

## **Life cycle assessment in beer industry: Current state and future prospects towards environmental sustainability**

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Food production and processing industries require a variety of resources, including raw materials, energy and water, which is oftentimes depicted in severe environmental effects. Life Cycle Analysis (LCA) is an efficient framework for evaluating the environmental impacts of product systems and decision support, with its main target being the identification of hotspots during the stages of production. Beer can be considered a food product, since it is mainly produced by barley grains, and is among the most popular and widespread products worldwide. In particular, beer production requires a large amount of grains, water, and energy that result in the production of substantial quantities of solid wastes (mainly in the form of spent grains) and wastewater. Consequently, several methods have been applied for the treatment of the aforementioned wastes in order to purify the wastewater and valorize the solid wastes for the production of energy, aiming in recycling them within the industry. The main objective of the present work was to evaluate the total environmental impact of a beer industry (scenario case) that has incorporated appropriate wastewater (aerobic digesters, membrane systems etc.) and solid wastes treatment methods (anaerobic digesters) and compare it to a typical beer industry (base case) via performing LCA. For this purpose, the whole process chain within the beer industry was studied, and data inventory for both cases was performed. LCIA was conducted using Gabi ts, the selected impact assessment method was ReCiPe 2016 (H), and as functional unit, 1 ton of treated barley was selected. According to the obtained results, water recycling and energy valorization of solid wastes for energy production and usage within the beer industry resulted in an improvement in the environmental footprint, contributing towards environmental sustainability.

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