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Environmental Performance Comparison of Two Microalgae Oil Production Routes

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Abstract

Among the various types of biodiesel surveyed, one type is biodiesel produced from biomass of microalgae oil. It has potential to be a promising biomass in the production of biodiesel since microalgae present great accumulation of lipids and fast photosynthetic growth when compared to other vegetable crops. Its production includes four main steps: cultivation of microalgae, biomass separation, oil extraction and transesterification. The present study aims to compare the environmental performance of the extraction step by wet and dry route. It was used the life cycle assessment (LCA) technique for comparative decision-making in case of the practice being adopted on a large production scale. In addition, simulations identified the points of environmental improvement of processes. The scenarios created and the analyses carried out indicated that the most critical point of the dry route is the great amount of electricity involved in step of biomass drying and this must be targeted for optimization. In the wet route, the use of citric acid was shown to be more problematic and is recommended to find alternatives for replacing this substance by another with the same function and lower impact. On both routes, the recovery of the solvent hexane showed environmental benefits and additionally in the wet route, ethanol recovery must occur in order to improve the performance of the process. For decision-making about which route to take, it is evident that the dry route presents major advantages.

Keywords: Life Cycle Assessment (LCA), Microalgae Oil, Biodiesel