

**EFFECTIVE MICROORGANISMS ON ORGANIC MATTER WITH  
CARBON AND NITROGEN MINERALISATION FOR EMPTY FRUIT  
BUNCHES COMPOSTING**

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COMPOSTING

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Dedicated to my parents, brothers and friends for their love and understanding.

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## ABSTRACT

This project aims to investigate the effect of Effective Microorganisms (EM) on the composting of oil palm empty fruit bunch (EFB) through organic matter degradation with carbon (C) and nitrogen (N) mineralisation by comparing the control sample (CTL) of EFB with no EM treatment and the EM-treated EFB sample (ETC). The maximum C mineralisation for CTL and ETC was recorded as  $671.4 \pm 86.55 \text{ mg CO}_2 \text{ Ckg}^{-1}\text{d}^{-1}$  on day one and  $713.5 \pm 68.5 \text{ mg CO}_2 \text{ Ckg}^{-1}\text{d}^{-1}$  on day two respectively. ETC had C mineralisation remained significantly higher than CTL from day 28 until day 40 before falling on day 41 and became on par with CTL. The total organic matter loss was  $3.75 \pm 1.35\%$  for CTL and  $10.78 \pm 3.77\%$  for ETC. This resulted in a total mineralised C of  $32.97 \pm 2.25\%$  and  $37.7 \pm 2.53\%$  total organic carbon for CTL and ETC, respectively. For N mineralisation, the presence of  $\text{NH}_4^+$  in early stage followed by  $\text{NO}_3^-$  dominance on later stage indicated successful composting. CTL had final value of 0.1 and ETC had 0.04 for  $\text{NH}_4^+/\text{NO}_3^-$  ratio. For curve fitting, first order kinetic model and first order exponential model were chosen as they were showed to better describe mineralization for recalcitrant organic matter by other studies. The first order exponential model showed better fit with p-value of 0.275 as compared to the first order model with p-value of 0.981 in this work. First order kinetic model failed to describe the N mineralisation with a high p-value of 0.989. The unfitness of models could be due to insufficient data over limited experimental time and sampling error for heterogenous materials. This study showed that both CTL and ETC were able to produce mature compost but ETC had better performance on the efficiency of EFB composting based on organic matter degradation, C and N mineralisation coupled with several others parameters (C/N, temperature, pH and microbial profile).

## ABSTRAK

Projek ini bertujuan untuk menyiasat kesan Mikroorganisma Efektif (EM) atas proses pengkomposan sisa tandan kosong buah kelapa sawit (EFB) melalui penggunaan bahan organik dengan pemineralan karbon (C) dan nitrogen (N). Sampel kawalan (CTL) yang tanpa tambahan EM manakala sampel ETC ditambahkan dengan EM. Pemineralan C maksimum adalah  $671.4 \pm 86.55 \text{ mg CO}_2 \text{ C kg}^{-1} \text{ d}^{-1}$  pada hari pertama bagi CTL dan  $713.5 \pm 68 \text{ mg CO}_2 \text{ C kg}^{-1} \text{ d}^{-1}$  pada hari kedua bagi ETC. ETC mempunyai pemineralan C yang lebih tinggi daripada CTL dari hari 28 hingga 40 sebelum ia menurun sehingga setanding dengan CTL pada hari 41. Bagi CTL, jumlah kehilangan bahan organik adalah  $3.75 \pm 1.35\%$  manakala ETC adalah  $10.78 \pm 3.77\%$ . Peratusan jumlah pemineralan C adalah  $32.97 \pm 2.25\%$  dan  $37.7 \pm 2.53\%$  untuk CTL dan ETC masing-masing. Bagi pemineralan N, dominasi  $\text{NH}_4^+$  pada peringkat awal dan  $\text{NO}_3^-$  pada peringkat seterusnya menunjukkan pengkomposan yang berjaya. Nilai terakhir untuk nisbah  $\text{NH}_4^+/\text{NO}_3^-$  adalah 0.1 bagi CTL dan 0.04 bagi ETC. Bagi penyuaian lengkung, model kinetic terbib pertama and model terbib pertama eksponen dipilih kerana pengajian lain telah menunjukkan kesesuaian model bagi mineralasi bahan organik yang tidak mudah dikomposkan. Model eksponen dengan p-value 0.275 adalah lebih baik dari model tertib pertama dengan p-value 0.981. Model kinetic tertib pertama didapati tidak sesuai untuk mineralisasi N dengan p-value rendah 0.989. Ketidaksesuaian model disebabkan oleh data yang tidak mencukupi, masa ujikaji yang terhad dan kesilapan persampelan. Pengajian ini menunjukkan CTL and ETC dapat menghasilkan kompos yang matang tetapi ETC mempunyai prestasi yang lebih baik dalam pereputan bahan organik, pemineralan C dan N bersama-sama dengan parameter lain (C/N, suhu, pH dan profil mikrob).