PROCESS OPTIMISATION FOR RAPID COMPOSTING OF OIL PALM BIOMASS

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One of the issues associated with the bio-conversion of oil palm biomass into bio-compost is the long maturation time of composting. Since the palm oil mills operate continuously at least six days a week generating large quantities of biomass and POME, rapid composting is very crucial in order to make composting projects efficient and effective in clearing the accumulated biomass. Rapid composting is largely dependent on the effectiveness of the microbes and optimisation of the composting process. One of the most efficient and promising techniques of centralised composting is using an aerobic composter, incorporating a microwave generator for final stage processing to eliminate microorganisms and other pathogens, and to retain the nutrients in the composter without producing any objectionable foul smell. This is particularly important if we need to export the bio-compost. The composter provides agitation, aeration and mixing of the compost materials, to induce the growth of indigenous microbes under aerobic condition, hence accelerating the composting process. The significant parameters in controlling the composting process are the temperature and the moisture content, which could enhance the effectiveness of mesophilic or thermophilic bacteria to utilise the substrate. The composting time is drastically reduced to two to three weeks subject to the types of waste used without any odour or leachate related problems. Several other successful applications of this system have been proven, for example, on the composting of cattle manure, municipal bio-solids, chicken litter, animal mortalities and food residuals.

THE PROCESS

The optimum condition for enhancing the decomposition of EFB with either POME of decanter cake (*Figure 1*), is at a temperature of 55ºC, air scale at 5 (supplying air) and moisture content of 70%-80%. The compost reactors were turned automatically by rotation twice a week. The product can be collected from the reactor after the third week of the composting process. *Table 1* shows the physico-chemical analysis of the compost based on dry weight basis.

Empty fruit bunch (EFB)

Decanter cake

Palm oil mill effluent (POME)

EFB compost

Figure 1. EFB, decanter cake and POME used as medium for composting.

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TABLE 1. CARBON AND NITROGEN CONTENT OF THE COMPOST FROM EFB BLENDED WITH DECANTER CAKE AND POME AT RATIO 50:50 AFTER THREE WEEKS COMPOSTING

Substrate	C (%)	N (%)	C/N
EFB + Decanter cake	36.68	3.033	12.09
EFB + POME	38.23	1.77	21.6

The addition of readily biodegradable organic matter (decanter cake) into the EFB fibres significantly improved the biodegradability and reduced the C/N ratio <20 as compared to that with fresh POME (*Table 1*). The compost turned into dark colour and was easy to be shredded.

The temperature of the composter was controlled at 55ºC, but due to the rotation and the inlet air, the condition became ambient and this is believed to be suitable for mesophilic composting. The temperature of the inner part of the compost in the composter was found to have increased from ambient to a maximum of 32ºC at Day 15 and decreased until the compost reached maturity at Day 21 (*Figure 2*).

BENEFITS OF THE SYSTEM

- Enhances the redistribution of microorganisms.
- Regulates the temperature of the compost pile;
- Aeration of the pile.
- Speeds up decomposition.
- Allows microbial succession to occur.
- Reduces undesirable fermentation by-products such as methane, noxious gases and toxics.

ECONOMIC FEASIBILITY

The capital investment for a rapid composting system with a capacity of 100 t per day is about RM 30 million (including machine and other costs). On an average of 330 working days per year, 30 t per day of fertiliser is produced. The projected payback period would be less than six years depending on the selling price of the end product.

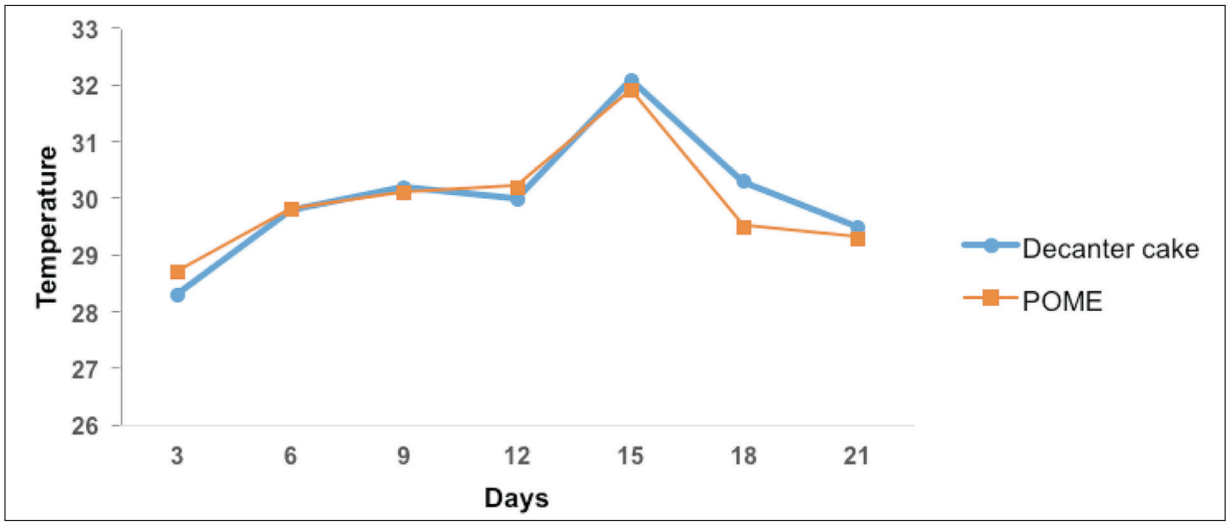

Figure 2. Temperature profile between decanter cake and POME during composting period.

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