



SEAMARK DELIVERABLE 6.4: BIOACTIVE PROPERTIES OF SEAWEED-BASED OLIGO AND POLYSACCHARIDES

Public summary of
confidential report

Monica Daubjerg Christensen¹, Eva Nordberg Karlsson¹, Anne S. Meyer², Morten Schiøtt², Olafur Fridjonsson³

Edited by:

Ólafur Friðjónsson, MATÍS, Iceland;
Maya Miltell, SUBMARINER Network
for Blue Growth EEIG, Berlin,
Germany.

Reviewed by:

Urd Grandorf Bak, Ocean Rainforest
Sp/F, KAldbak, Faroe Islands.

Due Date: 30.06.2025

Submission Date: 30.06.2025

Accepted Date: 30.06.2025

Deliverable Reference: D6.4

Work Package / Task:

6 / T6.4 Bioactive analysis

Keywords:

algae, circular economy,
ecosystem services

¹University of Lund, Lund, Sweden, ²Technical University of Denmark, Denmark, ³MATÍS, Iceland.

Primary contact for further information: Eva Karlsson eva.nordberg_karlsson@biotek.lu.se.

Summary:

A comprehensive high-throughput screening was conducted on the brown seaweed laminarin poly- and oligosaccharides produced and purified in WP6-Task 6.1, alginate oligosaccharides produced and purified in WP6 -Task 6.2, and fucoidan poly and oligosaccharides produced and purified in Task 6.4, as well as on the green seaweed ulvan oligosaccharides produced and purified in WP6-Task 6.3, to identify potential immunomodulatory agents which could serve as a commercial pharmaceutical product in near future. This deliverable (D6.5) describes the methodology used to analyse immunomodulatory activity, and the results of the analysis.

An immune response was observed by some derivatives of the three types of brown algae sugars studied in this task. The magnitude of the response was dependent on the size and structure of the saccharides. In some cases, no significant immunomodulating activity was observed, e.g. for the laminarin polysaccharides. In some cases, a response was observed only when treating DCs with the seaweed saccharides and co-culturing with allogeneic CD4+ T-cells, e.g. the laminarin from *Laminaria hyperborea*. Only laminarin oligosaccharide of certain type, size and structure promoted immune response.

When treating DCs with laminarin oligosaccharides, a size-dependent decrease in TNF α secretion by the *L. hyperborea* laminari-oligosaccharide fractions was observed. Reduction of TNF α by oligosaccharides LhF5 (*L. hyperborea*, dp5) and SIF3 (*Saccharina latissima* DP3) indicates anti-inflammatory properties.

When treating DCs with oligosaccharides LhF5 or SIF3 oligo fractions and co-culturing with allogeneic CD4+ T-cells, an indication of, and a marked effect on, Type 1 immune response was observed. The small oligosaccharides fractions (LhF5 and SIF3) might be useful as therapeutics against chronic inflammatory diseases.

Anti-inflammatory effect for the transglycoside product DP11 was observed with the increase of IL-10 secretion following treatment but not DP8, indicating structure function link

Fucoidan and fucoidan oligosaccharides showed size-dependent and dose-dependent effect on IL-12p40 secretion by DCs and subsequent IFN- γ secretion by co-cultured allogeneic T cells.



This project has received funding from the European Union's Horizon Europe research and innovation programme under Grant Agreement No 101060379. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union nor the European Research Executive Agency (REA). Neither the European Union nor REA can be held responsible for them.



Public Summary of Deliverable 6.4: BIOACTIVE PROPERTIES OF SEAWEED-BASED OLIGO AND POLYSACCHARIDES

Ulvan showed a size-dependent significant effect on IL6 and a similar trend was observed for other interleukins (although a lower number of ILs were tested in this case), while a corresponding effect was not shown for the oligosaccharides.

The study of the immune-potential of alginate oligosaccharides revealed that only oligosaccharides digested with AlyRm3 significantly increased DC secretion of IL-6, IL-10 and IL-12p40 as compared to Neg-DCs, without affecting the TNF α secretion. Further, AlyRm3 fully digested oligosaccharides, promoted a Th1 response. The enhanced immunomodulation by AlyRm3 digested alginate oligosaccharides, demonstrated in Task 6.6, indicates potential for therapeutic applications.