BIO ORGANIC FERTILISER

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Bio fertiliser production in the oil palm industry has so far concentrated mainly on the wastes from palm oil mills, but has excluded the refinery waste (namely, spent bleaching earth or SBE, *Figure 1*) discharged by the palm oil refineries (POR). There are now 59 POR, and the generation of SBE has increased to 240 000 t annually. For the past 30 years, SBE has been condemned as an industrial waste due to degradation of the residual oil in it, and the associated greenhouse gas emissions upon its disposal. Thus, there is some urgency to research on and to solve the problem by exploring the possibility of 100% recovery of SBE.

ENVIRONMENT CONCERNS ON SBE

SBE is the by-product from the bleaching earth used in POR for removing colour, phospholipids and residue gums from crude palm oil (CPO). Spillage during the discharge and collection of SBE at POR, and the disposal of SBE including residual deoiled SBE in landfills, are considered environment-unfriendly. Moreover, the cost of SBE disposal amounting to RM 15 million annually is a financial burden to POR.

NOVELTY OF THE INVENTION

A pilot SBE recovery project at Pasir Gudang, Johor has been focusing and concentrating on the recovery and conversion of SBE for potential applications as a total solution to abate the detrimental pollution problems created in its disposal. The efforts thus far enable the recovery of 100% SBE by composting SBE with agricultural by-products, and this has resulted in the development of *TKJ Bio Organic* – a cost-effective and user-friendly bio organic fertiliser (*Figure 2*).

The technology and product were awarded the following at the 22nd International Invention Innovation and Technology Exhibition (ITEX 2011):

i. The 2011 Asia Invention Cup.
ii. ITEX 2011 Best Invention.
iii. ITEX Gold Medal.
iv. Malaysian Innovation Product Award 2011.

CHARACTERISTICS OF *TKJ BIO ORGANIC*

The main characteristics of *TKJ Bio Organic* are its good water-holding capacity and its slow release of water/nutrients once it is mixed and activated with soil. It holds 20 ml of water per 100 g of dried SBE while soil mixed with *TKJ Bio Organic* (50:50) can hold up to 140 ml of water. A C:N ratio of nine fulfills the claim that it contributes to plant nutrition when applied to the soil, and that it is superior to other commercial organic fertilisers (*Table 1*) in terms of biological decomposition of organic residue and bioavailability of C, N and P.

Figure 1. SBE as a refinery and industrial waste – in landfill disposal.

Figure 2. The SBE-based TKJ Bio Organic.

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TABLE 1. COMPARISON OF NUTRIENT LEVELS BETWEEN *TKJ BIO ORGANIC* AND OTHER COMMERCIAL ORGANIC FERTILISERS (A, B, C)

Element	Fertiliser A	Fertiliser B	Fertiliser C	*TKJ Bio Organic*
Nitrogen	2.03	2.14	2.00	2.50
Phosphorus	1.98	1.95	2.00	3.30
Potassium	1.58	2.53	3.00	2.40
Magnesium	-	18.64	2.19	2.00
Calcium	-	24.20	2.00	4.50
Sulphur	-	1.81	0.14	0.50
Zinc	-	0.79	0.01	0.02
Silica	-	16.32	20.00	10.30
Organic matter	-	-	35.00	29.70
C:N ratio	-	-	12	9
pH	-	-	6.3	6.5

PERFORMANCE OF POT AND FIELD TRIALS

Several pot and field trials that have been conducted show that *TKJ Bio Organic* enhances soil fertility, promotes rapid root and plant growth, and improves crop quality while increasing crop productivity and yield (*Tables 2* and *3*).

ADVANTAGES/BENEFITS

The recovery and conversion of refinery waste (SBE) into a value-added quality bio organic fertiliser meets the concept of 'waste to wealth' in providing a total environment solution for POR. The technology and product will benefit both the oil palm industry and the nation's agricultural development plans.

TABLE 2. RESULTS OF A POT TRIAL ON OKRA

	Fresh fruit weight (g)	Dry fruit weight (g)
Control	16.21, 14.75, 16.95, 20.19 Mean: 17.03	1.65, 1.28, 1.38, 1.89 Mean: 1.55
SBE	25.99, 21.42, 28.32, 33.24 Mean: 27.24	2.30, 1.57, 2.02, 2.59 Mean: 2.12

TABLE 3. RESULTS OF A FIELD TRIAL ON GROUNDNUT var. MAGENTA

Parameter per plot (0.5 ha)		SBE-based fertiliser	Standard fertiliser package
Average plant height (cm)		61.3	100.1
No. of pods	1 pod	195	110
	2 pods	351	226
	3 pods	3	2
% of 2 pods		64%	67%
Fresh weight (g)		1201.2	756.2

PROPERTIES OF *TKJ BIO ORGANIC*

Enhancement of soil fertility	√	good
Promotion of rapid plant growth	√	good
Fertiliser application efficiency	√	excellent
Adequate organic content for controlled release of water and nutrients	√	good
Beneficial microbial rejuvenation	√	yes
Crop yield increase	√	> 20%
*Fertiliser cost reduction	√	> 25%

* *TKJ Bio Organic* (N: 2.5, P: 3.3, K: 2.4) used on grass, fruits and vegetables.
Price: RM 888 t^{-1}.

INTELLECTUAL PROPERTY RIGHTS

The intellectual property rights of this invention are jointly owned by MPOB and MPV Technologies (Pasir Gudang) Sdn Bhd.

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