ARTIFICIAL REEFS FOR SAFE AND SUSTAINABLE MARINE HABITAT REGENERATION

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ABSTRACT

A *multidisciplinary group of researchers* from the University of Alicante has developed a new system for the formation of artificial marine reefs and underwater structures with porous calcareous coating using electric current.

The system is characterised by the fact that it starts from a lightweight metal base of any geometric shape –with the possibility of assembly– and the final structure can be easily transported and placed, or fabricated in-situ. During the processing stage, substances are released into the environment that favour the development of phytoplankton and are harmless to the habitat, thus establishing a greater diversity of marine species on the structure itself.

This device allows the restoration of marine ecosystems, the purification of marine waters in aquaculture farms, as well as the sustainable exploitation of marine leisure (recreational diving).

Companies interested in acquiring this technology for commercial exploitation through licensing agreements are being sought.

TECHNOLOGY ADVANTAGES AND INNOVATIVE ASPECTS

ADVANTAGES OF THE TECHNOLOGY

The main **advantages** of this method compared to other systems currently in existence for similar purposes are as follows:

1) The **supports** used have a **very low weight**, as they are made of metal mesh on which the electrolysis is carried out.

2) These systems can be **easily transported, positioned and anchored** due to their low weight.

3) The final structures can adopt **any geometrical shape**, and can subsequently form more complex underwater structures.

4) The manufacturing process can be carried out ***in-situ*** at the final location or in **more controlled environments** (e.g. swimming pools, port areas, salt pans or industrial sites). The latter option facilitates a more exhaustive control of the process.

5) The **assembly can be carried out *in-situ*** by assembly, welding, fixing with connecting elements or stacking of the necessary modular elements.

6) The electrolytic process **avoids or reduces the environmental impact on the habitat**, as chemical species beneficial to living organisms in the marine environment are generated during the process. In fact, the products of the anodic electrochemical reaction are iron ions (Fe^{2+} and Fe^{3+}), species that favour the **development of phytoplankton**.

7) The large mesh spacing allows a greater homogeneity of the marine current lines, which favours the **homogeneous growth of the calco-magnesian coating.**

8) It allows a favourable interaction with the marine environment by facilitating the **adhesion of species**.

9) The free access and circulation of aquatic animals through the structure generates spaces that allow the **protection and development of numerous living species**.

INNOVATIVE ASPECTS OF THE TECHNOLOGY

The main innovation of this new system is the use of the **same ferrous element in both electrodes** (cathode and anode). This provides the following benefits:

- The generation of chlorine in gaseous form is avoided.
- Acidification of the liquid medium in the vicinity of the electrolysis zone is partially reduced.
- The oxidation of the anode releases positive iron ions (Fe^{2+} and Fe^{3+}), and these favour the development of phytoplankton.
- These cations are innocuous elements and totally respectful of the ecosystem.
- With these systems, a greater diversity and recruitment of marine species is achieved in the structure, as they allow the free circulation of aquatic animals through the structure.

In addition, the electrolysis process is carried out using **electrical current supplied by an external source**, which allows the process of calcareous coating of the structural support to be accelerated and perfectly controlled.

MARKET APPLICATIONS

This technology finds its main application in the fields of:

1. **Restoration of marine ecosystems** through the construction of artificial coral reefs.
2. **Mitigating the environmental impact** of waste from grow-out cages in industrial aquaculture farms by anchoring structures that act as biofilters of organic matter (**purification of marine waters**).
3. **Marine leisure and sustainable exploitation** of coastal areas and the near-shore maritime fringe, through the construction of structures for recreational diving activities (underwater water parks, underwater aquatic parks, etc.

COLLABORATION SOUGHT

Companies interested in acquiring this technology for **commercial exploitation** through utility model licensing agreements are sought.

Company profile sought:

- Manufacturers of **artificial marine reefs**.
- Manufacturers of **underwater structures** for recreational diving or marine water purification.