



UNIVERSITI PUTRA MALAYSIA

***INFLUENCE OF EFFECTIVE MICROORGANISMS (EM) IN THE
COMPOSTING PROCESS OF RICE STRAW***

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COMPOSTING PROCESS OF RICE STRAW**

By

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**Thesis Submitted to the School of Graduates Studies, Universiti Putra
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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of requirements for the degree Master of Science

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Rice (*Oryza sativa*) is a main staple food and also source of carbohydrate in many parts of the world, especially in Asia. In Malaysia, large rice plantation areas are concentrated in west coast mainly in northern area such as Kedah. These large plantation areas yields a large amount of rice straw residue. A major portion of this agricultural waste is disposed by burning or is mulched in rice fields. Serious environmental pollution can occur due to the inappropriate disposal of the waste. In order to add value and to reduce the volume for easier application, composting of rice straw has become increasingly popular. By composting, the properties of the organic matter are easier to handle, more suitable as soil conditioners and organic fertilizer and do not adversely affect the environment. However, composting of rice straw is generally time consuming. Therefore, the application of Effective Microorganisms (EM) to accelerate the maturity and enhance the quality of compost is observed. The objective of this study was to evaluate the effect of EM application on rice straw composting process, nutritional status contents (macro and micronutrients) and also maturity status of the resultant

compost. Composting were conducted using mixed raw materials with the ratios of 50% rice straw + 30% goat manure + 20% green waste (vegetables, fruits peels, etc.). There are two treatments in this study that is compost apply with EM and compost without EM (control) using heap methods and were composted for 90 days. The resultant compost were measured for physiochemical determination and also its maturity index.

All the parameters measured indicate that, there is a decomposition process occurs on both treatments. The parameters for the temperature, EC and pH shows there is decomposition of organic matter occurs during the 90 days period. The decreased in TOC values and C/N ratio also show organic compound is been consumed by microorganisms. Based on the analysis of certain physical, chemical and biological characteristics of compost obtained by composting rice straw with goat manure and green waste by using EM, it can be concluded that the compost, after 30 days, is very mature and stable compare to compost without EM. The t-test conducted shows that there is significance different between compost apply with EM and compost without EM. The application of EM in compost have increased macro and micronutrients content. The following parameters support this conclusion: compost applied with EM have more N, P and K content ($P < 0.05$) compared to compost without EM. While Fe in compost with EM is much more higher ($P < 0.05$) than compost without EM. Whereas for Zn and Cu, there is no significant difference between treatments. All of the micronutrients (heavy metal's) values are below the standard limit of heavy metals in compost.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk Ijazah Master Sains.

**PENGARUH BAKTERIA BAIK (EM) KE ATAS PROSES PENGKOMPOSAN
JERAMI PADI**

Oleh

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Padi (*Oryza sativa*) merupakan makanan ruji utama dan juga sumber karbohidrat di banyak kawasan di dunia, terutamanya di Asia. Di Malaysia, kebanyakan kawasan tanaman padi tertumpu di kawasan pantai barat terutamanya di kawasan utara seperti Kedah. Kawasan tanaman padi yang luas ini akan menghasilkan jumlah jerami padi yang banyak. Sebahagian besar daripada sisa pertanian ini dilupuskan secara pembakaran atau dibiarkan mereput di sawah padi. Pencemaran alam sekitar yang serius boleh berlaku disebabkan oleh pelupusan sisa yang tidak sesuai. Dalam usaha untuk menambah nilai dan bagi mengurangkan jumlah untuk aplikasi yang lebih mudah, pengkomposan jerami padi telah menjadi semakin popular. Melalui pengkomposan, sifat-sifat bahan organik adalah lebih mudah untuk dikendalikan, lebih sesuai sebagai perapi tanah dan baja organik dan juga tidak menjejaskan alam sekitar. Walaubagaimanapun, pengkomposan jerami padi secara amnya mengambil masa yang lama. Oleh itu, aplikasi bakteria baik (EM) untuk mempercepatkan kematangan dan meningkatkan kualiti kompos telah dikaji. Objektif kajian ini adalah untuk menilai kesan

aplikasi EM keatas proses pengkomposan jerami padi, kandungan status nutrien (*makro dan mikronutrien*) dan juga status kematangan daripada kompos yang dihasilkan. Pengkomposan telah dijalankan menggunakan bahan mentah yang dicampur dengan nisbah jerami padi 50% + 30% najis kambing + 20% sisa sayuran (sayuran, kulit buah, dan lain-lain). Terdapat dua olahan dalam kajian ini iaitu kompos dengan aplikasi EM dan kompos tanpa EM (kawalan) menggunakan kaedah timbunan dan dikompos selama 90 hari. Kompos yang terhasil telah diukur sifat-sifat fisiokimia dan juga indeks kematangan.

Semua parameter yang diukur menunjukkan bahawa, terdapat proses penguraian berlaku pada kedua-dua olahan. Parameter suhu, EC dan pH menunjukkan telah berlakunya pereputan bahan organik dalam tempoh 90 hari. Pengurangan nilai TOC dan nisbah C/N juga menunjukkan kandungan organik telah diuraikan oleh bakteria. Berdasarkan analisis ciri-ciri tertentu fizikal, kimia dan biologi kompos yang diperolehi melalui pengkomposan jerami padi dengan najis kambing dan sisa sayuran bersama aplikasi EM, dapat disimpulkan bahawa kompos ini, selepas 30 hari, adalah sangat matang dan stabil berbanding dengan kompos tanpa EM. Ujian-t yang dijalankan menunjukkan bahawa terdapat perbezaan yang ketara antara kompos dengan aplikasi EM dan kompos tanpa EM. Penggunaan EM dalam kompos telah meningkat kandungan makro dan mikronutrien. Parameter berikut menyokong kesimpulan ini: kompos dengan aplikasi EM mempunyai lebih kandungan N, P dan K ($P < 0.05$) berbanding dengan kompos tanpa EM. Manakala Fe di dalam kompos dengan aplikasi EM adalah lebih tinggi ($P < 0.05$) daripada kompos tanpa EM. Manakala bagi Zn dan Cu, tidak terdapat perbezaan

yang ketara antara olahan. Semua nilai mikronutrien (logam berat) adalah di bawah had piawaian logam berat dalam kompos.



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APPROVAL

I certify that an Examination committee has met on 27 April 2012 to conduct the final examination of Mohd Lokman Bin Che Jusoh on his degree thesis entitled “ Influence of Effective Microorganisms (EM) in the Composting Process of Rice Straw” in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and University Pertanian Malaysia (Higher Degree) Regulation 1981. The committee recommended that the student awarded the degree of Master of Science.

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DECLARATION

I declare that the thesis is my original work except for quotation and citation, which have been duly acknowledged. I also declare that this thesis has not been previously, and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or any other institution.

MOHD LOKMAN BIN CHE JUSOH

Date: 27th April 2012

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