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Production of sustainable aviation fuel precursors using the oleaginous yeast *Rhodotorula toruloides* PYCC 5615 cultivated on eucalyptus bark hydrolysate

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ABSTRACT

Sustainable aviation fuels (SAF) obtained from renewable sources of carbon can reduce carbon dioxide emissions and contribute for mitigating climate changes. In the present study, the yeast *Rhodotorula toruloides* PYCC 5615 was found to be highly promising for the bioconversion of eucalyptus bark hydrolysate and the accumulation of intracellular lipids which were further thermochemically processed to bioenergy intermediaries for SAF production.

Two growth medium formulations were tested. Eucalyptus bark hydrolysate, obtained by steam explosion followed by enzymatic hydrolysis, was supplemented with yeast nitrogen base medium or with corn steep liquor and mineral medium. The latter produced the highest fatty acid content and productivity (30 % w/w and 0.11 g/(L.h) respectively).

Thereafter, the whole yeast biomass (WB) and the de-oiled biomass (DOB), obtained after lipid extraction, were processed into Bio-crude using a hydrothermal liquefaction (HTL) reactor, with a yield of ≈40 % (w/w). The two obtained Bio-crude fractions and the yeast lipids fraction (YL) were further upgraded by hydrodeoxygenation (HDO), to remove oxygen atoms and increase the hydrocarbon content, resulting in a Bio-crude composed of linear long-chain fatty acids suitable for processing to SAF. The best Bio-crude characteristics was observed for WB and YL fractions, with 34.8 % and 40.7 % of hydrocarbons, respectively. Both WB and YL hydrocarbons were composed of C15-C17 compounds. These results demonstrate the potential of an integrated process based on microbial oils from *R. toruloides* PYCC 5615 to produce SAF precursors from Eucalyptus bark residues, contributing for the sustainable jetfuel bioproduction process.

1. Introduction

The European Union wants to accelerate the uptake of renewable energies to reach the goal of reducing net greenhouse gas emissions by at least 55 % by 2030 (https://energy.ec.europa.eu/topics/renewable-energy/renewable-energy-directive-targets-and-rules/renewable-energy-targets_en). Therefore, the search for renewable energy sources and low carbon solutions may contribute to achieve this target.

The electric mobility approach is an effective solution for light-duty road transport decarbonization. However, other hard-to-electrify transportation sectors, such as maritime, off-road vehicles and the aviation sectors, need sustainable aviation fuels (SAF) and synthetic fuels until 2050 to significantly reduce their greenhouse gas (GHG) emissions.

According to the report published by the International Air Transport Association (IATA), in 2022 the aviation industry was responsible for around 2 % of global carbon emissions (https://www.iea.org/energy-system/transport/aviation), its decarbonization being imperative to the zero GHG emissions goal for this sector. Current thermochemical

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