WASTE AUDIT AT COCONUT-BASED INDUSTRY AND VERMICOMPOSTING OF DIFFERENT TYPES OF COCONUT WASTE

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ABSTRACT

While the increase in the number of agro-based industries in Malaysia supports economic growth positively, it affects environment negatively by generating large amount of agrowaste. This study aimed to identify and quantify the types of coconut waste generated from selected coconut-based industry and tried to assess the possibility of vermicomposting different types of coconut waste. Therefore, this study evaluated the potential of using *Eudrilus eugeniae* to decompose coconut wastes. Also, waste audit was carried out at Kapar Coconut Industry Sdn. Bhd., where different types of coconut-based products were being processed namely, spray dried coconut milk powder and low fat desiccated coconut. The waste audit focused on selected sites; the paring station, production site, packing site, storage, and administration site. Two main types of wastes were often generated throughout the coconut processing, namely coconut husk (CH) from dehusking process (540kg/week) and coconut shell (CS) from deshelling process (1456kg/week). Since, these two types of coconut wastes are considered as organic waste, bioconversion was suggested to be one of the best alternatives for managing these wastes in a manner that potentially avoid or minimize environmental degradation. Vermicomposting process was conducted for three different types of coconut wastes; coconut husk (CH), spent coconut flake (SCF) and coconut shell. The experiments were prepared with three different ratios (100% waste), Goat manure (GM): waste (30:70) and GM: waste (50:50). The physical and chemical analyses were determined at various stages of vermicomposting process for all three types of coconut wastes. The degradation rate was higher in spent coconut flake than with coconut husk and coconut shell. Spent coconut flake needed only 16 days to be completely degraded, the coconut husk required 50 days for total degradation, while coconut shell decomposition continued

even after 50 days. Weight loss at final stage of vermicomposting process was higher in coconut husk than with spent coconut flake and coconut shell. The final concentrations of heavy metals were lower than US biosolid and EU limit standards in all three types of coconut wastes. The C-to-N ratio declined at final stage of vermicomposting process in all three types of coconut waste and it was within favourable ranges (lower than 20) except the coconut shell. The earthworm's (*Eudrilus eugeniae*) weight increased in all three types of coconut wastes, but the number of worms decreased at final stage of vermicomposting. Therefore, this study concluded that all three types of coconut wastes could be decomposed at different rates and also inferred that this worm (*Eudrilus eugeniae*) is a potential bioagent for faster degradation of coconut waste. Moreover, from the economic point of view, the coconut-based industry could gain more profit from vermicomposting coconut wastes instead of selling the waste out.

ABSTRAK

Peningkatan jumlah industri asas tani semakin meluas di Malaysia sekaligus membantu pertumbuhan yang positif dari segi ekonomi. Namun demikian, ia memberi impak negatif terhadap alam sekitar disebabkan oleh pertambahan jumlah sisa pertanian yang turut meningkat . Kajian ini bertujuan untuk mengenal pasti dan mendapatkan kuantiti jenis-jenis sisa kelapa yang dihasilkan daripada industri terpilih berasaskan kelapa di samping untuk menilai kebarangkalian kajian vermipengkomposan dengan menggunakan jenis-jenis sisa kelapa yang berbeza. Justeru, kajian ini juga bertujuan untuk menilai potensi penggunaan cacing *Eudrilus eugeniae* dalam penguraian sisa kelapa. Selain daripada itu, audit sisa juga telah dijalankan di Kapar Coconut Industri Sdn. Bhd, di mana pelbagai jenis produk berasaskan kelapa diproses di industri tersebut iaitu, serbuk santan kelapa dan kelapa kering rendah lemak. Audit sisa difokuskan kepada bahagian yang terpilih iaitu, tapak pengupasan, tapak pengeluaran, bahagian pembungkusan, penyimpanan, dan pentadbiran. Terdapat dua jenis sisa utama yang terhasil di sepanjang pemprosesan kelapa iaitu,sabut kelapa daripada proses peleraian sabut (540kg/minggu) dan tempurung kelapa daripada proses pengupasan kelapa (1456kg/minggu). Kedua-dua jenis sisa kelapa tersebut dianggap sebagai sisa organik, maka penukaran biologi telah dicadangkan untuk menjadi salah satu alternatif yang terbaik dalam menguruskan sisa ini dan berpotensi untuk mengelakkan atau mengurangkan pencemaran alam sekitar. Proses vermipengkomposan telah dijalankan ke atas tiga jenis sisa kelapa iaitu; sabut kelapa, hampas kelapa dan tempurung kelapa. Sebanyak tiga jenis nisbah yang berbeza dijalankan dalam kajian ini iaitu,nisbah (100% sisa), nisbah tahi kambing:sisa (30:70) dan nisbah tahi kambing:sisa (50:50). Analisis kimia dan fizikal telah ditentukan mengikut setiap peringkat proses

vermipengkomposan yang berbeza daripada ketiga-tiga jenis sisa kelapa tersebut. Kadar degradasi adalah lebih tinggi pada hampas kelapa berbanding dengan sabut kelapa dan tempurung kelapa. Hampas kelapa hanya mengambil masa selama 16 hari untuk didegradasi sepenuhnya, manakala sabut kelapa memerlukan 50 hari untuk didegradasi dan tempurung kelapa mengambil masa lebih daripada 50 hari untuk proses degradasi yang lengkap. Penurunan berat cacing pada peringkat akhir proses vermipengkomposan mencatatkan jumlah yang lebih tinggi pada sabut kelapa berbanding hampas kelapa dan tempurung kelapa. Kepekatan logam berat adalah lebih rendah daripada AS biosolid dan had piawaian EU pada ketiga-tiga jenis sisa kelapa semasa di peringkat akhir kajian. Nisbah C kepada N adalah berkurang pada peringkat akhir proses vermipengkomposan untuk ketiga-tiga jenis sisa kelapa dan ia adalah dalam julat yang memuaskan (lebih rendah daripada 20) kecuali tempurung kelapa. Berat (*Eudrilus eugeniae*) cacing tanah meningkat dalam ketiga-tiga jenis sisa kelapa, namun bilangan cacing menurun pada peringkat akhir vermipengkomposan. Berdasarkan kajian, dapat disimpulkan bahawa ketiga-tiga jenis sisa kelapa boleh diuraikan pada kadar yang berbeza dan cacing (*Eudrilus eugeniae*) adalah merupakan agen biologi yang berpotensi untuk mendegradasikan sisa kelapa dengan segera. Selain itu, dari sudut ekonomi, pihak industri berasaskan kelapa seharusnya tidak menjual sisa kelapa begitu sahaja, sebaliknya lebih banyak keuntungan dapat diperolehi dengan melakukan proses vermipengkomposan sisa kelapa.

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LIST OF ABBREVIATIONS

Kg	Kilogramme
IPCC	Intergovernmental Panel on Climate Change
Cm	Centimeter
Cap	Capita
CH	Coconut husk
SCF	Spent coconut flake
CS	Coconut shell
m	Meter
MYR	Malaysian Ringgit
KC	Kapar coconut industry
GHG	Greenhouse gases
EU	European Union
MSW	Municipal solid waste
VCO	Virgin Coconut Oil
DC	Desiccated coconut
UNEP	United Nation Environmental Programme
UNIDO	United Nation Industry Development Organization
EC	Electrical conductivity
VS	Volatile solids
WTP	Wastewater treatment plant
CMP	Coconut Milk Powder
SC	Shredded Coconut
GM	Goat manure