Journal of the Taiwan Institute of Chemical Engineers 79 (2017) 116–124

Contents lists available at ScienceDirect

Journal of the Taiwan Institute of Chemical Engineers

journal homepage: www.elsevier.com/locate/jtice

Recent progress in catalytic conversion of microalgae oil to green hydrocarbon: A review

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ARTICLE INFO

Article history:
Received 24 August 2016
Revised 14 June 2017
Accepted 14 June 2017
Available online 7 August 2017

Keywords:
Biofuel
Microalgae
Lipid content
Green hydrocarbon
Catalytic conversion

ABSTRACT

The increase in greenhouse gas emission due to the burning of fossil fuels since the last century has led to global warming. This has triggered numerous researches in green hydrocarbon alternatives from renewable oil. Microalgae is one of the potential sources of green hydrocarbon, which will reduce the dependency on fossil fuel. This is because microalgae have a high oil or lipid content, rapid growth rate, and high ability to sequester carbon dioxide. Besides that, their cultivation does not require arable land and will, therefore not compete with global food production. The current biofuel production is based on the transesterification of triglyceride to biodiesel which suffered from several drawbacks such as high acidity, high viscosity, and low heating value, *etc.* A more efficient reaction route needs to be developed to produce biofuel which possesses similar properties as the fossil-derived fuel. Therefore, this review aims to encompass the conversion of microalgae oil towards green hydrocarbons *via* various catalytic reactions. The fundamental chemistry and mechanisms involved in the conversion of microalgae oil to useful chemical products are also discussed in detail.

1. Introduction

1.1. Current trend

For the last few decades, energy crisis has threatened the world due to excessive utilisation of the global depleting oil reserves by the ever-increasing human population. According to the United States Environmental Protection Agency (USEPA), 40% of the primary energy is consumed by transportation and contributed 71% of greenhouse gas (GHG) emission in 2010 [1,2]. Currently, fossil fuels supply about 90% of the global energy demand [3]. Apart from the fluctuating petroleum fuel prices, there are more worrying issues associated with the utilisation of these non-renewable fuels including deterioration of health standards and environmental issues [4]. To overcome the increasing demand for a new source of hydrocarbon, for various industrial applications as well as to reduce various environmental problems, researchers are focusing on developing sustainable alternatives. Biofuels have several advantages over fossil fuels, which include sustainability, non-toxicity, biodegradability, and extremely low CO_2 emissions [5]. As shown in Fig. 1, the evolution of biofuel from the first generation by using edible oil crops such as corn, rapeseed, soybean, *etc.* to the fourth generation with the development of engineered microalgae. In the first generation, both biofuels and biodiesel are produced from edible oil crops such as rapeseed, palm, sunflower, soybean, coconut *etc.*

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http://dx.doi.org/10.1016/j.jtice.2017.06.028
1876-1070/