Journal of Oil Palm Research
DOI: https://doi.org/10.21894/jopr.2020.0029

LIFE CYCLE ASSESSMENT FOR PALM OIL REFINING AND FRACTIONATION

CHEE LIANG YUNG*,; VIJAYA SUBRAMANIAM* and SUMIANI YUSOFF‡**

ABSTRACT

A gate-to-gate life cycle assessment (LCA) for production of refined palm products, i.e. *refined, bleached and deodourised (RBD) palm oil, palm olein and palm stearin was performed. Five years inventory data were obtained from six palm oil refineries located in Malaysia – three from Peninsular, two from Sabah and one from Sarawak. The LCA study was conducted using SimaPro software version 8.5 and the impact assessment was performed according to ReCiPe 2016 methodology. Allocation based on economic value was found suitable for the current study,* i.e. *allocating higher environmental burden to the more valuable main products - RBD palm oil from refining process and RBD palm olein from fractionation process. No difference was observed in the environmental impacts between allocation based on mass and energy content due to similar energy content of the products. Bleaching earth, electricity and transportation of crude palm oil (CPO) were identified as hotspots in palm oil refining whereas RBD palm oil was the single major hotspot in fractionation process. Improvement in transportation of CPO can significantly reduce the overall environmental impact, through sourcing of CPO from nearby mills and use of modern Euro 5-compliant trucks as mode of transportation.*

Keywords: fractionation, LCA, palm oil, refining.

Date received: 4 June 2019**; Sent for revision:** 4 June 2019**; Accepted:** 1 August 2019.

INTRODUCTION

Refining of crude palm oil (CPO) is an important process in the palm oil industry. In the refining process, CPO is purified by removal of undesired minor components such as gums, free fatty acids (FFA), heavy metals, colour pigments, *etc*. before it is used in downstream applications be it for edible or non-edible usages. In 2017, the total production of CPO in Malaysia was recorded at 19.92 million tonnes (MPOB, 2018). Of this, 81.2% or 16.18 million tonnes of CPO were processed locally to produce refined palm products either for local use or export (Kushairi *et al*., 2018). Refined, bleached and deodourised (RBD) palm oil is the main product of the refining process whereas palm fatty acid distillate (PFAD) is the by-product. The refineries in Malaysia are also equipped with fractionation process that can fractionate RBD palm oil further into low melting liquid olein and high melting solid stearin. In 2017, 90.9% of the total RBD palm oil produced were fractionated into 10.68 million tonnes of RBD palm olein and 2.87 million tonnes of RBD palm stearin (MPOB, 2018). These refined palm products including PFAD were traded commercially as commodity.

CPO is the feedstock for palm oil refining. It is extracted from the mesocarp of palm fruits at palm oil mills which are typically located near to oil palm plantations (Khairudin *et al*., 2012) and transported to palm oil refineries via road tankers. Palm oil refineries are typically located near to port area to facilitate export of refined palm products. In Malaysia, most of the refined palm products are produced for export market. The total export volume of RBD palm oil, palm olein, palm stearin and PFAD in 2017 was recorded at 11.04 million tonnes (MPOB, 2018).

* Malaysian Palm Oil Board,
6 Persiaran Institusi, Bandar Baru Bangi,
43000 Kajang, Selangor, Malaysia.
E-mail: clyung@mpob.gov.my

** Department of Civil Engineering,
Faculty of Engineering,
Universiti Malaya, 50603 Kuala Lumpur, Malaysia.

‡ Institute of Ocean and Earth Sciences,
C308, Institute of Advanced Studies Building,
Universiti Malaya, 50603 Kuala Lumpur, Malaysia.