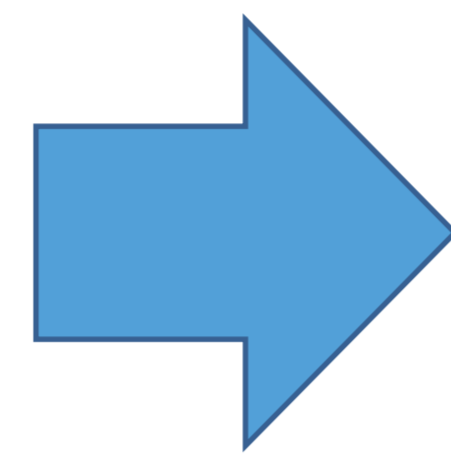


# Composition of seaweed from the shores of Mar Menor Lagoon with potential use in Agriculture

## INTRODUCTION



The **Mar Menor lagoon**, located in a semi-arid area (Murcian coast), is one of the largest hypersaline coastal lagoons of Spain. In the last years, the green alga *Caulerpa prolifera* has colonized the lagoon's muddy bottom spreading not only in the shallow water sandy areas with no other living organisms but also in other regions' habitats of marine plants such as *Cymodocea nodosa*, a phanerogam that grew in almost the whole Mar Menor basin and now is being displaced to only a few areas because of the wide explosion of the alga. The algae growth has increased reaching in August 2020 volumes approx. 60 tons of biomass (algae and phanerogam) that had to be removed and disposed of as waste with a significant economic cost and environmental impact.

In addition to the actions being taken to reduce pollution in the area, such as restricting the use of synthetic fertilizers and, in particular, nitrates, efforts are being made to explore potential uses for this waste in various sectors, including agriculture and energy production. The first step is the characterization of this material, which is fundamental to lead its subsequent application.



**ALGARIKON** is a coordinated Spanish project focused on the Valorisation of the algae accumulated on Mar Menor shores as a result of its eutrophication.

The work presented here is a part devoted to the transformation of the algae residues to Biostimulants for plants, developed by the UAM group.



## OBJECTIVE

The aim of this work was to obtain a chemical characterization of the residue accumulated on the Mar Menor lagoon containing *C. prolifera* and certain sludge from the Mar Menor lagoon to orientate its potential use in Agriculture.

## MATERIALS AND METHODS



*C. prolifera* algae material was gathered from the Mar Menor shore, thoroughly rinsed with tap water, and preserved at -56°C



The percentage of humidity and total chlorophyll content were determined in the fresh waste



It was freeze-dried, sifted to 4 mm to eliminate fine impurities, and milled.

- pH, and electric conductivity (1:5 extract),
- CNHS elemental analysis,
- Nitrates concentration (UNE-EN 10304-1),
- Organic matter by calcination method
- Ionic analysis by Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES, iCAP-PRO X Duo Spectrometer, Thermo Scientific, UK).
- Other bioactive compound: concentration of hormones (Albacete et al. 2008), organic acids, and amino acids.
- Carbon concentration by FT-IR and CP-MAS <sup>13</sup>C-NMR.

## RESULTS

The spectroscopic characterization of the organic carbon by FT-IR showed a major fraction related to carbohydrates and an appreciable amount of aliphatic and aromatic structures and possible N-H groups.

The semi-quantitative analysis by <sup>13</sup>C-NMR showed 48% of O-alkyl groups, 12% of di-O-alkyl groups, 23% of aliphatic-C, 11% carboxyl-C, and 5% aromatic-C

Table 1. Chemical properties and ionic analysis of *C. prolifera* waste on lyophilized material

Properties	Value	Properties	Value
%C	37.4	<b>Micronutrient concentration (mg/Kg)</b>	
%H	5.1	Fe	2330
%N	4.0	Mn	3010
%S	1.6	Zn	63.37
m.o. (%)	73.9	Cu	6.52
NO <sub>3</sub> <sup>-</sup> (mg N/Kg)	61	B	
pH (1:5)	6.51	Mo	1.04
Conductivity (mS/cm) (1:5)	21.0	Na	23553
Humidity (%)	77.8 ± 0.7	Cl	5703
Total chlorophyll (g/Kg)	2.33 ± 0.39	<b>Other elements concentration (mg/Kg)</b>	
<b>Other Macronutrient concentration (g/Kg)</b>		Al	3490
P	0.41	As	14.6
K	7.64	Br	374
Mg	6.98	I	280
Ca	38.77	Pb	82

*C. prolifera* shows a significant concentration of nitrate, Fe, and Mn.

Table 2. Concentration of hormones, organic acids, and aminoacids in *C. prolifera* waste on lyophilized material

Hormones	Value (µg/Kg)	Organic acids	Value (mg/Kg)
Ethylene precursor		Malic	1.75
	ACC	Succinic	29.4
Cytokinins		Citric	9.95
	tZ	Fumaric	0.982
	ZR		
	iP		
Gibberellins		<b>Aminoacids</b>	<b>Value (mg/Kg)</b>
	GA1	Aspartate	0.320
	GA3	Glutamine	0.481
		L-Citrulline	0.360
Auxins		Trans-4-Hydroxy-L-	
	GA4	Proline	0.688
		Proline	4.177
	IAA	Glutamate	9.618
	OxIAA	Valine	1.111
	PAA	Phenylalanine	1.139
	Mel	Tryptophan	0.256
Stress hormones		Iso/Leucine	0.309
	ABA		
	SA		
	JA		

A significantly high concentration of some hormones was obtained, indicating the high potential of the waste to be used as biostimulant.

## CONCLUSIONS

Chemical composition of the waste of *C. prolifera* from the Mar Menor shores presents a broad array of active and nutritional compounds, including Fe, Ca, N, as well as certain hormones, amino acids, and organic acids, indicating that it may have potential use in agriculture, particularly as a fertilizer and biostimulant.

