MATERIALS FOR BIO-CONSTRUCTION
RECYCLING DISCARDED SEA SHELLS

With the aim to solve the important environmental pollution problems caused by sea shell waste generated by fisheries and aquaculture industry, experiments and studies are being carried out in different countries to provide an efficient and profitable use for this waste by manufacturing materials for bio-construction. These studies also aim to contribute to greater sustainability in the construction sector, reducing CO2 emissions caused by the production and use of concrete, by taking advantage of locally available material such as sea shell waste made up of calcium carbonate.

Examples of these advances can be found in territories of Spain, Peru and the United Kingdom, where fishing and aquaculture are especially developed and thanks to the pioneering work of universities, design studios, companies and experts, results of general interest have been achieved.

In the Region of Galicia in Spain, in December 2021, the Hijos de Rivera-UDC Chair in Sustainable Development at the University of Coruña awarded a prize for research on the use of mussel shells as a bioconstruction material.. Galicia contributes significantly to the annual production of mussels in Spain and it is estimated that this industry generates 25,000 tons of waste per year in the region. The study has experimented with different applications of the biomaterial derived from mussel shells, producing aggregates for the manufacture of concrete and innovative coating mortars. In fact, the material has been successfully used as a loose fill for insulation, because mussel shells have turned out to be a material with low thermal conductivity and an acoustic performance comparable to that of other insulating materials available in the market.

The research work was carried out within the framework of the Biovalvo Project : *Assessment of Galician bivalve shells in the field of construction* developed by the University of Coruña in collaboration with different companies. The project ended with the construction, at the Elviña Coruña Campus, of an experimental building that includes all the materials analyzed and described in the research. Mussel shells were included in the ceiling, walls, floor and foundation of the building. The Biovalvo experimental module, designed under the Passivhaus standard and Bio-construction criteria, has been recognized as one of the finalist projects in the Ibero-American Passivhaus contest. More details on the experiments carried out and the results achieved can be found in the document presenting the Biovalvo Project in Brazil.

The Acuired magazine from Peru, edited by the National Aquaculture Information Network and promoted by the Ministry of Production,

published in March 2022 the case study on ecological bricks made with crushed shell valves called *conchas de abanico*. Official sources estimate that shell waste in Peru reaches 72,000 tons/year and its final disposal represents a critical problem for the industry and for the territories. A considerable part of this waste is generated by the production of *conchas de abanico* in Sechura, in the Piura Region, creating a serious environmental problem. In this context, the companies Expertisse Plus Consultores and Biotecnos have developed a circular economy pilot project for the manufacture of ecological bricks based on crushed shells, to demonstrate that an environmental liability, determined by a value chain waste, can be converted into a social and economic asset.

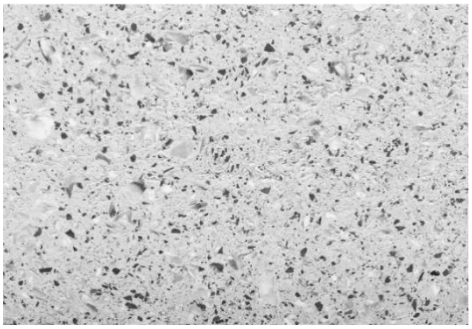
The production process of these bricks reduces the ecological footprint of the *concha de abanico* value chain and of the brick production value chain itself, because it uses discarded material and because it does not require the burning used for the conventional bricks. The companies were able to optimize the mix of materials to incorporate the greatest amount of crushed shells and the final product has been submitted for technical evaluation to Sencico, the national approval authority for construction materials in Peru. The goal is to massify the production of these ecological bricks, absorbing a consistent part of the national annual production of shell waste that is accumulated in dumps.

Committed to the territory, the Facultad de Ingenieria de la Universidad de Piura has also made an important contribution during several years, by carrying out studies on the use of shell waste as a filler to produce sustainable concrete. These works, which have achieved promising results of academic and general interest, have been published on different knowledge platforms. In addition to contributing to solving environmental problems, they show that it is possible to reduce CO2 emissions generated by concrete production by taking advantage of a calcareous filler made with materials available in the Piura Region, such as the *concha de abanico* shell waste.

In the United Kingdom, since 2017 Local Works Studio has been designing and prototyping discarded shell materials to be used as tiles, plasters, renders, bricks, mortars, paints and other cladding and surface finishes for buildings. Adopting an innovative approach to develop new and forgotten materials using local waste and by-products the Local Works Studio emphasizes the aspect of recovering traditional knowledge in the use of these waste materials. They started considering that the process of transforming seashells into building materials dates back over a thousand of years and has evolved in coastal communities and islands with abundant shell material and lacking certain natural resources for construction.

Analyzing the historical examples of these inventive processes in the world, they elaborated the article *Building with shells - historical references* that summarizes the research presenting information of general interest. Recovering ancient knowledge, shells from oysters, mussels, scallops, whelks, crabs and lobsters can all be processed into building lime, a very fine and easy to work material. The Local Work Studio continues to develop the Shellcrete project producing prototype materials for construction, building insulation and external wall cladding, transforming shellfish waste from fishing industries and seafood restaurants. The Local Work Studio website also reports that they are developing a short film documenting the processes and applications of this material.

A consistent documentation available on the internet shows the large number of universities that in different countries of the world carry out studies on this subject and allow knowing the results achieved in this important field of the circular economy to improve the environment and the construction sector.



To know more

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Article in UDC website

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Local Works Studio website

Building with shells - historical references in Local Works Studio

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A World Built of Oyster Shells by David Cecelski