 250, 180, 90 µm), the two particle-size classes with the best dielectric behaviour will be selected, and PCM:dolomite mixtures will be prepared and tested from 25 to 800 °C to determine the minimum PCM content that yields tan δ > 0.1 across the temperature range, thereby defining the eight pre-calcination mixtures for subsequent rotary-kiln testing.