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Life Cycle Analysis of Bioethanol Production from Fermentation of Pyrolysis Gas

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ABSTRACT

As the effects of climate change continue to intensify and the need for clean energy sources grows, the production of bioethanol from synthesis gas is presented as a common solution. Synthesis gas is composed of a mixture of gases such as CO, CO_2, H_2, and NOx, which contribute to air pollution, and certain *Clostridium* species can metabolize these gases for bioethanol production. Bioethanol is a highly important biofuel among renewable energy sources due to the advantage of being directly usable when mixed with gasoline. The pyrolysis process offers a significant alternative to the costly pretreatment methods used for utilizing waste and lignocellulosic raw materials in bioethanol production. In this study, the environmental impacts of bioethanol production from pyrolysis gas using pure *Clostridium* culture and mixed species will be compared through a life cycle analysis. The functional unit of the study has been defined as the production of 1 g of bioethanol. The impact categories to be examined in the study are climate change impact (carbon footprint), acidification, eutrophication, and ozone depletion.

Keywords: renewable energy; climate change, carbon footprint; synthesis gas, bioethanol.