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W.J.J. Huijgen
J.W. Dijkstra
A.N.G. Wortel
J.W. van Hal

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Wouter Huijgen^{1,*}, Jan Wilco Dijkstra¹, Andre Wortel¹ & Jaap van Hal¹

¹⁾ Biomass & Energy Efficiency, Energy Research Center of the Netherlands (ECN), Westerduinweg 3, 1755 LE, Petten, Netherlands. E-mails: huijgen@ecn.nl, dijkstra@ecn.nl, wortel@ecn.nl, vanhal@ecn.nl.

^{*)} Corresponding author.

Seaweed biomass is a complementary carbon source to lignocellulosic and micro-algae biomass to produce fuels and chemicals via biorefinery approaches [1]. As seaweed grows off-shore, it neither competes with the food supply nor has other land use issues. Since about $\frac{3}{4}$ of the earth is covered by water and seaweeds grow fast, the potential is large. The main components of seaweeds are specialty carbohydrates (up to ~60wt%), proteins and minerals. Examples of such specialty carbohydrates are mannitol, alginic acid, a valuable thickening and gelling agent, ulvans, which are bioactives, and rhamnose. The nature and contents of seaweed carbohydrates are species, season and location dependent. The proteins can contribute to alleviating the growing need for feed protein, whereas the minerals can be recycled into sustainable fertilizers. Finally, the organic process residues could be digested for energy purposes.

In this presentation we will show the technical viability of the production of biobased chemicals and fuels from members of native (to the North-Sea) brown, red and green seaweeds using species *specific* biorefinery concepts. As an example, the biorefinery of the green macroalgae *Ulva lactuca* will be presented to isolate specialty carbohydrates such as rhamnose as well as conversion of these carbohydrates into furans. Another example is the biorefining of Kelps such as *Laminaria digitata* and *Saccharina lattissima*. From these Kelps we have successfully isolated and purified mannitol, alginate and glucose. Mannitol is used as a sweetener and could, e.g. after conversion isomannide, be applied for various biobased plastics. A coarse techno-economic evaluation of the studied biorefinery concepts will be presented.

A crucial part of the development of economic seaweed biorefinery concepts is seaweed storage. Due to the high seasonal variation of the biochemical composition of seaweed, one would for example preferably harvest seaweeds at the peak sugars. In some cases, this means that the seaweed can only be harvested during a couple of months of the year. We have studied the storability of Kelps and how the storage approach affects the biorefinery by processing fresh and stored seaweed from several different storage concepts.

Finally, new and future developments within the new EU-H2020 MacroFuels project will be briefly discussed.

References:

[1] Hal, J.W. van, Huijgen, W.J.J, López-Contreras, A.M. (2014) Opportunities and challenges for seaweed in the biobased economy, Trends in Biotechnology 32(5), 231-3.

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ECN

Westerduinweg 3
1755 LE Petten
The Netherlands

P.O. Box 1
1755 LG Petten
The Netherlands

T +31 88 515 4949
F +31 88 515 8338
info@ecn.nl
www.ecn.nl

