

## KNOW-HOW IN THE BIOTECHNOLOGY OF EXTREMOPHILE MICROORGANISMS



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### ABSTRACT

The *Extremophile Biotechnology* research group at the University of Alicante specialises in the study and application of extremophile microorganisms, primarily halophiles (organisms tolerant to high salt concentrations), such as halarchaea, microalgae and cyanobacteria.

Their expertise focuses on enzyme biotechnology, microbial metabolism, the development of high value-added bioactive compounds and bioremediation. Furthermore, they have the capacity to develop stable biocatalysts with a wide range of substrates, and to develop solutions for quality control.

The research group seeks to collaborate with companies and other research centres interested in the development of innovative products and/or processes in the agri-food, cosmetics, health and environmental sectors, amongst others.

### ADVANTAGES AND INNOVATIVE ASPECTS

The research group's expertise is distinguished by:

- 1. Developing high-performance proteins and enzymes:** these are enzymes that are extremely stable (both thermally and chemically) due to their extremophile origin, enabling their use in more efficient industrial processes and under extreme conditions.
- 2. Providing specific environmental solutions (bioremediation):** thanks to knowledge of the metabolic pathways involved in the adaptation mechanisms of extremophile organisms to stressed environments, it is possible to develop different systems and processes for the bioremediation of contaminated soil and water or for carbon sequestration, thereby reducing anthropogenic impact.
- 3. Provide robust R&D&I capabilities:** the group has extensive experience in omics techniques (proteomics and transcriptomics), protein engineering (directed mutagenesis) and the cultivation of microorganisms.
- 4. Producing high-value products through the cultivation of microalgae and cyanobacteria:** these microorganisms are a source of a wide range of bioactive compounds of interest due to their nutritional, antioxidant, cardioprotective or neuroprotective properties; their antiviral, antibacterial or antifungal activity; or their potential use as biopolymers, amongst other applications. Whether for use as a food source or for the production of other bioactive compounds, these microorganisms are a resource that does not compete with other sectors such as agriculture or livestock farming. Furthermore, their ability to capture CO<sub>2</sub> helps to reduce the carbon footprint of production processes.

### MARKET APPLICATIONS

The research group's knowledge and expertise can be applied in the following sectors:

- **Cosmetics industry:** The properties of certain derivatives of halophilic organisms, such as carotenoids (antioxidants) and exopolysaccharides, make them valuable ingredients for skincare products.
- **Agri-food:** Use of biostimulants and biopesticides produced through the cultivation of microalgae and cyanobacteria. Production of functional

ingredients. Use of microalgae derivatives in animal feed (aquaculture and livestock farming).

- **Health:** Production of cardio- and neuroprotective compounds through the cultivation of microalgae and cyanobacteria. Development of surface disinfectant formulations.
  - **Textile and tanning industries:** Use of pigments and dyes obtained from cultures of extremophile microorganisms. Use of halophilic enzymes at different stages of production.
  - **Packaging industry:** Use of biopolymers produced by halophilic organisms.
  - **Industrial biotechnology:** Application of extremophilic enzymes as biocatalysts in industrial processes requiring thermal stability or in the production of metabolites of interest.
  - **Environmental sector:** In bioremediation solutions for the removal of contaminants from soil and water (metals or nitrogen compounds), or as CO<sub>2</sub> sinks.
  - **Algae sector:** This is a sector whose development is being promoted within the European Union. Genetic improvement of microalgae, as well as advancements in their cultivation processes, will facilitate the production of high-value products, as well as their use as carbon sinks in bioremediation projects.
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#### COLLABORATION SOUGHT

It is looking for companies or organisations interested in:

- **Commissioning R&D&I services** for the development of new products or processes based on extremophile enzymes or halophilic microorganisms.
  - Establishing **collaborative projects** to optimise and scale up the production of bioactive compounds (microalgae/cyanobacteria), to develop bioremediation solutions or to open up new lines of research.
  - Utilising the group's **specialised services**, which include:
    - o Development of methods for protein purification and characterisation.
    - o Gene cloning and sequencing.
    - o Overexpression of recombinant proteins.
    - o Functional studies of proteins and enzymatic assays.
    - o DNA analysis.
    - o Design of molecular markers for the identification of plant varieties.
    - o Identification of microorganisms in environmental samples or wastewater.
    - o Design and manufacture of small-scale photobioreactors.
    - o Biomass characterisation: lipid and amino acid profiles.
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