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# CARBON FOOTPRINT MITIGATION IN THE MANUFACTURE OF BIODIESEL FROM RECYCLED FRYING OIL USING ETHANOL AS AN ALTERNATIVE

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**Abstract** – Increasing climate change is driving the search for more sustainable strategies to mitigate the environmental impacts associated with the production of biodiesel derived from frying oil. Although the transesterification of frying oil (FA) allows obtaining biodiesel, the inputs used in this process can have a high environmental cost, particularly in terms of Carbon Footprint (CF). The use of ethanol as a reagent in the transesterification of FA appears as a promising alternative, with the potential to significantly influence the Life Cycle Assessment (LCA) of biodiesel and reduce its carbon footprint. In this study, the HC was evaluated for the LCA of the production of 1 kg of biodiesel under two experimental conditions: a 1:6 molar ratio of methanol-AF and a 1:9 ratio of ethanol-AF, using potassium hydroxide (KOH) at 0.35 % as catalyst and the subcritical temperatures of both alcohols to obtain biodiesel in a short time. The methodology included the definition of the LCA according to ISO 14067:2018, the elaboration of a greenhouse gas (GHG) emissions inventory for each stage of the production process and the calculation of the HC using CCaC<sub>2</sub> software. Five key stages in the production of biodiesel from FA were identified. The results showed that the CH of biodiesel produced with methanol is 5.79 kg CO<sub>2eq</sub> per functional unit (FU), while biodiesel obtained with ethanol plus 5 has a CH of 5.35 kg CO<sub>2eq</sub>/UF. This represents an environmental improvement of 7.60 % in favour of ethanol. Thus, it is concluded that the use of ethanol offers superior environmental performance in the LCA of biodiesel made from frying oil.

**Keywords** – Biodiesel; carbon footprint; Life Cycle Assessment; transesterification.

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