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D4.3 Protocol for production of fucoidan-rich fraction

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Deliverable D 4.3

Work package 4

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Summary

This deliverable report D4.3 provides a protocol for the production of a fucoidan-rich fraction from *Saccharina latissima* from the Faroe Islands. The protocol is supported by experimental data and model data described in Deliverable 4.1.

Fucoidan is a polymer whose variation in composition is important to the functionality of the polysaccharide. The structure of fucoidan has been reported to vary according to species, season, location and maturity. Fucoidans are a structurally diverse family of sulphated polysaccharides containing fucose as a major monomer, usually along with other monosaccharides which may include galactose, xylose, arabinose, mannose, glucose or glucuronic acid. Sulphated polysaccharides like fucoidan play a key role in adaptation to osmotic stress. Fucoidans demonstrate a variety of pharmaceutical relevant biological activities. In addition to the versatile pharmaceutical applications of these compounds, their use as a food supplement is under discussion.

It is known from literature that fucoidan can be extracted from seaweed with water or dilute acid. After mild treatment of seaweed biomass these polysaccharides are most likely still intact, and purification can be performed by filtration or precipitation. In this study fucoidan is extracted from *Saccharina latissima* cultivated at the Faroe Islands. Various extraction methods have been investigated to produce fucoidan-rich extracts. Trials have been performed to optimize the process with the final aim to analyse the fucoidan-rich fraction.

Partner WR worked on the extraction of fucoidan from dried *Saccharina latissima* by dilute acid extraction and a microwave-assisted extraction. Several parameters were tested during the extraction process – temperature, pH, extraction time - to evaluate the impact of these parameters on the extraction efficiency. After extraction the material was centrifuged, and the pellet was separated from the supernatant. The soluble carbohydrates in the supernatant were precipitated with ethanol. After centrifugation, both fractions were freeze dried and analysed. High Performance Anion Exchange Chromatography (HPAEC) was used for the quantification of the monosaccharides fucose and glucose originating, respectively, from the polysaccharides fucoidan and laminarin.

Extraction under light acid conditions resulted in very low fucose yields in the liquid fractions (4-6 wt%). The results showed that the largest part of fucoidan remained in the seaweed matrix. The ethanol extractions were very efficient in mannitol extraction (almost 100 wt%) and most likely polyphenol extractions, based on the colour of the liquid fraction. Results showed no clear relation between the parameters investigated – EtOH extraction, time, pH and T - and fucose content in the samples. It is possible that the experimental conditions during dilute acid extraction were not optimal.

Microwave-assisted extraction showed higher yields (50-90 wt% fucose yield). However, the concentrations were still too low to do measurements on structural properties of the fucoidan like molecular weight. It is expected that acid conditions cause degradation of the fucoidan molecule, and that water extractions are

preferred. It was seen that EtOH-extraction as a pretreatment followed by a water treatment at 90 °C may be a good option. Advantage of using a microwave is the short residence time, thereby probably preventing degradation of fucoidan.

Partner LUN worked on the extraction of fucoidan from dried *S. latissima* by dilute acid, alkali and hot water. After extraction the fucoidans were isolated and crude fucoidan was purified by size exclusion chromatography. In this study the dilute alkali conditions resulted in the highest extraction yield of fucose (45 wt%) but the recovery of fucoidan was very low. Dilute acid looked promising, but also hot water extraction resulted in reasonable amount of fucoidan extracted.

Studies described in this report focussed on fucose and fucoidan yields in relation to various experimental conditions. However, most optimal fucoidan extraction conditions must be determined in combination with properties of the resulting fucoidans, with special attention to the biological activity after extraction.

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