12th INTERNATIONAL CONFERENCE ON SUSTAINABLE SOLID WASTE MANAGEMENT
25 - 28 June 2025, Paphos, Cyprus

Balancing quality and yield of biofuel and biochar in the pyrolysis of industrial macroalgae sludge: future perspectives with a circular economy approach in the EU FLEXBY project

E. Ciurcina, R. Pardo, L. Taboada-Ruiz, J. Holgado, P. Álvarez Rodríguez, M. Díaz-Somoano, B. Ruiz*

Carbon Science and Technology Institute (INCAR), CSIC. C/ Francisco Pintado Fe 26, 33011, Oviedo, Spain.

Presenting and corresponding author email: ***begorb@incar.csic.es***

INTRODUCTION

The accumulation of macroalgae bio-waste, particularly in the form of solid waste from industrial processing of macroalgae, poses significant environmental and human health challenges. The transformation of industrial macroalgae sludge into valuable bio-based products and energy sources is a promising solution to mitigate its negative environmental impact, while supporting the transition towards a circular bio-economy. It has also demonstrated significant potential for bio-energy production.

OBJECTIVE

- Investigate the feasibility of using industrial macroalgae sludge as a valuable resource.
- Obtain bioenergy and bioproducts through conventional pyrolysis (CP) processes.
- Maximize bio-oil and gas yields.

METHODOLOGY

RESULTS

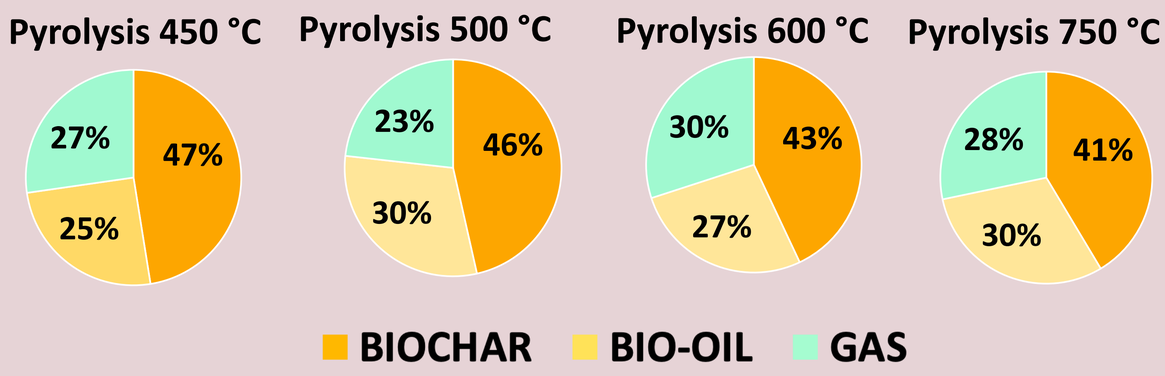
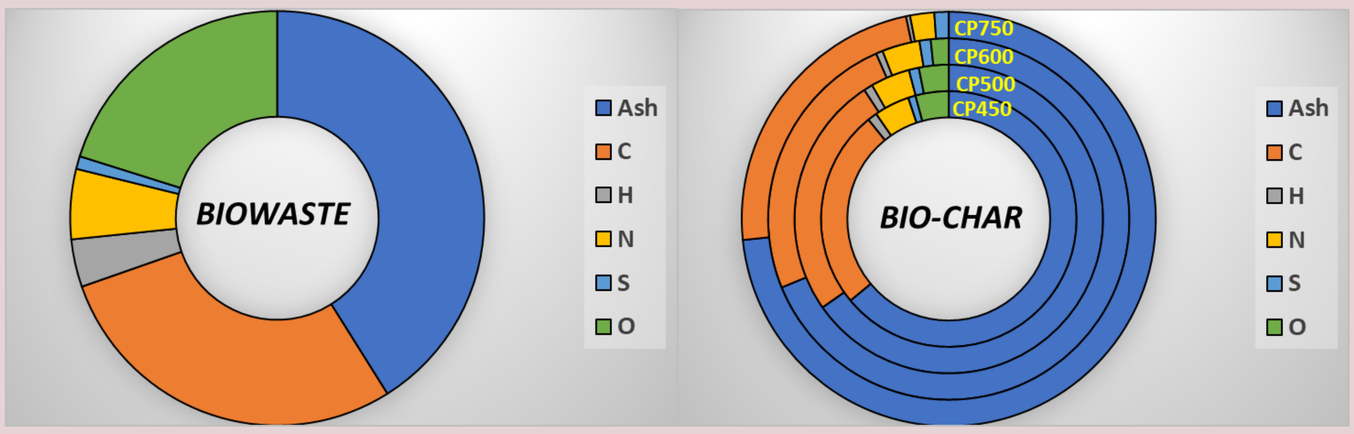


Fig.1. Yield of the pyrolysis fractions obtained at different temperatures

Fig. 2. Chemical composition of the macroalgae sludge waste and bio-chars



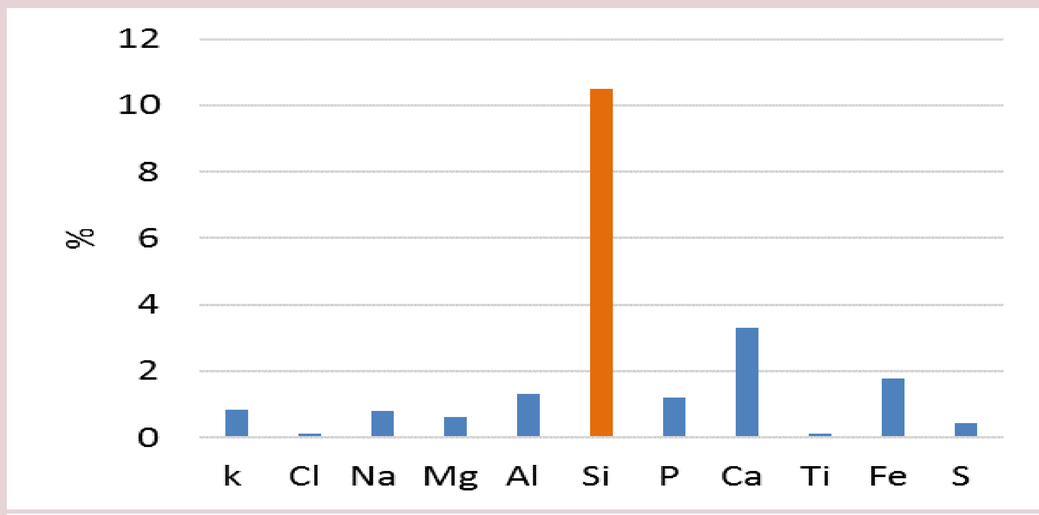


Fig. 3. Inorganic composition of macroalgae sludge waste

CONCLUSION

The European Flexby Project aims to develop heavy biofuels for the transport sector using microwave pyrolysis processes from biomasses, including various industrial biogenic sewage sludge. In the framework of this project, a sewage sludge residue from the agar-agar industry has been used and subjected to conventional pyrolysis, which will later be compared with microwave pyrolysis. The impact of conventional pyrolysis temperature was examined as a critical variable to optimise biochar, bio-oil and gas yields. It has been observed that at low pyrolysis temperature the bio-oil yield is optimised. All processes have been demonstrated to produce a high level of biochar, with the maximum yield (47%) being achieved at the lowest temperature (450°C)

ACKNOWLEDGMENTS

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or CINEA. Neither the European Union nor the granting authority can be held responsible for them.

The work described in this publication was subsidised by Horizon Europe (HORIZON) framework through the Grant Agreement Number 101144144. Additionally, the authors thank the Agar-Agar industry for providing the industrial macroalgae sludge used in this work.

Funded by the European Union