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“Development on the margin”

## Life Cycle Analysis of Biochar from Palm Oil empty Fruit Bunches

SONI SISBUDI HARSONO<sup>1</sup>, PHILIPP GRUNDMANN<sup>1</sup>, ANJA HANSEN<sup>1</sup>, IDRIS AZNI<sup>2</sup>, SALLEH MAM<sup>2</sup>,  
TINIA IDATY MOHD GHAZI<sup>2</sup>, HANG LAU LEK<sup>2</sup>

<sup>1</sup>*Leibniz Institute for Agricultural Engineering Postdam-Bornim, Technology Assessment, Germany*

<sup>2</sup>*Universiti Putra Malaysia (UPM), Dept. of Chemical and Environmental Engineering, Malaysia*

### Abstract

One of the main residual products of the palm oil industry is the empty fruit bunch (EFB). For every tonne of oil palm fresh fruit bunch (FFB) that goes to the mills for processing and oil extraction, around 22 to 24% is left over as EFB after steaming and removal of the fruits from the FFB. The EFB is partly incinerated at the mills, contributing to air pollution from palm oil production in Malaysia and Indonesia. In view of this impact, the Malaysian Environmental Air Quality Regulation prompts mills to implement alternative management methods for the disposal of the EFB. In some cases the EFB is spread as organic fertiliser under the tree of palm oil. However, carbon sequestration in soils using biochar from EFB is envisioned as a possible counter measure for mitigating and adapting to climate change, and converting EFB into a valuable product. Biochar is a stable carbon-rich product that results from heating biomass materials. There is a limited research of Life Cycle Analysis (LCA) of biochar from oil palm empty fruit bunch. The objective of this study is to assess energy balances and Global Warming Potential (GWP) of biochar production from EFB and its application in the field. We evaluated biochar production from EFB based on data obtained from a slow pyrolysis pilot plant operated in Malaysia. The products obtained from the slow pyrolysis of EFB are biochar (20%), moisture (50%), syngas (25%) and bio-oil (5%). We used the Life Cycle Analysis (LCA) methodology to trace and analyse the energy balance and GWP of biochar from EFB. The results indicate a positive energy balance of around 25%. The analysis shows that CO<sub>2</sub> emissions, and to a lesser extent also N<sub>2</sub>O and CH<sub>4</sub> emissions, are the main contributors to the global warming potential (GWP) of biochar production from EFB. The results indicate, that the GWP of biochar from EFB is much higher than the GWP discussed in other studies using wood as feedstock. This is mainly due to the intensive use energy (*i.e.* diesel and electricity) for operating the biochar production facility.

**Keywords:** Biochar, empty fruit bunch, global warming potential, greenhouse gas balances, GWP, LCA, oil palm, slow pyrolysis