BLOCOYSTER – Ecological concrete blocks made with oyster shell waste

Summary

The BLOCOYSTER project aims to contribute to a sustainable blue economy by reducing environmental pollution caused by aquaculture waste, incorporating it into the production of sustainable concrete blocks. The initiative's objective is to enhance the value of the production chain by utilising local materials and reducing the environmental impact of waste generation, and also to promote economic, environmental, and social benefits.

The project, developed in Portugal with the support of the Mares Circulares funding, proposes the utilisation of aquaculture waste (Oyster shells) for the creation of new products in the Construction Sector. The approach aligns with government guidelines that advocate for the utilisation of local materials in delineating aquaculture areas, a practice that is in accordance with the principles of the blue circular economy and sustainable development in coastal areas.

The Oyster Shells waste was obtained from cooperatives in the Ria Formosa region (the main production area of oysters in Portugal), subsequently undergoing a cleaning process that involved both natural and laboratory methods. The shells were then crushed and sieved for utilisation in two distinct forms on concrete mixtures:

1. As a partial substitute for binder (Oyster powder).
2. As a partial substitute for fine aggregates (Oyster sand).

Following the laboratory tests, the optimal proportions were identified as 10% replacement for cement and 30% replacement of fine aggregates with oyster shell waste in concrete mixes.

The Life Cycle Assessment (LCA) revealed that blocks with naturally washed shells have a lower environmental impact than conventional blocks, showing advantages in reducing CO_2 emissions and the extraction of natural resources. Also, the reuse of shells prevents their improper disposal, thereby mitigating impacts on the coastal ecosystem.

From a socio-economic perspective, BLOCOYSTER fosters the creation of local employment opportunities, promotes the reuse of waste materials, and contributes to the reduction of construction costs. This initiative positions itself as an affordable and replicable solution for coastal communities. The pilot experiment also demonstrated the applicability of the blocks for protecting aquaculture ponds, replacing traditional cement blocks.

The project's continuity is ensured by the exploration of complementary applications of the shells in mortars, 3D printing, green roofs, and photocatalytic products through master's and doctoral theses. The expansion to an industrial scale will necessitate the execution of new logistical studies and the identification of additional funding sources. However, the preliminary findings indicate the presence of robust technical, environmental, and economic viability.

In summary, BLOCOYSTER presents a pioneering solution that integrates sustainability, circular economy, and local valorisation, exerting a beneficial effect on both the construction sector and aquaculture.

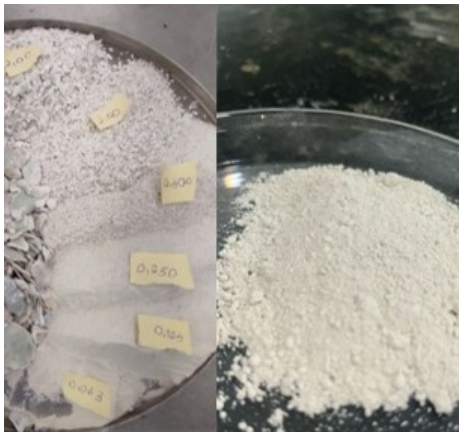

Figure 1. Oyster Sand and Oyster Powder.

Figure 2. Ecological concrete blocks made with oyster shell waste.

Project Reference

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Leading Institution

IST-ID – Associação do Instituto Superior Técnico para a Investigação e o Desenvolvimento (Portugal)

Partners

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2023-2024

Total

7 000.00€

CERIS

7 000.00€

Project website

https://percoat.tecnico.ulisboa.pt