

ENHANCEMENT OF NITROGEN UPTAKE IN
PALM OIL-BASED COMPOST BY USING
RICE HUSK ASH (RHA) FOR CHINESE
KALE'S GROWTH

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ABSTRAK

Abu sekam padi (RHA), enapcemar efluen kilang kelapa sawit (POME) dan kek decanter (DC) telah banyak dihasilkan dalam industri pengilangan beras dan pengilangan minyak sawit, yang boleh menyumbang kepada pencemaran alam sekitar akibat daripada pengurusan sisa yang tidak cekap. Oleh itu, penggabungan RHA dengan enapcemar POME dan DC, dapat digunakan sebagai bahan tambahan dalam penghasilan kompos untuk memudahkan pengambilan nitrogen (N) oleh tanaman. N adalah salah satu nutrien yang paling diperlukan oleh tumbuhan. Dalam penghasilan baja (kompos organik atau bukan organik), adalah sangat penting untuk memastikan tahap N yang mencukupi untuk pertumbuhan tanaman. Penyelidikan ini bertujuan untuk menyiasat komposisi RHA terbaik dalam pengeluaran kompos berasaskan minyak sawit melalui analisis sifat fizikokimia dan untuk menilai kesan kompos terbaik yang dirumuskan dalam pengambilan nitrogen dan pertumbuhan kailan Cina melalui pendekatan ujian lapangan. Dalam kajian ini, kompos dihasilkan menggunakan enapcemar POME, DC dan RHA, di mana komposisi RHA divariasikan dalam lingkungan 0% (wt/wt) hingga 30% (wt/wt). Nisbah berat enapcemar POME ke DC dikekalkan pada 1:1 (wt/wt). Bahan mentah dan kompos matang dianalisis berdasarkan sifat fizikokimia (pH, kandungan kelembapan, kapasiti penahan air, makronutrien dan mikronutrien). Instrumen Wavelength Dispersive X-ray Fluorescence (WDXRF), CHNOS Elemental Analyzer dan kaedah Micro-Kjeldahl digunakan untuk menganalisis kandungan nutrien kompos. Untuk tujuan analisis data, data eksperimen dianalisis menggunakan perisian Design Expert melalui analisis Satu-Faktor-Pada-Satu-Masa (OFAT) di mana Analisis Varians (ANOVA) telah dilakukan dan model regresi polynomial telah dibangunkan. Keberkesanan komposisi RHA terbaik yang dipilih dari prosedur analisis data disahkan melalui kajian ujian lapangan dan dibandingkan dengan sampel kawalan. Tanaman *Brassica oleracea* var. *alboglabra* L. (kailan Cina) digunakan dalam ujian lapangan, di mana corak pertumbuhan diperhatikan selama enam minggu. Corak pertumbuhan diperhatikan dari segi purata berat dan pengambilan N oleh tanaman. Pengambilan N dianalisis menggunakan kaedah Micro-Kjeldahl berdasarkan jumlah kandungan N daun. Parameter lain, seperti suhu persekitaran dan kandungan kelembapan medium juga dicatat sepanjang ujian lapangan. Hasilnya dibentangkan dalam grafik siri masa, yang diplot menggunakan perisian MINITAB®18. Berdasarkan hasil sifat fizikokimia kompos matang, RHA10 (10% RHA) dipilih sebagai formulasi kompos yang terbaik antara komposisi yang lain. Berbanding dengan rawatan kawalan, penggunaan rawatan RHA10 pada medium tanaman berjaya meningkatkan pengambilan N oleh kailan Cina kira-kira 19% hingga 31%. Sementara itu, berat purata kailan Cina didapati meningkat kira-kira 13% hingga 53% dengan penggunaan rawatan RHA10 berbanding rawatan kawalan. Kesimpulannya, penambahan 10% RHA ke dalam kompos berasaskan minyak sawit telah terbukti berjaya mengekalkan kandungan N di dalam kompos yang akan diambil oleh tumbuhan untuk pertumbuhan. Hal ini disebabkan oleh sifat silika dalam RHA yang boleh mengikat nutrien dan mencegah daripada kehilangan nutrien dalam media tanaman.

Kata kunci: Abu sekam padi, enapcemar POME, kek decanter, kompos, pengambilan nitrogen

ABSTRACT

Rice husk ash (RHA), palm oil mill effluent (POME) sludge and decanter cake (DC) have been abundantly produced in rice milling and palm oil milling industries, which could contribute to environmental pollution due to their inefficient waste management. Therefore, the incorporation of RHA with POME sludge and DC can be utilized as an additive in compost production to facilitate the nitrogen (N) uptake in plants. N is one of the most required nutrients by plants. In the development of fertilizers (organic or inorganic composts), it is crucial to ensure that the N level is sufficient for plant growth. This research aims to investigate the best RHA composition in the production of a palm oil-based compost through physicochemical properties analyses and to evaluate the effect of best-formulated compost on the nitrogen uptake and growth of Chinese kale plant through a field test approach. In this work, the compost was prepared using POME sludge, DC and RHA, in which the composition of RHA was varied in the range of 0% to 30% (wt/wt). The weight ratio of POME sludge to DC was maintained at 1:1 (wt/wt). The raw materials and matured composts were analyzed based on their physicochemical properties (pH, moisture content, water holding capacity, macronutrients and micronutrients). The Wavelength Dispersive X-ray Fluorescence (WDXRF) instrument, CHNOS Elemental Analyzer and Micro-Kjeldahl method were employed to analyze the nutrient contents of the composts. For data analysis purposes, the experimental data was subjected to statistical analysis by using the Design Expert software through one-factor-at-a-time (OFAT) analysis whereby the Analysis of Variance (ANOVA) was performed and the polynomial regression models were developed. The effectiveness of the best RHA composition selected from the data analysis procedure was validated through a field test and compared with the control sample. *Brassica oleracea* var. *alboglabra* L. (Chinese kale) was utilized in the field test, in which the growth pattern was observed for six weeks. The growth pattern was observed in terms of the plants' average weight and N uptake. The N uptake was analyzed using the Micro-Kjeldahl method based on the leaf's total N content. Other parameters, such as the surrounding temperature and the moisture content of the media were also recorded throughout the field test. The results were presented in time-series graphs, which were plotted using the MINITAB®18 software. Based on the physicochemical properties of the matured compost, RHA10 (10% RHA) was chosen as the best-formulated compost among the other compositions. Compared to the control treatment, the application of RHA10 treatment on the growing medium managed to enhance the N uptake of the Chinese kale plant by approximately 19% to 31%. Meanwhile, the average weight of the Chinese kale plant was found to be enhanced by approximately 13% to 53% with the application of RHA10 treatment compared to the control treatment. In conclusion, the addition of 10% RHA into the palm oil-based compost was proven to maintain the N content inside the compost that will be taken up by the plant for its growth. This is due to the properties of silica in RHA that can bind the nutrients and prevent the loss of nutrients in the growing media.

Keywords: Composting, decanter cake, nitrogen uptake, POME sludge, rice husk ash

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