UNIVERSITI PUTRA MALAYSIA

EFFECT OF SHAKING PERIOD AND WASTEWATER TYPE ON COMPOST TEA QUALITY

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FSPM 2015 12

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2015

Dedicated to

My Father,

Wan Muhammad Sabri Bin Wan Embong

My Siblings

Wan Nur Najwa , Wan Muhammad Amri, Wan Nur

Nisa

My Friends,

Asrul, Nazrin, Fauzi, Nabila, Ifah, Ainul

ABSTRACT

Inappropriate method used for treating POME, sago waste water and pond water might pollute the environment especially water and soil ecosystem. Thus, utilization of wastewater in compost tea production might reduce environmental problems in relation to wastewater disposal. Thus, this study was conducted to determine the effect of shaking period and wastewater types on compost tea quality. This study consist four treatments and 3 replications. The treatments were extracted for compost tea at two shaking period which were 30 and 60 minutes. The use of POME in compost tea production increased the pH, total N and available K content in compost tea. This was due to high pH, and high amount of N and K content in raw materials used for compost tea production (compost and POME). Shaking period affects the pH, available P, and K, and total N content in compost tea samples. Microbial activity during the extraction process caused the different in all studied parameters. In conclusion, POME is the best wastewater to enhance the pH, total N and available K content in compost tea. However, further study on the effectiveness of compost tea is highly recommended to be done in the near future for the benefits to soil and plant health.

ABSTRAK

Penggunaaan kaedah yang tidak sesuai untuk merawat POME, air sisa buangan kilang sagu dan juga air kolam mungkin boleh mencemarkan alam sekitar terutamanya ekosistem air dan tanah. Oleh sebab itu, penggunaan air buangan dalam menghasilkan kompos ekstrak mungkin boleh mengurangkan masalah alam sekitar yang berkaitan dengan pelupusan air sisa buangan. Oleh itu, kajian ini telah dijalankan bagi menentukan kesan jangkamasa goncangan dan jenis air sisa buangan terhadap kualiti kompos ekstrak. Kajian ini mengandungi empat rawatan dengan tiga replikasi. Rawatan yang digunakan diekstrak larutan komposnya pada dua jangkamasa goncangan iaitu 30 dan 60 minit. Penggunaan POME dalam menghasilkan kompos ekstrak telah meningkatkan pH, jumlah N, dan kandungan K dalam kompos ekstrak yang dihasilkan. Ini disebabkan oleh, kandungan Ph, N dan K yang tinggi dalam bahan asas yang digunakan dalam penghasilan kompos ekstrak (kompos dan POME). Jangkamasa goncangan telah menyebabkan pH, P dan K tersedia dan jumlah N didalam sampel kompos ekstrak. Aktiviti mikrob semasa proses pengekstrakkan telah menyebabkan perbezaan di dalam kesemua parameter yang duji dalam kajian ini. Secara kesimpulannya, POME adalah merupakan air sisa buangan terbaik dalam meningkatkan Ph, jumlah N dan K tersedia dalam kompos ekstrak. Walaubagaimanapun, kajian seterusnya terhadap keberkesanan kompos ektrak adalah amat dicadangkan untuk dilakukan pada masa hadapan untuk memberi kebaikan kepada kesihatan tanah dan tanaman.

AKNOWLEDGEMENTS

First of all, I would like give my gratitude to the most Merciful, ALLAH for giving me the strength and patience in completing my study. Special thanks to all lecturers, friends and staff of the Department of Crop Science Universiti Putra Malaysia Bintulu Sarawak Campus for their help during my study. This research may not be completed without the help and patience from all of them. I would like to also express my gratitude to my beloved supervisor, Dr. Susilawati Kasim for her support and encouragement, comments, motivation, and for being the inspiration while doing my research. Special thanks to my friends especially, Asrul bin Nadzri, Muhammad Fauzi bin Jipri and Mohamad Nazrin bin Rosli for helping me while doing my laboratory works.

APPROVAL SHEET

I certify this research project report entitled "Effect of Shaking Period on Compost Tea Quality" has been examined and approved as a partial fulfilment of the requirements for the Degree of Bachelor Science Bioindustry in the Faculty of Agriculture and Food Sciences, Universiti Putra Malaysia Bintulu Sarawak Campus.

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CHAPTER 1

INTRODUCTION

Compost tea is a liquid extract of compost that contains plant growth compounds and beneficial microorganisms. Liquid extracts have been used for hundreds of years in agriculture to promote plant and soil health. These extracts have historically been derived from a wide range of plant materials and animal manures, using a variety of processing methods. Compost tea can be used to substitute chemical-based fertilizers, pesticides, and fungicides to sustain environmental quality, as little amount chemical group are applied in an agriculture activities (Diver, 2002). According to Igham (2007) compost tea can increases plant growth, provides nutrients to plants and soil, provides beneficial organisms, helps to suppress diseases and also replaces toxic garden chemicals. Compost tea can be produced by steeping finished compost in water to extract beneficial microorganisms and chemical compounds into solution. They are produce in a variety of ways with or without aeration, and with or without the addition of nutrient sources (Igham, 2007).

Aerated Compost tea is a more recent concept that incorporates aeration technology to create optimum levels of oxygen for growth and reproduction of beneficial aerobic microorganisms. Compost teas are now being produced and used in large-scale agriculture, viticulture, horticulture, nurseries, lawn care, and residential gardens. Aerated compost tea is a "water-based oxygen rich culture containing large populations of beneficial aerobic bacteria, nematodes fungi and protozoa, which can be used to bio remediate toxins. Good compost tea could potentially contain with thousands of beneficial microorganisms where they can be used to bind and break down the range of contaminants (Yeggie, 2011).

Non-Aerated Compost Tea (NCT) is also known as traditional method where "passive" brewing (where no oxygen input is required) was used to produce compost extract. NCT relies on the use of stable compost without sugar additives, under low oxygen level with occasional stirring of the extract. The term anaerobic (no oxygen) has been used to refer to NCT in some recent literature because they contain low numbers (density) of beneficial microbes than that of aerated compost tea. "Beneficial microbe" are those microbes that have been identified as supportive of healthy plants and it is required mostly to sustain crop production in current agriculture practice (Yeggie, 2011).

1.2 Justification

Compost product that are available in the market nowadays is less effective because they contain less nutrient that are required by plant. Thus, compost tea could be used as an alternative because it contain significant amount of nutrient and also microbe. The use of compost tea might reduce the uses of chemical fertilizer, besides reducing amount of waste amount disposed onto the land. High compost tea quality is became the most important criteria in current agriculture practices because it can set as soil fertility booster and pesticide. Thus, the objective of this study was to determine the effect of shaking and wastewater types on compost tea quality.

CHAPTER 2

LITERATURE REVIEW

2.1 Compost Tea

Compost tea is a liquid extract of compost that contains plant growth compounds and beneficial microorganisms. Liquid extracts have been used for hundreds of years in agriculture to promote plant and soil health. These extracts have historically been derived from a wide range of plant materials and animal manures, using a variety of processing methods. Aerated Compost Tea is a more recent concept that incorporates aeration technology to create optimum levels of oxygen for growth and reproduction of beneficial aerobic microorganisms. Compost teas are now being produced and used in large-scale agriculture, viticulture, horticulture, nurseries, lawn care, and residential gardens.

Compost tea is produced by steeping finished compost in water in order to extract beneficial microorganisms and compounds into solution. It is made in a variety of ways, including with or without aeration, and with or without adding supplemental nutrient sources.in certain condition, growing solution was used together with aeration to produce compost tea compost tea recommended to be used immediately after its production. This is to enhance its effect or to maximize the benefit of compost tea. Ideally, the tea will be used within 4-6 hours of decanting from the brewer. Keeping it cool, out of the sunlight and in an open-top container, can prolong the useful life of the tea. Periodic stirring or continued aeration will prolong its life even longer. Eventually, however, the organisms in the compost tea will consume all food and air that are available to them, causing their populations to rapidly decline. Any tea that is left over or "expired" can be added to the compost pile or to the soil. NP Compost tea can be applied to the soil or directly to the plant as a foliar spray. When it is used as a foliar application, it is best to strive through leaf coverage using a fine mist. Foliar applications are best done early morning or pre-dusk to minimize the effects of UV rays. When used as a soil drench, compost tea should be applied so that it moves into the root zone. This can be accomplished by following the tea application with additional water. Use full strength or dilute1:1 (tea to water) for indoor houseplant and garden plants. Drenching a medium size plant requires about 2 cups of tea plus enough water to get the solution down to the roots. Compost tea can be diluted (up to 1:3 tea to water) to cover a larger area like a lawn. When applying to lawns, apply the tea either just before or just after watering. Compost tea is recommended to be applied once or twice a month throughout the growing season (Guardia *et al*., 2010).

Though compost tea contain some nutrients and micronutrients, tea should not be thought of as a fertilizer. Application might diverse soil biological characteristic and promotes more efficient nutrient cycling, which can eventually reduce the amount of fertilizer nutrients required. Compost tea should not be viewed as a fungicide or pesticide either. Research has not shown that compost teas can prevent foliar diseases through foliar sprays in a consistent fashion. Compost tea is more accurately described as a soil or foliar inoculant to be used in combination with other good organic gardening practices and inputs.

2.2 Agriculture Waste

Agricultural waste, which includes both natural (organic) and non-natural wastes, is a general term used to describe waste produced on a farm through various farming activities. These activities can include but are not limited to dairy farming, horticulture, seed growing, livestock breeding, grazing land, market gardens, nursery plots, and even woodlands. Agricultural and food industry residues, refuse and wastes constitute a significant proportion of worldwide agricultural productivity. It has variously been estimated that these wastes can account for over 30% of worldwide agricultural productivity. When agriculture waste was discharged to the environment, agricultural wastes can be both beneficial and detrimental to living matter. They normally affect natural resources such as surface and ground waters, soil and crop , as well as human health (Sarmah 2005).

Farmers are required to dispose of agricultural waste in a good manner likely to cause less pollution to environment and human health. Management of agricultural waste could reduce the effect to human health and environment. Waste could be transformed into valuable product and can be applied back to agriculture site. Inappropriate handling of agriculture waste caused problem such as water pollution. As stated by US Environmental Protection Agency (2012), agriculture waste can potentially contribute significantly on farm revenue. Waste management helps to maintain a healthy environment for farm animals and can reduce the need for commercial fertilizers while providing other beneficial nutrients for crop production.

2.3 Palm Oil Mill Effluent (POME)

POME is one of the agriculture waste that has been produce by oil palm mill activities. Impropriate handling of this waste will cause damage to our ecosystem. POME is one of the wastewater that can be used in making compost tea. This was because POME has a lot of beneficial nutrient that can promote of plant growth and increasing soil fertility (Table 2.3) (Palaniapan, 1993). Beneficial nutrient in POME may also affect soil biological properties.

Table 2.3 Selected nutrient content in POME

Parameter	Average Amount	Range
pH	4.2	3.4-5.2
Oil and grease	4000	10250-43750
Biochemical oxygen demand (BOD)	25000	15.000-100000
Chemical oxygen demand (COD)	51000	11500-79000
Total solids	40000	115000-79000
Suspended solids	18000	5000-54000
Total volatile solids	34000	9000-72000
Phosphorus (P)	35	4-80
Potassium (K)	7500	180-1400
Magnesium (Mg)	180	
Calcium (C)	2270	
Boron (B)	615	
Iron (Fe)	439	
Manganese (Mn)	7.6	
Copper (Cu)	46.5	
Zinc (Zn)	2.0	

*All values are in mg L^{-} except pH
Adopted from: Palaniapan. (1993)

2.4 Sago Wastewater

Sago wastewater can be obtained through extraction process of sago pith (Ramanujam, 1996). It is classified as a very high in organic matter and a non-toxic waste. Sago wastewater normally has foul smelling and acidic in nature (Murthy and Patel, 1961; Sastry and Mohan, 1963). Starch extraction process from sago pith generally requires large quantities of water, thus huge amount of wastewater was released from sago mills. The bulk of the sago wastewater is liquid (94-97%), with 3-6% solid waste called 'hampas'. Sago wastewater can pollute surface water. Lack of visible enforcement from the relevant authorities on effluent disposal resulted in serious contamination of the rivers. Based on study by Phang *et al.* (2000), the wastewater is usually discharged into the rivers at about 10- 22 tons per day from each factory. The waste contains a very high carbon to nitrogen ratio (105:0.12) and it is suitable to be used in anaerobic fermentation in an up-flow packed bed digestor. Sago wastewater had highest crude protein, carbohydrate and lipid content of the biomass at 68, 23 and 11%, respectively. It also had low COD, ammoniacal-N and phosphate levels.

2.5 Seawater

Seawater is a renewable resource that is freely available for use. Seawater has a lot of microbe such as zooplankton that can be activated during the compost tea production. This microbe can be activated when compost tea is produce in aerobic condition (Anderson, 2003). The nutrients found in seawater are essential to the survival of plant and marine life. Typical seawater has a salinity or salts dissolved in the water of approximately 35 parts per thousand. It may have different types of gases, nutrients and substances through decaying of dead plants and animals. Nitrogen is an important part of the ocean ecosystem and it is released into seawater when dead plants begin decomposing and the faeces of marine may directly contribute to the levels of N in seawater. Much likely N and P is a dissolved nutrient found in seawater that is important for plant growth. This was because most dead plant and marine faecal matter falls to the bottom of the ocean, and caused the greatest concentrations of P found near the sea bed. (Castro and Huber, 2008).

Table 2.5 Selected nutrient content of seawater

Parameter	Amount
Chloride	19.345
Sodium	10.752
Magnesium	1.295
Potassium	0.390
Calcium	0.416
Nitrogen	7.52
Phos horus	0.39

Source: Castro and Huber,(2008)
* All the value is based on the average of sea water

2.6 Pond water

A pond is a body of standing water, either natural or man-made, that is usually smaller than a lake. They may arise naturally in floodplains as part of a river system, or they may be somewhat isolated depressions (examples include vernal pools and prairie potholes). Usually they contain shallow water with marsh and aquatic plants and animals. A few animals also make their home in ponds, including both alligators and beavers. A wide variety of man-made bodies of water are classified as ponds. Some ponds are created specifically for habitat restoration, including water treatment. Others, like water gardens water features and koi ponds are designed for aesthetic ornamentation as landscape or architectural features. Fish ponds are designed for commercial fish breeding, and solar ponds designed to store thermal energy (Canadian Council of Ministers of the Environment, 1995).

Standing bodies of water such as puddles, ponds, and lakes are often categorized separately from flowing water courses, such as a brook, creek, stream or river. Nutrient levels and water quality in natural or man-made ponds can be controlled through natural process such as algal growth, or man-made filtration such as an algae scrubber (Alan, 2009).

Ponds can also resulted from a wide range of natural processes. Any depression in the ground which collects and retains a sufficient amount of precipitation can be considered a pond, and such depressions can be formed by a variety of geological and ecological events. Rivers often leave behind ponds in natural flood plains after spring flooding, and these can be very important for fish breeding fish particularly in large river systems like the Amazon. Retreating glaciers can leave behind landscapes filled with small depressions, each developing its own pond. Many areas of landscape contain small depressions which form temporary ponds after spring snow melt, or during rainy seasons; these are called vernal ponds, and may be important sites for amphibian breeding.

Often the entire margin of the pond is fringed by wetland, and these wetlands support the aquatic food web, provide shelter for wildlife, and stabilize the shore of the pond. Some grazing animals like geese and muskrats consume the wetland plants directly as a source of food. In many other cases, the plants fall into the water and decay, then a large number of invertebrates then feed on the decaying plants and these invertebrates provide food for wetland species including fish, dragonflies and herons. A pond may have combinations of three different food webs, one based on larger plants, one based upon decayed plants, and one based upon algae. Hence, ponds often have a large number of different animal species using the wide array of food sources. They therefore provide an important source of biological diversity in landscapes. Vernal ponds are ponds which dry up for part of the year. Natural occurring vernal ponds do not usually have fish. They are called vernal ponds because they are typically at their peak depth in the spring ("vernal" means to do with the spring). The absence of fish is a very important characteristic, since it provides amphibians with breeding locations free from predation by fish. Hence, introducing fish to a pond can have serious detrimental con equence . In some parts of the world, such as California, the vernal ponds have rare and endangered plant species (Alan 2009).

Pond water is also a renewable resources that can be used as a solution in making compost tea. Pond water also has many good microbes that can be activated while used in of making compost tea. Pond water can be found in any pool that produces green water. There have microbes as zooplankton, phytoplankton and various types of microorganism that can be activated during the process of producing compost. It is also a renewable resource. N and P are nutrients that may cause increased growth of aquatic plants and algae. Nitrate-N concentrations above 3 mg/L and any detectable amounts of total P (above 0.025 mg/L for our laboratory) may be indicative of pollution from fertilizers, manures or other nutrient-rich waste that promote eutrophication to occur (Swistock, 2014).

CHAPTER 3

MATERIALS AND METHODS

3.1 Preparation of Compost Tea

Compost was collected from Universiti Putra Malaysia Campus Bintulu Sarawak. Detail characteristic for the material used in making compost tea was showing in Table showing in Table 3.1. Four different type of waste water which is palm oil mill effluent (POME) was collected at Lavang Estate Sime Darby sago waste water collected from sago mill, Mukah, Sarawak, pond water collected from UPMKB hatchery and sea water was collected from Tanjung Batu, Bintulu.

About 130mL of wastewater was added into compost. Afterward, they were shook for 30 and 60 minutes at room temperature. After shaking, the solution (compost tea) was filtered using filter paper before analysed for pH N, P and K. Treatment description was presenting in Table 3.2.

Table 3.1 Selected properties for raw material used in compost tea production

Raw material	Total N (%)	Available P (ppm)	Available K (ppm)
Compost	0.99	6827	1699
POME	0.075	180	2270
Sago Wastewater	0.018	65	15
Seawater	0.062	39	97.3
Pond water	0.002	0.01	

Adopted from: Asrul and Susilawati (2015), Palaniapan (1997) and Swistock (2014)

Table 3.2 List of treatment used in compost tea production

Treatment ID	Treatment Description
T1	Compost + pome
T2	Compost +sago
T3	Compost + seawater
T4	Compost + pond water

3.2 Compost Tea pH

Compost tea pH was analysed using pH meter. The pH were measured directly after shaking. Before measurement, the pH meter was calibrated using two buffer solutions namely pH 4.0 and pH 7.0. The electrode of the pH meter was inserted firstly into a buffer solution of pH 7.0 before rinse using distilled water. Afterward, second buffer solution of pH 4.0 was measured at room temperature. Lastly, compost tea pH was measured using pH meter at room temperature.

3.3 Total Nitrogen (N) Analysis

About 10mL of compost tea was added into distillation flask. Then 10 mL of 40% NaOH was poured into compost tea. They were then distillate for about 5 minutes and the gas produce was trap into 2% boric acid. A 2% boric acid was prepared by weighing 80 g of pure boric acid (H_3BO_3) into 5 L flask before 3500 mL of water was added into it. The boric acid was then heated and swirl until it totally dissolves, they were then allowed to cool at room temperature. Afterwards 80 mL of mixed indicator was added into it (0.099g bromocresolgreen + 0.066 g methyl red in 100 mL of ethanol). Next, 0.1M NaOH was carefully drop into the solution until the solution becomes reddish purple (pH 5.0). The solution was make up to 4 L with distilled. The distillate was titrated against 0.01 M HCI or 0.01 M H_2SO_4 until the colour changed from green to purple. Percentage of N in compost tea was then is calculated using following formula:

%N	[(V-B) x M x R x 14.01] x 100

Where :

V	Volume of 0.01 M HCI or H_2SO_4titrated for the sample (ml)
B	Digested blank titration volume (ml)
M	Molarity of HCI or H_2SO_4 solution
14.01	Atomic weight of N
R	Ratio between total volume of the digest and the digest volume used for distillation

3.4 Total Phosphorus Determination

Compost tea was firstly filtered through Whatman filter paper no.2 into 100mL volumetric flask and make up it to volume. About 667mg of potassium antimony tartrate $KSbO.C_4H_4O_6$ was dissolving in 250mL of distilled water. Then, ascorbic acid was prepared by dissolve it into 80mL of distilled water in 100mL volumetric flask. The standard solution was prepared by weighing 219.4g of KH_2PO_4 They were then placed in 100mL volumetric flask and dissolved using distilled water. This stock solution (50 mg/P) was then diluted by pipetting 20mL into 500mL volumetric flask and diluted until the mark. Then, 2mL was pipetted from the extract into 50mL volumetric flask. The blue colour was develop within 10 minutes and remain stable for several hours. Afterward, stable sample was quantified for their P contact using spectrophotometry. The amount of P was then calculated using following formula:-

Total P	–	UV reading x (v/v) x dilution factor
v/v	–	volume markup / volume sample

3.5 Analysis of Potassium (K)

Direct measurement for K contact was done for all compost tea samples. Before determination was conducted, compost tea sample need to be diluted from 100 to 1000x, depend on the wastewater type used. As example, T1 required 1000x dilution factor because K content in the sample is high. Then the sample was then analysed using atomic absorption spectroscopy (AAS).

CHAPTER 4

RESULTS

4.1 Total Nitrogen Content in Compost Tea Sample

Different trend for total N content was recorded in the compost tea was recorded as different types of wastewater was used to extract total N from mature compost. POME showed the most effective wastewater for total N extraction at 30 minutes shaking period whilst seawater caused highest amount of N at 60 minutes. Pond water and sago wastewater however reduced total N in compost tea as they were used together with mature compost. Each treatment perform differently at different shaking period. T1, T2 and T4 required 30 minutes to enhance N content in compost tea, but for T3, 60 minutes was needed (Figure 4.1).

Table 4.1 Effect of treatment on total N content at 30 and 60 minutes haking period

Treatment	**Waste water type**	**Total**	
		30 min	**60 min**
T1	POME	23.35±0.67[a]	14.35±0.11[c]
T2	Sago Wastewater	18.86±1.64[b]	14.15±0.02[d]
T3	Pond Water	14.01±0.02[d]	18.28±1.21[b]
T4	Seawater	18.68±0.12[c]	18.35±0.15[a]

Different letters within column indicate significant different using DNMRT at $p<0.05$

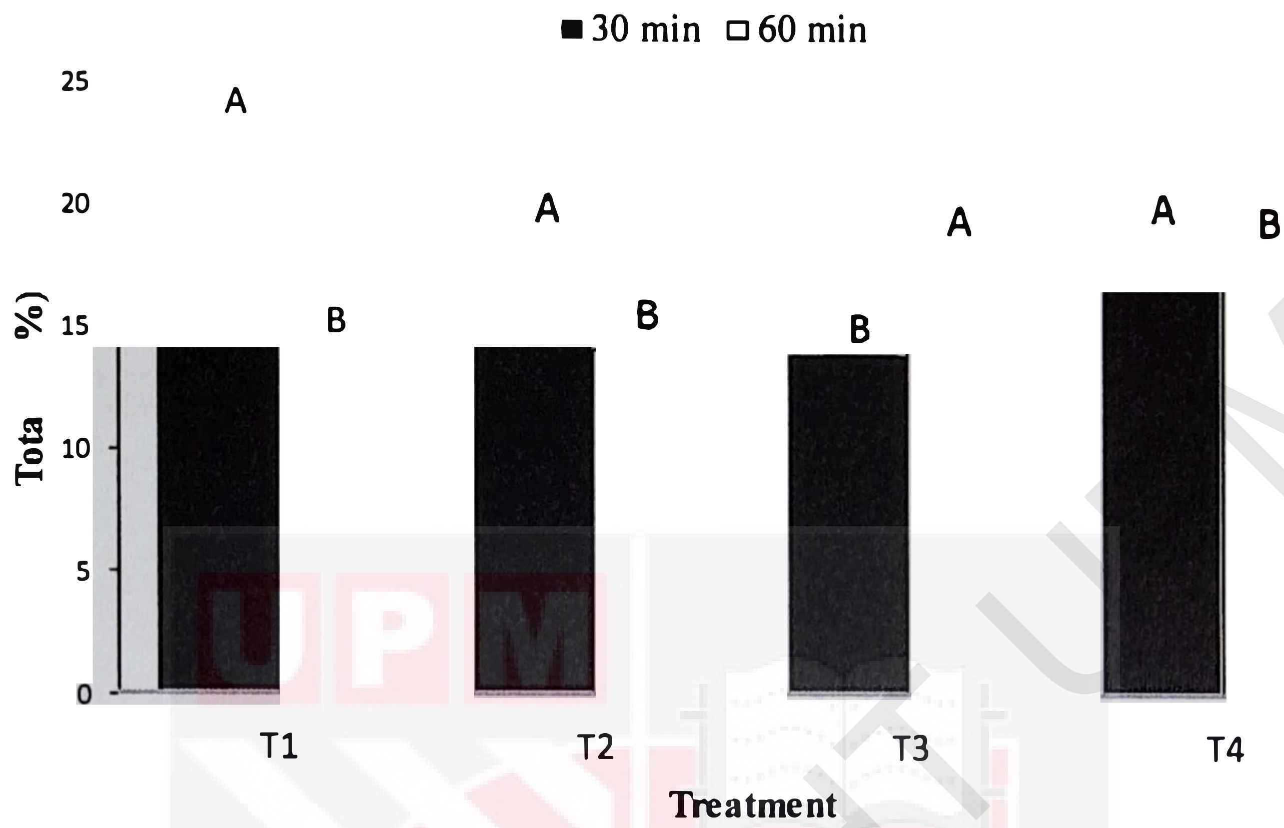

Figure 4.1: Effect of shaking period on total n content in compost tea

4.2 Available Phosphorus Content in Compost Tea Sample

The amount of available P content for T1, T3 and T4 was higher at 60 minutes shaking period than that of 30 minutes. The used of sago wastewater (T2) need about 30 minutes shaking period to enhance available P in compost tea. At 30 minutes shaking period, the highest amount of available P was recorded in T2 (sago wastewater) and the lowest available P was in T4 (seawater). However, at 60 minutes shaking period, the highest available P was recorded for T3 and the lowest was for T2 (Table 4.3).

Table 4.2 Effect of Treatment on Available P Content at 30 And 60 Minutes Shaking Period

Treatment	Wastewater type	Available P (ppm)	
		30 min	60 min
T1	POME	23.13±0.17[c]	55.52±0.17[c]
T2	Sago Wastewater	69.12±0.29[a]	13.62±0.14[d]
T3	Pond Water	28.62±0.027[b]	105.63±0.17[a]
T4	Seawater	19.11±0.46[d]	77.396±0.19[d]

Different letters within column indicate significant different using DNMRT at $p<0.05$

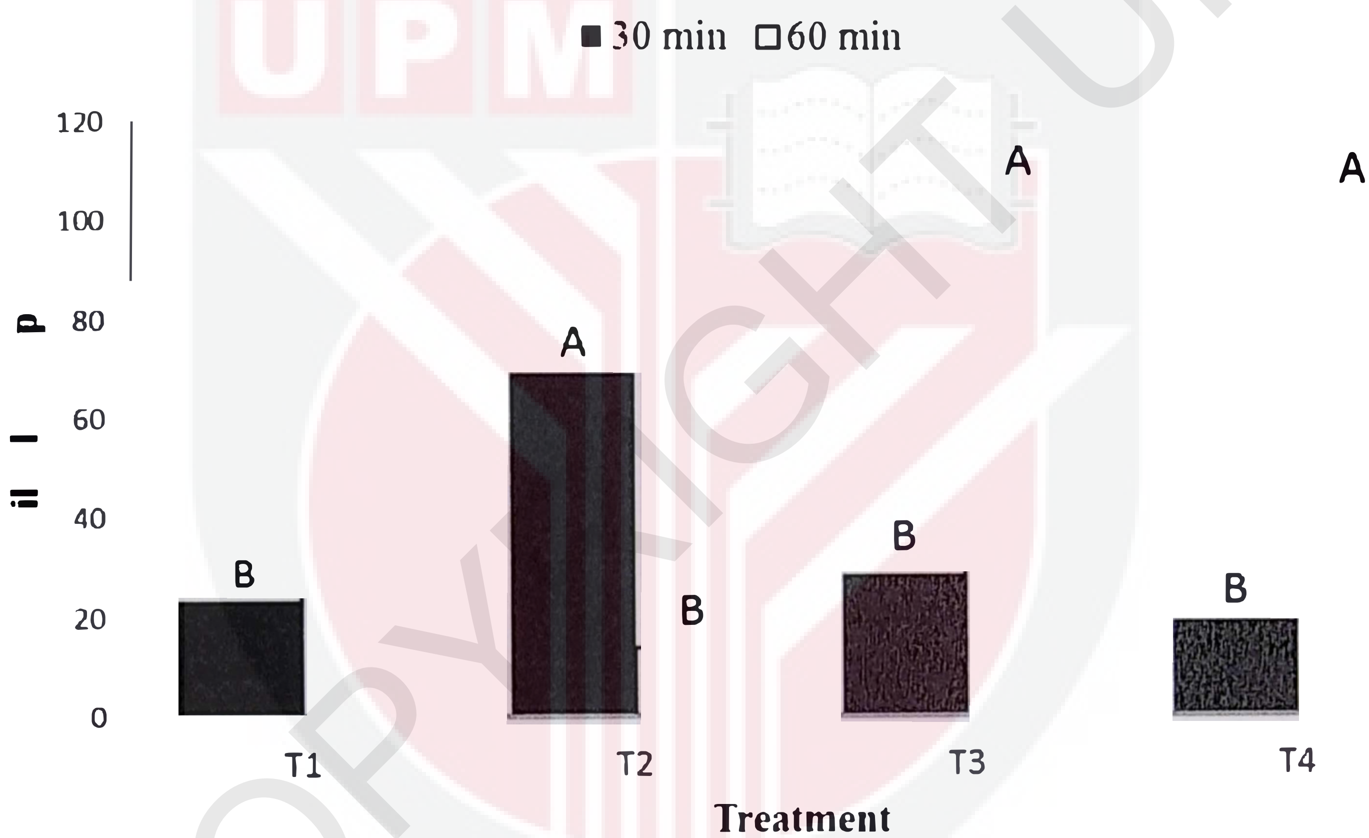

Figure 4.2: Effect of shaking period on available P content in compost tea

4.3 Available K Content in Compost Tea

Available K content for T1 and T2 were increased as the shaking period increased from 30 to 60 minutes. Contrary T3 and T4 showed higher K content at 30 minutes shaking period. This showed that, T3 and T4 required shorter shaking period than that of T1 and

T2. Available K was highest in T1 and lowest in T3. Same trend occurs as 60 minutes shaking period was applied to extract nutrient content from mature compost, the highest amount of available K was recorded in T1 and the lowest was in T3.

Table 4.3 Effect of treatments on available K content at 30 and 60 minutes shaking Period

Treatment	**Waste water type**	**Available K (ppm)**	
		30 min	**60 min**
T1	POME	526±0[a]	551.7±0.88[a]
T2	Sago Wastewater	74.03±0.29[c]	77.53±0.15[c]
T3	Pond Water	63.77±0.027[d]	61.63±0.35[d]
T4	Seawater	97.30±0.46[b]	83.23±0.09[b]

Different letters within column indicate significant different using DNMRT at p<0.05

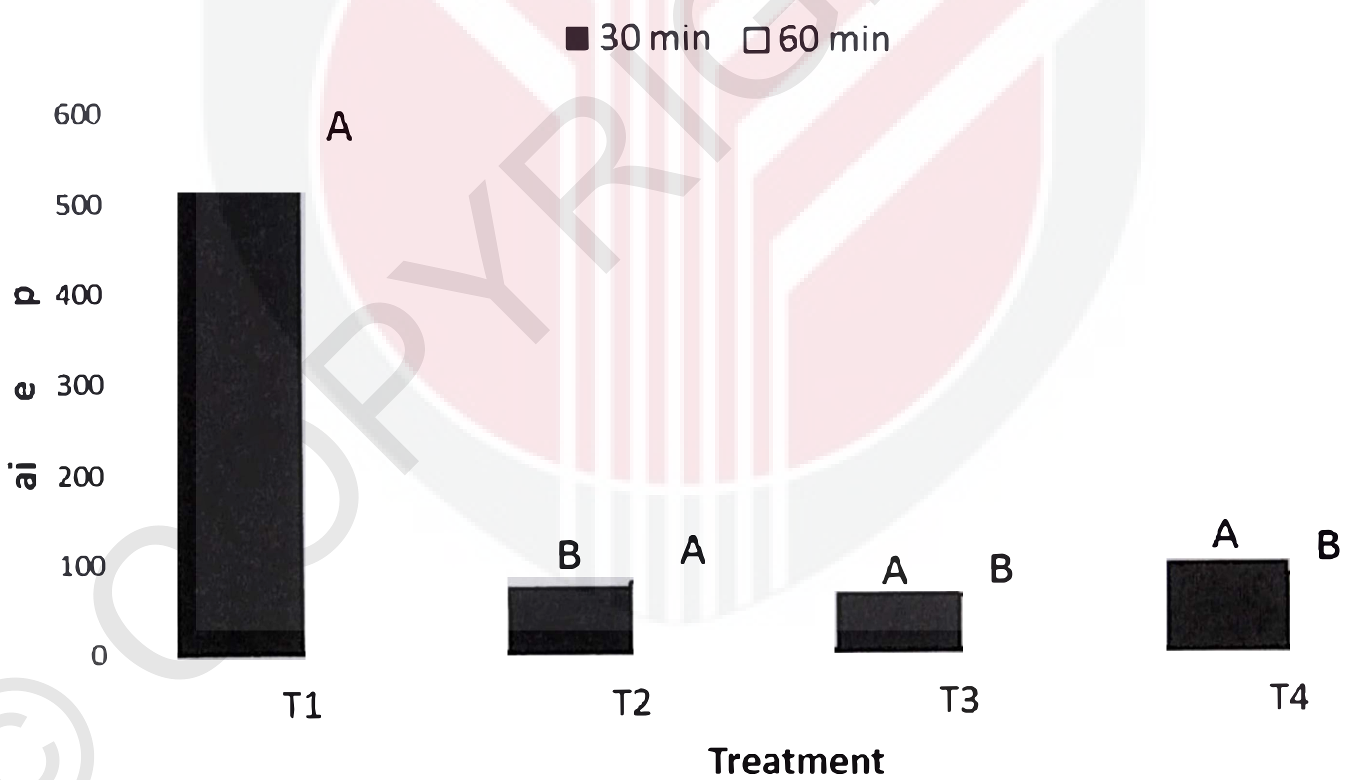

Figure 4.3 Effect of Shaking Period on Available K Content

4.4 Effect of Treatment On compost tea pH

T1, T3 and T4 had higher pH at 60 minutes shaking period. T2 however had higher pH at 30 minutes shaking period (Figure 4.4). Addition of POME caused highest pH at both shaking period. The lowest pH was given by seawater and pond water for 30 and 60 minutes, respectively. Addition of sago wastewater (T2) caused the second highest pH after POME. This shows that, even though POME and sago wastewater are acidic in nature, combination of these water with mature compost increased compost tea pH.

Table 4.4 Effect of treatment on pH at 30 and 60 minutes shaking period

Treatment	**Waste water**	**30 min**	**60 min**
T1	POME	9.26 ± 0.003^{a}	8.98 ± 0.006^{a}
T2	Sago	8.20 ± 0.003^{b}	8.32 ± 0.007^{b}
T3	Pond Water	8.077 ± 0.003^{c}	6.74 ± 0.003^{d}
T4	Sea Water	8.02 ± 0.003^{d}	6.96 ± 0.003^{c}

Different letters within column indicate significant different using DNMRT at $p<0.05$

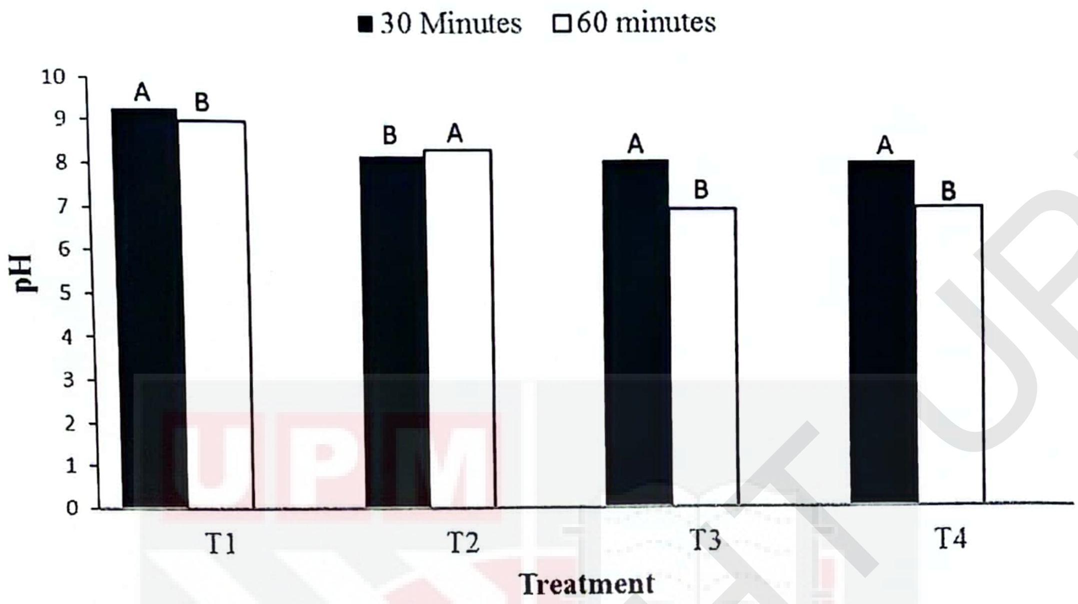

Figure 4.4: Effect of Shaking Period on pH of compost tea

CHAPTER 5

DISCUSSION

High pH was observed for mixture of POME or sago wastewater with mature compost. The pH of compost might be the main reason for this finding. According to Asrul and Susilawati, (2015), mature compost used in this study has the pH of 8.58, this might contribute to wish of compost tea compost tea. Besides microbial activity that use carbon source as their energy might also cause the increase of pH in the solution as stated by Kuhlman (1990).

POME and seawater caused highest N content at 30 and 60 minutes shaking period, respectively. High amount of N in POME might be one of the factor for the highest content at 30 minutes shaking period as stated by Palaniapan, (1993), POME contain about 0.075% of N. Addition of POME into mature compost cau ed high N content. In addition, mature compost, use in this study also contain high N content (Asrul and Susilawati, 2015). This might be the other reason for high content in compost tea. Seawater can enhance N content in compost tea because of the microbial activity. Seawater has a lot of microbes that can inoculate in soil (Alan, 2009). Besides, seawater and sea salt can stimulate plant health by providing some trace nutrient that are usually lacking in the soil. The highest value of available P at 30 minutes shaking period in compost tea was observe in T2 (sago wastewater). High amount of P is due to high P content in mature compost. The increase of pH of the compost tea after they were mixed with sago wastewater could be the reason this finding (Table 3.1). As stated by Schulze

(1964), high pH might activate P dissolution thus, enhanced P availability in the solution. Available K is high when POME was shook for both 30 and 60 minutes shaking period that used to extract solution. This was because POME and mature compost has a high amount of available K inside it (Palaniapan, 1997; Asrul and Susilawati 2015)

CHAPTER 6

CONCLUSION

Shaking period affect the amount of pH, N, P and K content in compost tea. Similarly, different type of wastewater used caused the decreased or increased of pH, N, P and K content. To enhance pH and N content in compost tea, POME is the best wastewater to be use at 30 minutes shaking period. Compost tea can have a very high available P content when pond water was used and at 60 minutes shaking period was applied. Available K content can be enhanced as POME at 60 minutes shaking period was used during compost tea extraction. Finally POME can be classified as the most effective source to increase the pH N and K of compost tea. Further study on effectiveness of compost tea is highly recommended to be done in the near future. This was because high nutrient content in the compost tea might benefits the plant and soil health.

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PUBLICATION OF THE PROJECT UNDERTAKING

This is to certify that I have no objection to publish the project entitled ' effect of shaking period and wastewater type on compost tea quality" by the supervisor in a joint authorship. However, it has to be evaluated by the Faculty of Agriculture and Food Sciences, Universiti Putra Malaysia Bintulu Sarawak Campus and published in the form approved by the Faculty.

Wan Muhammad Aizat Bin Wan MuhammaD Sabri

Date: 10/7/2015