

TECHNOLOGIES FOR HARVESTING MICROALGAE FOR BIODIESEL PRODUCTION: A COMPARATIVE LCA STUDY

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Key Words: life cycle assessment; microalgae cultivation; harvesting technologies; wastewater; CO₂

In recent years, Life Cycle Assessment (LCA) has been used in multiple studies to evaluate the environmental benefits resulting from the production of biofuel from microalgae. Literature in this field shows that one of the main issues associated with biofuel production is energy consumption during the harvest of microalgae algae, largely due to the high yield of dry matter required for the subsequent production of biodiesel. To date, no existing LCAs have specifically focused on assessing alternative approaches to harvest microalgae.

The aim of this paper is to analyze the utilization of emerging and innovative technologies for microalgae harvest, in terms of changing environmental impacts associated with biodiesel production, utilizing a case study in Ontario, Canada.

An LCA model will be developed applied to four different scenarios, based on the use of four alternative harvest technologies. These technologies include (1) APIIm-modified CNC, (2) modified magnetic nanoparticles (MNP), and (3) bacteria for algal separation. An additional scenario (4) will examine a system that avoids dry matter concentration and moves directly from microalgae production straight to lipid extraction. In each scenario, increasing algae harvesting efficiency is examined based on both microalgae species and the harvesting technology adopted, and potential environmental and economic benefits associated with biodiesel production are quantified. The case study in Ontario, Canada, is informed by partnership with industrial partners (a cement company and a water treatment utility) who have provided primary data to the study. The LCAs will be carried out in a fashion designed to allow comparison across all harvest scenarios, using a common model developed in Simapro. Different impact assessment methodologies will also be considered in the analysis, in order to characterize the sensitivity of the obtained results.