# POTENTIAL OF THE MARINE MICROALGAE *DUNALIELLA SALINA* AND *HALOCHLORELLA RUBESCENS* FOR THE PRODUCTION OF VALUABLE PRODUCTS IN COASTAL ENVIRONMENTS IN THE BAY OF CADIZ

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## Introduction

Microalgae have gained popularity within the scientific community due to their potential in biomass production and synthesis of valuable compounds, including photosynthetic pigments, proteins, lipids, and carbohydrates, contributing to sectors such as cosmetics, pharmaceuticals, nutrition, and agriculture [1]. The objective of this study was to determine growth parameters and biomass quality of two species under different culture conditions.

**_Dunaliella salina_ and _Halochlorella rubescens_**

Species isolated from the "La Esperanza" salt pans as a part of the MedArtSal project were selected for their high content of valuable natural products

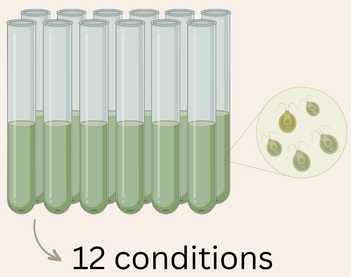
**MedArtSal project**

*"Sustainable Management Model for Mediterranean Artisanal Salinas"*
This project studies the culture potential of species native to the Bay of Cadiz

## Material & Methods

**Kinetic parameters of growth [2], pigments, carbohydrates, lipids, and proteins, were determined**

- **5 mL → Culture medium screening**
  Two culture mediums: Agricultural fertilisers and modified f/2 medium



12 conditions

- **1 L → Different light intensities test**
  Simulating average light intensities typically observed in the Bay of Cadiz

50, 200, 400, 600, 800 µmolphotons·m$^{-2}$s$^{-1}$

- **60L → Outdoor comparitive experiment**
  In HRAP type reactors under ambient temperature and irradiance conditions

## Results & Discussion

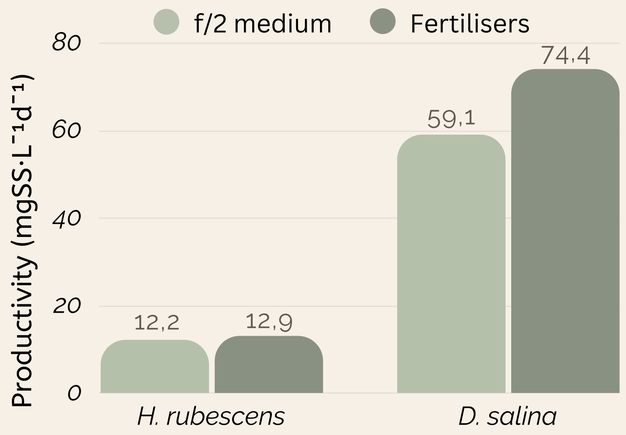



*Figure 1: Average maximum productivities achieved in the screening test for each species and culture medium*

For *D. salina*, the use of agricultural **fertilisers** showed promise as a cheaper alternative to Guillard's **f/2 medium**, achieving the highest productivity without the addition of trace elements and vitamins. *H. rubescens* showed similar growth with f/2 medium and fertilisers, with no significant improvement when adding trace elements and vitamins.

*Table 1: Productivities and concentrations of valuable compounds acheived under different light intensities*

| | Light intensity µmolphotons·m$^{-2}$s$^{-1}$ | Maximum productivity mgSS·L$^{-1}$d$^{-1}$ | β-carotene mg·L$^{-1}$ | Lipids % | Proteins % | Carbohydrates % |
|---|---|---|---|---|---|---|
| ***D. salina*** | 50 | 63,9 | 0,4 | 12,2 | **18,1** | 25,5 |
| | 200 | 116,4 | 0,6 | 12,1 | 13,9 | 39,8 |
| | 400 | **117,3** | 0,8 | **13,1** | 13,7 | **52,2** |
| | 600 | 110,5 | 0,5 | 12,5 | 11,6 | 44,2 |
| | 800 | 97,7 | **1,6** | 9,4 | 11,3 | 35,3 |
| ***H. rubescens*** | 50 | 96,3 | 0,7 | 21,8 | 5,5 | 19,6 |
| | 200 | 105,2 | 1,1 | **23,6** | 3,6 | 20,1 |
| | 400 | **134,3** | **2,2** | 23,0 | **6,1** | **22,9** |
| | 600 | 100,4 | 1,7 | 20,3 | 5,4 | 19,8 |
| | 800 | 102,6 | 1,7 | 22,0 | 4,2 | 20,9 |

Both species showed highest productivity at **400 µmolphotons·m$^{-2}$s$^{-1}$**. The β-carotene content in *D. salina* increased with increasing light intensity, while *H. rubescens* showed the highest concentration at an intermediate intensity. *D. salina* showed higher concentrations of proteins and carbohydrates, while *H. rubescens* showed a higher lipid content.

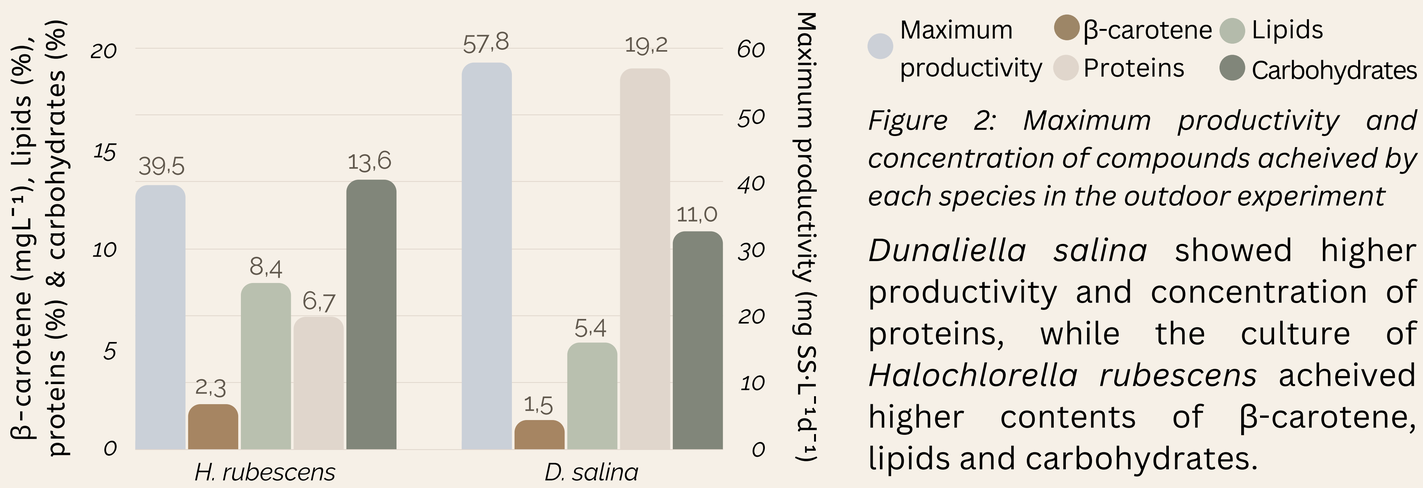



*Figure 2: Maximum productivity and concentration of compounds acheived by each species in the outdoor experiment*

*Dunaliella salina* showed higher productivity and concentration of proteins, while the culture of *Halochlorella rubescens* acheived higher contents of β-carotene, lipids and carbohydrates.

## Conclusions

- The use of agricultural fertilisers proved to be a promising alternative for both species compared to f/2 medium.
- Both species demonstrated growth viability and produced compounds of commercial interest under average light intensities typically observed in the Bay of Cadiz, with highest productivities obtained at 400 µmol photons·m$^{-2}$s$^{-1}$.
- In the outdoor experiment, *D. salina* showed higher productivity and protein production, while *H. rubescens* produced higher levels of β-carotene, lipids and carbohydrates.

**Both species are promising candidates for mass cultivation in the Bay of Cadiz**

This work has been supported by the MEDARTSAL Project. EUENPI-CBCMED Programme

[1] Hachicha, R., Elleuch, F., Ben Hlima, H., et al. (2022). Biomolecules from Microalgae and Cyanobacteria: Applications and Market Survey. *Applied Sciences, 12*(4), 1924

[2] Villar-Navarro, E., Garrido-Pérez, C. & Perales, J. A. (2021). The potential of different marine microalgae species to recycle nutrients from recirculating aquaculture systems (RAS) fish farms and produce feed additives. *Algal Research, 58*, 102389

SACMA
UCA Universidad de Cádiz
SEA EU European University of the Seas
cei·mar campus de excelencia internacional del mar
IN·MAR Instituto universitario de investigación marina