

ZERO WASTE TECHNOLOGY FOR PALM OIL MILLS (POMEDfree)

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Rapid growth of palm oil production in Malaysia in the last few decades has given rise to major environmental issues, particularly the discharge of large quantities of treated waste effluent into the rivers as well as the emission of methane from palm oil mill digestion ponds to the atmosphere. The proposed technology offers a zero waste technology for palm oil mills through effective judicial management of solid and liquid waste produced after the milling process. The technology involves the initial reduction of the effluent production rate from the milling processes followed by its spraying on shredded empty fruit bunches in the presence of thermophilic microbes. The continuous composting aerobic activity will be able to evaporate all the liquid, thus resulting in zero effluent discharge. During the trial, it was found that the nutrient-rich compost was in excellent condition for use as a fertiliser in oil palm plantations.

OBJECTIVE

The POMEDfree technology is a promising technology for palm oil millers to address the concern of effluent discharge from palm oil mills. This technology is developed with the primary objective of eliminating the effluent discharge from palm oil mills.

METHODOLOGY

POMEDfree technology is a waste management system designed to address the negative impact of palm oil mill effluent (POME) discharged into the watercourse. The technology offers a new method for waste management of empty fruit bunches (EFB) and liquid waste effluent by evaporating all the liquid through the composting process combined with a tight control on POME production rate in the mill processing. Compost is the end product, which has valuable nutrients and will be returned to the plantation for field application.

Evaporation of the liquid in the effluent enables the mill to do away the secondary treatment using its usual ponding system and also the tertiary treatment plant (polishing plant), hence no land irrigation or watercourse discharge of the treated effluent is required. Through the complete elimination of effluent discharge from the palm oil mill, this technology can effectively stop potential pollution of rivers. The flow chart of a POMEDfree plant attached to the mill is shown in Figure 1.

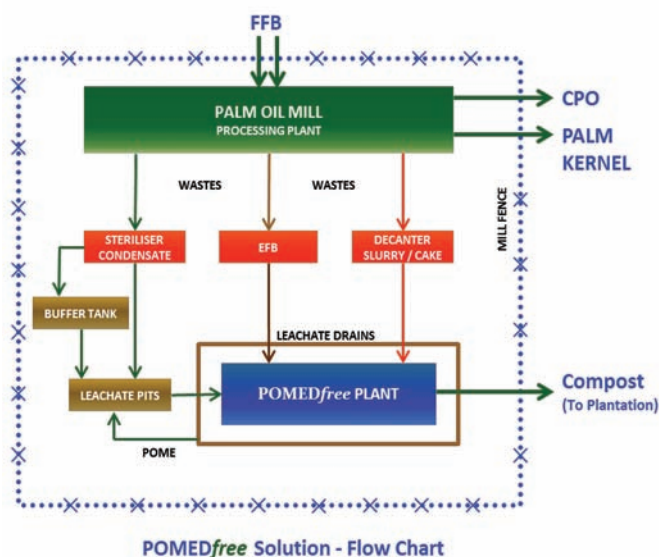


Figure 1. POMEDfree technology process.

This technology uses thermophilic aerobic bacteria, fungi and actinomycetes to achieve a high rate of biological evaporation. With proper selection of process equipment and good system control, POMEDfree is able to evaporate most of the water in the effluent thus eliminates the effluent treatment system and land irrigation. The compost by-product has up to 2.5 times higher nutrients than other partial composting because 100% of the solid and liquid wastes are used back in the composting process.



Figure 2. Raw effluent is sprayed on the heap of the windrow.



Figure 3. The by-product compost is ready for field application.

THE PRODUCT OF POMEDfree™

The six to eight weeks compost from the POMED-free zero waste technology exhibits good nutrient content compared to normal fertiliser composting as shown in Table 1.

TABLE 1. CHEMICAL ANALYSIS POMEDfree COMPOST

Nutrients	POMEDfree compost			
	Dry basis (%)	1 t compost (kg)	Fertiliser cost (RM kg ⁻¹)	1 t compost (RM)
N	2.51	25.10	3.91	98.14
P ₂ O ₅	0.71	7.10	2.03	14.41
K ₂ O	7.49	74.90	2.90	217.21
MgO	1.62	16.20	3.30	53.46
CaO	1.13	11.30	0.87	9.83
Total	13.46	-	-	393.06

BENEFITS TO THE PALM OIL INDUSTRY

- i. No more worries for BOD 20 ppm compliance.
- ii. Allow consideration for palm oil mills to be built in sensitive areas:
 - areas with peat soil.
 - areas close to rivers, aquaculture and villages.
- iii. Savings in mineral fertilisers:
 - savings of up to RM 4 million a year in mineral fertiliser for a 45 t hr⁻¹ mill.
 - with 100% recycling of nutrient from wastes (EFB and POME), the compost produced has up to 2.5 times higher nutrients compared to other partial compost.
- iv. Sustainability:
 - reduction of greenhouse gases.
 - zero pollution to rivers.

ECONOMIC EVALUATIONS

With a total of 270 000 t FFB processed per year for a typical 45 t hr⁻¹ palm oil mill, at an average compost fertiliser price of RM 380 t⁻¹, the compost as a by-product will bring an additional revenue of RM 7.6 million a year. Net savings is about RM 4.8 million a year after deducting the cost of production and application of POMEDfree fertiliser composting project. The payback period is about four to six years.

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