

DUST+ – Innovative composites with powder incorporation resulting from limestone cutting sludge

Summary

The project DUST + aimed to develop new composites based on stone powder from the residual sludge that results from the processing of limestone incorporating hydraulic or polymeric binders. In the initial phase, a new sludge settling system was designed, which allowed the replacement of chemical flocculant products currently used by others of biological origin. At the same time, sludge treatment processes have been developed to ensure their compatibility with the binders. Subsequently, the compositions for the new composites were defined, studying and experimentally optimizing the physical and mechanical performance, and durability of the resulting materials. Specific compositions of composites were developed that allow their application by 3D printing and/or projection. In parallel, new products were designed that can be manufactured from these new composites and interconnected with natural stone elements, such as reinforcement sublayers, decorative pieces, and urban furniture. Finally, the new composites and products were produced in an industrial environment and subjected to an extensive campaign to validate their functional and environmental performance, guaranteeing the pre-established requirements and the proposed innovation potential. To guarantee the success of the project, a multidisciplinary consortium with complementary skills in the critical areas of innovation was defined, composed of SOLANCIS, CeNTI, Universidade de Coimbra and Itecons.

Main goals:

1. Design and develop new composite materials with the incorporation of powder resulting from limestone processing sludge;
2. Conceive and develop a new settling system for the sludge for the replacement of current chemical flocculants with others of biological origin;
3. Optimize waste treatment operations that enable the use of sludge in the development of new composite materials, from an environmental, energetic, economic, and operational point of view;

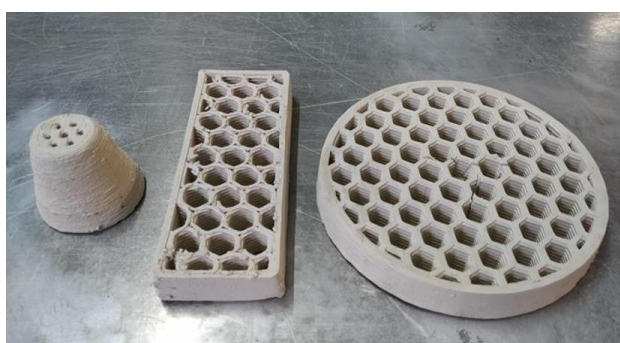


Figure 2. 3D printing prototypes.

4. Demonstrate the mechanical, thermal, acoustic performance and durability of the new composites;
5. Design folders from composite materials with incorporation of limestone powder residues for projection and 3D printing;
6. Characterize and ensure the compatibility of new materials with natural stone elements, such as reinforcement sublayers, decorative pieces, and urban furniture.

Main results:

1. New sludge settling system, whose process is characterized using biofloculants with less environmental impact;
2. Composite materials/pastes based on the incorporation of powder resulting from limestone processing sludge;
3. Creation of innovative products, namely, pieces in natural stone, using the developed composite materials/pastes, based on printing technology (3D printing/projection);
4. Demonstrated that there is a high rate of circularity in new products through the incorporation of limestone powder sludge residues.



Figure 1. Residual sludge.



Project Reference

POCI-01-0247-FEDER-047076

Leading Institution

SOLANCIS – Sociedade Exploradora de Pedreiras S.A. (Portugal)

Partners

CeNTI – Centro de Nanotecnologia e Materiais Técnicos, Funcionais e Inteligentes (Portugal), UC – Universidade de Coimbra (Portugal), Itecons – Instituto de Investigação e Desenvolvimento Tecnológico para a Construção, Energia, Ambiente e Sustentabilidade (Portugal)

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Funding

COMPETE 2020, Portugal 2020

Period

2021-2023

Total

848 683.25€

CERIS

Coimbra Hub: 180 595.34€

Project Website

<https://www.itecons.uc.pt/service/s/projects/104?locale=en>