

# PALM FRUIT FACTORY: KEY SOLUTION TO ACHIEVING ZERO GREENHOUSE GAS EMISSION FROM PALM OIL MILLS

PUAH CHIEW WEI; CHOO YUEN MAY; AUGUSTINE ONG SOON HOCK; RAVIGADEVI SAMBANTHAMURTHI; TAN YEW AI and N RAVI MENON



The conventional palm oil mills produce crude palm oil (CPO), palm kernels and other oil palm biomass such as empty fruit bunches (EFB), fibre, shells and palm oil mill effluent (POME). Biomass such as EFB is used as mulch in the plantation to retain and recycle soil nutrients. In addition, all palm oil mills in Malaysia use fibre and shells as boiler fuel to produce steam for their processing needs and for electricity generation. However, a large amount of liquid biomass in the form of POME is also generated.

The novel oil palm fruit processing plant described here enables the total utilisation of the oil palm fruit to produce palm oil puree, a new palm-based food source. Palm oil puree is suitable as a new energy food source, because it is a balanced nutritional source of essential macro and micro nutrients including carbohydrates, proteins, carotenoids, tocopherols and tocotrienols, vitamins, phenolic acids and polyphenols.

Palm fruit factory involves the conventional harvesting of fresh fruit bunches (FFB) from oil palm plantations with minimal modification at the palm oil mills. Palm fruit factory enables the production of value-added palm oil puree in addition to CPO and palm kernels. The palm fruit factory complies with the health and safety standards for the production of food for human consumption, including the hazard analysis and critical control point (HACCP) certification and methodology.

More importantly, the life cycle assessment study for the production of CPO with palm fruit factory shows a significant reduction, particularly for the climate change impact category (Figure 1). This approach in the production of CPO with methane avoidance at the palm oil mills can enhance the image of palm oil as an environmental friendly product.

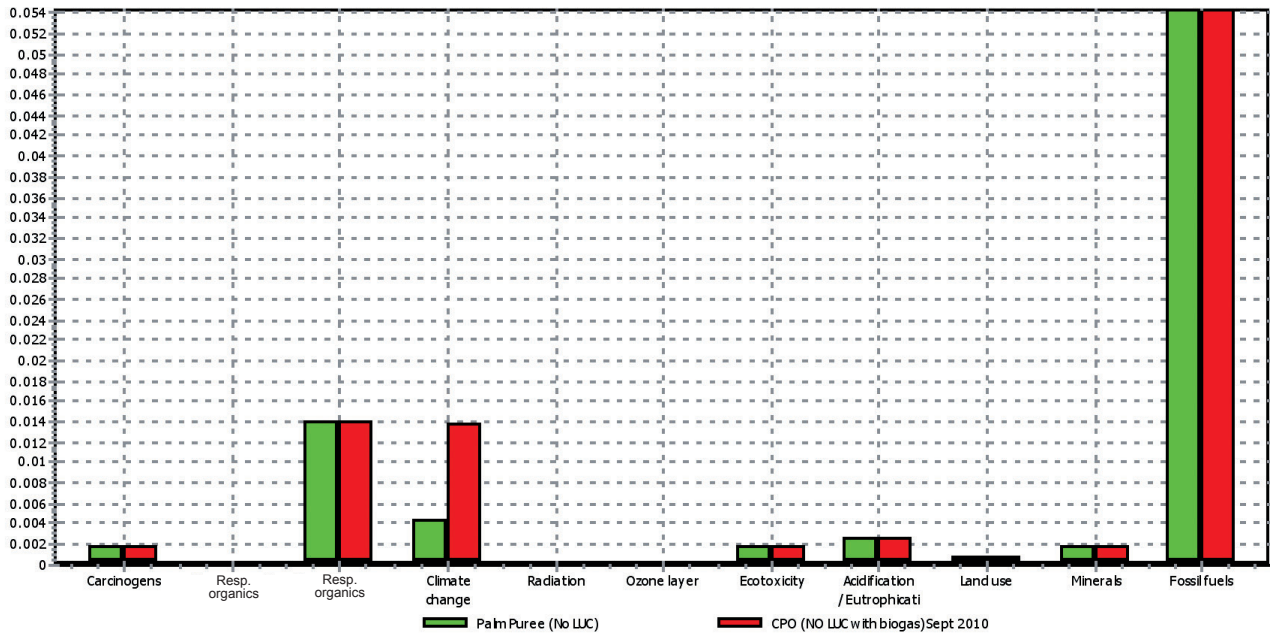


Figure 1. Normalised life cycle impact assessment for the production of 1 t crude palm oil for palm oil puree and biogas capture at palm oil mills.



## BENEFITS

- Achieve zero greenhouse gas (GHG) emission from palm oil mills and contribute to mitigation of climate change and global warming.
- An estimate of 20 million tonnes of GHG reduction from the Malaysian oil palm industry if implemented in all the palm oil mills in Malaysia.

**TABLE 1. NUTRITIONAL VALUE OF PALM OIL PUREE**

Nutrition information	
Energy	400-700 kcal 100 g <sup>-1</sup>
Calories	350-600 kcal 100 g <sup>-1</sup>
Carbohydrate	1.3%-2.8%
Protein	0.6%-2.1%
Ash content	0.5%-1.5%
Moisture content	50%-85%
Fat	40.5%-54.8%
- Monounsaturated fat	18.5%-22.3%
- Polyunsaturated fat	3.5%-5.5%
- Saturated fat	1.5%-3.2%
Carotenoids	26-75 mg 100 g <sup>-1</sup>
Tocols	
- α-tocopherol	10-20 mg 100 g <sup>-1</sup>
- α-tocotrienol	8-15 mg 100 g <sup>-1</sup>
- γ-tocotrienol	30-58 mg 100 g <sup>-1</sup>
- δ-tocotrienol	7-35 mg 100 g <sup>-1</sup>
Vitamin B	ND-10 mg 100 g <sup>-1</sup>
Vitamin C	ND-10 mg 100 g <sup>-1</sup>

Note: ND = not detectable, <0.001 mg 100 g<sup>-1</sup>.

- Compliance with stringent regulatory requirements of <20 ppm biochemical oxygen demand (BOD) of discharge for palm oil mill effluent as there is virtually no discharge.
- Contribute to more than 70% of GHG emission savings and resulting in palm oil biodiesel produced in Malaysia meets the sustainability criteria as stipulated under the European Union Renewable Energy Directive.

Tables 1 and 2 show the nutritional value of palm oil puree and the concentration of polyphenols in terms of gallic acid equivalent, respectively.

**TABLE 2. COMPOSITION OF POLYPHENOLS IN PALM OIL PUREE**

Polyphenols	Composition in terms of gallic acid equivalent (mg kg <sup>-1</sup> )
Dry weight	>30 000
Wet weight	1300-2500

## INTELLECTUAL PROPERTY

Invention: Oil palm fruit processing plant  
Patent applications have been filed as follows:

Country	Application No.
Malaysia	PI20083758
Indonesia	P00200900486
Thailand	0801005188
Colombia	09-102483
Nigeria	NG/C/2009/331
Papua New Guinea	PG/P/2009/00038

For more information, kindly contact:

Director-General  
MPOB  
P. O. Box 10620  
50720 Kuala Lumpur, Malaysia.  
Tel: 03-8769 4400  
Fax: 03-8925 9446  
www.mpob.gov.my