Review article

Nutrient Dynamic of Vermicompost Tea after Adding Molasses and Oxygen

NATCHAVATTHON KHATTIYAPHUTTHIMET
Department of Soil Sciences and Environment, Faculty of Agriculture, Khon Kaen University, Khon Kaen, Thailand

THAMMARED CHUASAVATHI
Department of Soil Sciences and Environment, Faculty of Agriculture, Khon Kaen University, Khon Kaen, Thailand

CHULEEMAS BOONTHAI IWAI*
Integrated Water Resource Management Research and Development Center in Northeast Thailand, Khon Kaen University, Khon Kaen, Thailand
Email: chuleemas1@gmail.com

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Abstract Nowadays, organic agriculture has become an important activity for control of soil pollution and degradation. The use of organic manures and bio fertilizers are important practices in the field of agriculture. Vermicompost tea is a liquid organic bio fertilizer. Vermicompost tea is composed of plant nutrient, plant hormone and microorganism. However, during storage of the vermicompost tea, its quality could change, hence improving the quality of vermicompost tea is important. The aim of the study was to investigate the changes of quality of vermicompost tea after molasses and oxygen addition. The vermicompost tea used in this study came from the *Eudrilus eugeniae* composting worms, fed with vegetable, soil, cow manure, and ashes of 4:3:2:1 ratio. Experiment design was factorial 4*2 in completely randomized design with three replications. Factor A was different rate of molasses (0%, 0.5%, 2.5% and 5.0%). Factor B was oxygen and non-oxygen. After 3 days, the results showed that there was an interaction of pH, EC, total nitrogen and total phosphate content but no interaction of total potassium content between 2 factors. Nutrient content (total nitrogen, total phosphorus and total potassium) and electrical conductivity (EC) were significantly increased at higher rates of molasses but pH was decreased ($P < 0.01$). The addition of oxygen, pH, EC and total potassium content was increased while total nitrogen and total phosphorus were decreased. Therefore, the quality improvement of vermicompost-tea can be achieved by adding molasses.

Keywords vermicompost tea quality, molasses, oxygen

INTRODUCTION

Organic Agriculture is agricultural production management system that sustains the ecosystems, health of soil and people. This system uses organic substance (e.g., compost. vermicompost, vermicompost tea) and avoids the used synthetic materials or plants, animals or microorganisms derived from genetic modification (National Bureau of Agricultural Commodity and Food Standards Ministry of Agriculture and Cooperatives, 2009). These synthetic chemicals are fertilizers, pesticides, hormones, antibiotics, etc. In addition, organic agriculture provides high yielding soil, rich in nutrients and non-toxic together with low production cost. Vermicompost tea is liquid biofertilizer from vemicomposting. It is also rich in the macro and micronutrients and growth regulators (e.g., indole acetic acid, gibberellins, and cytokinins) (Arancon et al., 2005) and can also be useful as a foliar spray (Edward et al., 2010). Scientists found that there was an abundance of microorganisms which promoted plant growth and yield. Humic acid in

Vermicompost tea can improve quality of soil (Atiyeh, 2001). However, during storage of the vermicompost tea, quality can be changed, hence improving the quality of vermicompost tea is interesting. The aim of study was to investigate the quality changes of vermicompost tea after molasses and oxygen addition.

METHODOLOGY

Vermicompost-tea

The study was conducted at the Center for Learning and Development of Earthworms for Agriculture and Environment, Faculty of Agriculture, Khon Kaen University. The vermicompost tea used in this study came from the *Eudrilus eugeniae* composting worms, fed with vegetable, soil, cow manure and ashes at 4:3:2:1 ratio used with vermicompost tea storaged for 6 months

Experiment Design

The pot experiment was conducted under greenhouse conditions. A factorial treatments in 4 x 2 completely randomized design was installed. Factor A was added at 0%, 0.5%. 2.5% and 5.0% rate of molasses. Factor B was adding oxygen and non-oxygen on 3 days.

Analysis of Chemical Properties

The study of some chemical properties was carried out in the laboratory at the Central Laboratory (Thailand) Co. Ltd. The pH was measured using a pH meter, electrical conductivity (EC) by using an electrical conductivity meter, total of nitrogen (total N) by using the Kjeldahl method, total phosphorus (total P_2O_5) by using the spectrophotometric molybdovanadophosphate method, total of potassium (total K_2O) by using the flame photometric method.

Statistical Analysis

Analysis of variance (ANOVA) was done on the data using Statistix 10 program. Treatment means were compared by applying Least Significant Difference (LSD) and the significant difference was accepted at $P \leq 0.05$.

Table 1 Chemical characteristics of molasses

Parameter	Results
H (1:2)	5.1
EC (1:10)	6.63 mS/cm
Total nitrogen	0.3361%
Total phosphorus (T-P_2O_5)	0.133%
Total potassium (T-K_2O)	1.563%

RESULTS AND DISCUSSION

The chemical results of vermicompost-tea after adding different rates of molasses (0%, 0.5%, 2.5% and 5.0%) and oxygen are shown in Table 2.

Acidity and Alkalinity (pH)

There were significantly different values of pH after adding molasses and oxygen ($p \leq 0.01$) and it had interaction between ratio of molasses and oxygen ($p \leq 0.01$). The pH value decreased after

adding molasses. It may be due to acidity of molasses but the pH value increased after adding oxygen, possible due to higher amounts of alkalinity.

Table 2 Chemical properties of vermicompost-tea after adding molasses and oxygen

Treatment	pH	EC (mS/cm)	T-N (%)	T-P_2O_5 (%)	T-K_2O (%)
Vermi- tea	8.27 a	11.28 ef	0.0212 d	0.0006 e	0.284 f
Vermi-tea + 0.5%Molasses	7.33 b	10.58 f	0.0073 e	0.0026 b	0.286 f
Vermi-tea + 2.5%Molasses	5.53 d	12.62 cd	0.0243 c	0.0038 a	0.315 e
Vermi-tea + 5.0 %Molasses	5.67 d	13.72 ab	0.0772 a	0.0043 a	0.382 b
Vermi-tea + Oxygen	8.07 a	13.09 bc	0.0197 d	0.0012 de	0.346 cd
Vermi-tea + 0.5%Molasses + Oxygen	7.33 b	11.94 de	0.0197 d	0.0022 b	0.330 de
Vermi-tea + 2.5%Molasses + Oxygen	6.67 c	12.01 de	0.0221 cd	0.0016 cd	0.362 c
Vermi-tea + 5.0 %Molasses + Oxygen	6.43 c	14.43 a	0.0461 b	0.0044 a	0.428 a
Main Factor : A					
Vermi- tea	8.17 a	12.19 b	0.0204 c	0.0009 c	0.315 c
Vermi-tea + 0.5%Molasses	7.33 b	11.26 c	0.0135 d	0.0024 b	0.308 c
Vermi-tea + 2.5%Molasses	6.10 c	12.32 b	0.0232 b	0.0027 b	0.339 b
Vermi-tea + 5.0 %Molasses	6.05 c	14.07 a	0.0616 a	0.0044 a	0.405 a
Main Factor: B					
Non oxygen	6.70 b	12.05 b	0.0325 a	0.0028 a	0.317 b
Oxygen	7.13 a	12.87 a	0.0269 b	0.0024 b	0.367 a
A x B	**	**	**	**	ns
A	**	**	**	**	**
B	**	**	**	**	**
%CV	3.38	3.82	5.04	15.30	3.11

*ns = non significantly difference, ** Significant correlation at 0.01 level, * Significant correlation at 0.05 level*
Means within the row and column followed by the same letter were not significantly different at $p \leq 0.05$ by the Least Significant Difference (LSD)

Electrical Conductivity (EC)

There is significantly different EC after adding molasses and oxygen and it has interaction between ratio of molasses and oxygen ($p \leq 0.01$). The EC values increased after adding molasses and oxygen; this may be due to the amount of increasing microorganisms which was affected by the decomposition of organic matter that resulted in increased ions causing the EC values to rise.

Total of Nitrogen (T-N)

There were significantly different values of T-N after adding molasses, oxygen ($p \leq 0.01$) and it had interaction between the ratio of molasses and oxygen ($p \leq 0.01$). The T-N values increased after adding molasses but decreased after adding oxygen. However, it was bulk matter that increased the T-N values and depended on the amount of molasses.

Total of Phosphorus (T-P_2O_5)

The T-P_2O_5 values provided the same analysis results as the T-N. There were significantly different values of T-P_2O_5 after adding molasses, oxygen ($p \leq 0.01$) and it also had interaction between the ratio of molasses and oxygen ($p \leq 0.01$). The T-P_2O_5 values increased after adding molasses but decreased after adding oxygen. The reduction may be due to the immobilization. The amount of increasing microorganisms in the compost takes up phosphorus in greater quantities for growth.

Total of Potash (T-K_2O)

There were significantly different values of T-K_2O after adding molasses, oxygen ($p \leq 0.01$) and it has no interaction between ratio of molasses and oxygen ($p > 0.05$). The T-K_2O provides an increase as observed for EC, T-N and T-P_2O_5 after adding molasses. The T-K_2O values increased after adding molasses and oxygen. The increase of EC after adding molasses and oxygen due to the amount of microorganism.

CONCLUSION

The study on the influence of molasses and oxygen on the quality of vermicompost tea proved that nutrient content (total nitrogen, total phosphorus and total potassium) and electric conductivity were significantly increased at higher rates of molasses but pH was decreased ($P < 0.01$). On the addition of oxygen, pH, EC and total potassium content were increased while total nitrogen and total phosphorus were decreased. Therefore, the addition of molasses improved the quality of vermicompost tea.

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