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Development of Life Cycle Water Footprints for the Production of Fuels and Chemicals from Algae Biomass

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Abstract

This study develops life cycle water footprints for the production of fuels and chemicals via thermochemical conversion of algae biomass. This study is based on two methods of feedstock production – ponds and photobioreactors (PBRs) – and four conversion pathways – fast pyrolysis, hydrothermal liquefaction (HTL), conventional gasification, and hydrothermal gasification (HTG). The results show the high fresh water requirement for algae production and the necessity to recycle harvested water or use alternative water sources. To produce 1 kg of algae through ponds, 1564 L of water are required. When PBRs are used, only 372 L water are required; however, the energy requirements for PBRs are about 30 times higher than for ponds. From a final product perspective, the pathway based on the gasification of algae biomass was the thermochemical conversion method that required the highest amount of water per MJ produced (mainly due to its low hydrogen yield), followed by fast pyrolysis and HTL. On the other hand,

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