

Unraveling the challenges of biodiesel production from waste cooking oil

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Abstract

In 2021, almost 200 countries at the United Nations Climate Change Conference (COP26) recognized the emergency of reducing carbon emissions. A large number of countries are beginning a transition towards a more sustainable world. India, China, EU, Brazil and the United States have formalized their pledges to reach net zero or carbon neutrality between 2030 and 2070 (UNDP, 2022). The increase of biofuels in the energy matrix is one of many strategies to reach this goal (MMA, 2021). In 2020, the use of biodiesel avoided the emission of 18.1 megatons of carbon dioxide gas in Brazil (EPE, 2021). Biodiesel feedstocks cost is approximately 80% of the total costs, and it represents a major challenge to the competitiveness of biodiesel (Yaqoob et al., 2021). In this sense, biodiesel production costs could be reduced by 30-40% by using residual raw materials such as waste cooking oil (WCO) (Hajjari et al., 2017). Currently, waste cooking oil is a food waste that causes pollution through irregular disposal, mainly in water bodies. Furthermore, several hazards are associated with irregular reuse of WCO for food preparation (Zhao et al., 2021). In the current study, a systematic review was conducted following a defined protocol to analyze and discuss the technological and non-technological barriers to the use of WCO as a potential feedstock for biodiesel production. The results of this research show important challenges that need to be overcome. Concerning technological barriers, variables that influence the yield of the conversion process, such as catalyst, alcohol content, reaction time and temperature have a great impact on the decision about the raw material to be used for biodiesel production. Over 70% of the papers highlight the search for improvements in processing technologies or catalysts for improved conversion yield. In terms of non-technological barriers, most of the results pointed towards the importance of government subsidies, incentives and specific regulations in order to promote the use of WCO in the biodiesel industry. Challenges in the collection, transportation and storage stages were also identified as important barriers in the supply chain of WCO. One option cited by the literature is centralising WCO collection that could use the urban collection service. The absence of a structured supply chain, and risks associated with leaks and spills show that the use of WCO for biodiesel production needs a systemic approach. This research suggest that WCO is a promising feedstock and investments in research and development

and in a more robust supply chain could contribute to a major input of waste feedstocks into biofuel production.

Keywords: waste cooking oil, biodiesel, food waste, waste management, circular economy

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