Bio-based Industries Consortium

BIO-BASED INDUSTRIES Public-Private Partnership

Funded by the European Union

D4.1 Report on biorefinery approach based on sample composition

Macro Cascade -Project

H2020-BBI-PPP-2015-1

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Deliverable D4.1

Work package 4

Version: Re-submission/21-11-2019

Project number: 720755

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Summary

The objective of task 4.1 of workpackage 4 Extraction and Separation is the design of biorefinery approaches for the production of alginate-rich, fucoidan-rich and protein-rich fractions, as well as mannitol, laminarin and polyphenols. Biorefinery schemes were developed based on overall chemical composition of seaweed samples and the technical feasibility was determined.

The composition of *S. latissima* from the Faroe Islands, harvested in May and stored in three different ways (frozen, air dried and ensiled), was determined. Main difference between frozen, air dried and ensiled samples was observed for the mannitol content, which was zero for the ensiled sample, and which had also the lowest total carbohydrate content.

Biorefinery schemes were developed for these fresh, air dried and ensiled seaweed samples based on the chemical composition and properties of the various target compounds. Focus was on water-based, scalable and industrially relevant methods.

For this deliverable, alginate was regarded as main product with classical alginate extraction as benchmark procedure and the other target compounds as co-products. Mannitol and laminarin contents vary within the seasons and can best be extracted from seaweed with high contents of mannitol and laminarin (autumn harvest) and not from ensiled seaweed (no mannitol present) (see also Deliverable report 4.4). Further research within the Macro Cascade project will focus more on the other target compounds fucoidan and protein as main product.

In classical alginate extraction, the first step is acid hydrolysis in order to remove non-alginate material and to convert Ca-alginate to alginic acid. We suggested to do mild extractions prior to alginate extraction for isolation of vulnerable (bioactive) compounds like laminarin, mannitol and fucoidan. The technical feasibility of such a process was described and a processing scheme was designed for the production of alginate, mannitol, laminarin (with high and low degrees of branching), fucoidan, and a protein-rich solid stream from brown seaweed.

The scheme is complex with respect to the large number of unit operations, but it can be considered simple given the absence of multiple recycle streams. A mass balance was derived based on equipment specifications and performance of the operations based on experimental work, literature data and estimations. Mannitol and fucoidan were obtained with high purity, laminarin was obtained at a significant lower purity, which can be improved by adding a purification step, if required. The scheme was technically feasible, but the efficiencies assumed for most of the equipment have to be confirmed experimentally.

DTI's subcontractor ALGIA assisted in discussions on biorefinery options for *Saccharina latissima* and review ed the deliverable report.

6 ACKNOWLEDGEMENT

This deliverable is part of the Macro Cascade project. This project has received funding from the Bio-Based Industries Joint Undertaking under the European Union Horizon 2020 research and innovation programmed under grant agreement No 720755