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SWOT analysis for a further LCCA-based techno-economic feasibility of a biogas system using seaweeds feedstock

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Abstract

The main objective of the concept of sustainability is to meet various demands of burgeoning development and fast growing population in the best possible way while considering economic, social and environment aspects. Sustainable sources such as macroalgae or most commonly seaweeds, should be a subject of further investigations. Production of seaweeds is holding the capacity of different conversion roots and applications, such as human food and animal feed, biochemicals, bio-actives, bioremediation, bioenergy and biofuels, due to availability of various trace elements, minerals, vitamins and other biochemical elements, such as proteins, polysaccharides and less lipids with different application opportunities [1]. Seaweeds are widespread around the globe, however, its production is mainly located in Asian region and just a small share is represented by European countries. Not all the countries which have direct access to the sea practice seaweed cultivation or harvesting, including Latvia. Nevertheless, the results of SWOT analysis show that there are considerable amounts of strengths and opportunities for seaweeds to be potential as a feedstock for biorefinery concept in Latvian context, however there are still significant weaknesses and possible threats that are delaying development of the industry. There is non-estimated potential to cultivate seaweeds in Latvian conditions, therefore the overall preliminary analysis on techno-economic feasibility of seaweed biomass cultivation and its conversion system in Latvian context should be done.

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Keywords: macroalage; seaweeds; seaweed conversion systems; biogas; the Baltic Sea; SWOT analysis; life-cycle cost analysis; LCCA

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1. Introduction

The main objective of the concept of sustainability is to meet demand of burgeoning development and fast growing population for food, feed and energy and other needs in the best possible way while considering economic, social and environment aspects. The sustainable development concept has encouraged debate on looking towards to discover new sources to meet these needs. Oceans, seas and other water bodies have a reserve of such sources, as a result there is a rapidly growing literature and investigations on the potential of incompletely utilized aquaculture sources, largely macroalgae or most commonly seaweeds. Under the common name of seaweeds are considered incomputable species of macroscopic, multicellular marine plant-like organisms. Production of seaweeds is holding the capacity of different conversion roots and applications, such as human food and animal feed, biochemicals, bio-actives, bioremediation, bioenergy and biofuels, due to availability of various trace elements, minerals, vitamins and other biochemical elements, such as proteins, polysaccharides and less lipids with different application opportunities [1–3].

Due to huge diversity of total number of species, seaweeds are mainly categorized in higher level grouping based on pigmentation, such as Ochrophyta or brown algae, Rhodophyta or red algae, and Chlorophyta or green algae [4]. The total number of seaweed species is estimated with a degree of uncertainty at between 8,000 and 10,500 [4]. On logical grounds, there is compelling reason to argue that the capacity of seas and oceans in terms of seaweeds is not completely discovered yet.

Seaweed production, namely, cultivation and harvesting from wild stocks, is practiced in many countries and currently is a multi-billion industry [5]. Seaweeds are widespread around the globe at different sea depths. As a result on the whole at least 291 species are used worldwide from 43 countries, including 33 Clorophytes or green algae, 75 Ochrophyta or brown algae and Rhodophytes or red algae species [6]. Remarkable that the number of practiced species takes approximately 3 % share of the total number of seaweeds estimated to the present, which means that use of other seaweed species in the future can request more studies and investigations.

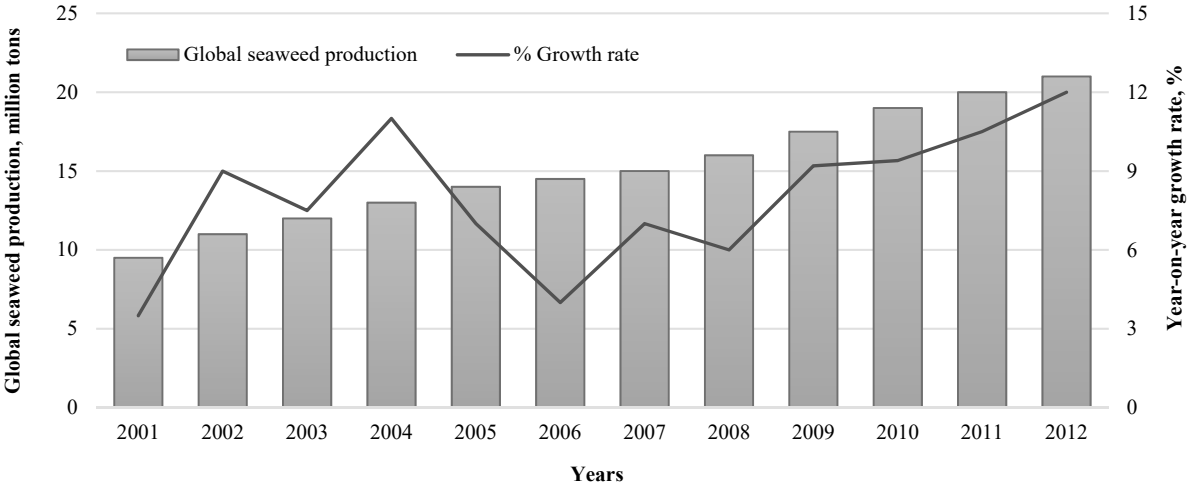

Fig. 1. World seaweed production and growth rate (year-on-year) [5].

Since 2001 the production of seaweeds has been systematically increasing with an average year-on-year growth rate of 8 % [7]. Taking into account production level of 2012 and ongoing growth in the seaweed farming activities, current production of seaweeds worldwide could be estimated more than 25 million t wet weight. However, seaweed production is mainly located in Asian region and just a small share is represented by European countries such as Norway, France, Ireland and Iceland, which are harvesting seaweeds from wild stocks [6]. It should be noted, that not all the countries which have direct access to the sea practice seaweed cultivation or harvesting. Indeed, Latvia is no exception and yet is not using such valuable source for different kind of end-products.