PROCEEDINGS

2nd International Conference on Adaptive and Intelligent Agroindustry (ICAIA)

September 16 - 17, 2013

IPB International Convention Center
Bogor - Indonesia

Organized by:

Department of Agroindustrial Technology

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Indonesian Agroindustry Association

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   (Secretary of Departement of Agroindustrial Technology, IPB)
5. Ono Suparno, Prof.
   (Departement of Agroindustrial Technology, IPB)
6. Agus Buono, Dr.
   (Head of Department of Computer Science, IPB)

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Departement of Agroindustrial Technology, Faculty of Agricultural Engineering and Technology Bogor Agricultural University

George Mason University, Fairfax, Virginia, USA

Indonesian Agroindustry Association (AGRIN)

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WELCOMING ADDRESS

Prof. Dr. Ir. Nastiti Siswi Indrasti
Head of Agroindustrial Technology Department
Faculty of Agricultural Engineering and Technology
Bogor Agricultural University

On

Second International Conference on Adaptive and Intelligence Agroindustry (2nd ICAIA)

Bogor, September, 16 – 17, 2013

Assalamu'alaikum Warohmatullahi Wabarokatuh
In the name of Allah, the beneficent and the merciful,

Distinguish Guest, Ladies and Gentlemen
Let me first thank you all for accepting the invitation to participate in this 2nd International Conference on Adaptive and Intelligence Agroindustry (ICAIA). In particular I would like to thank Rector of IPB (Institut Pertanian Bogor/Bogor Agricultural University) Prof. Herry Suhardiyanto for supporting this event as part of the series academic event in celebrating the 50th Anniversary of Bogor Agricultural University.

In fact, the idea of organizing this conference was the continuation of the International Workshop on Computational Intelligence and Supercomputing Technology for Adaptive Agroindustry held by the Department of Agroindustrial Technology, Bogor Agricultural University last year.

Professor Kenneth A De Jong from George Mason University, US has successfully conducted joint international research with some staff from the Department of Agroindustrial Technology and Department of Computer Science, Bogor Agricultural University. The research aims to develop an integrated and intelligent system (namely SMART-TIN©) for the design of adaptive agroindustrial system in order to achieve a sustainable agroindustry that can mitigate global climate change and at the same time secure food, water, energy and natural medicine supply.

We are certainly proud to have been able to assemble this event in IPB, Bogor. The range of participants and audience at this conference is precisely something I would like to stress. The main goal of the conference is to provide an effective forum for distinguished speakers, academicians, professional and practitioners coming from universities, research institutions, government agencies and industries to share or exchange their ideas, experience and recent progress in Adaptive and Intelligent Agroindustry.

Distinguish Guest, Ladies and Gentlement,
Global climate change is the most challenging problems for us today and in the near future. This global change in our climate can lead to the shortage of the food, water, bioenergy and natural medicine that will affect the quality of human life. Many studies indicate that the threat of food, water, bioenergy and natural medicine crisis due to global climate change still worries our society. This problem can be solved by the development of agroindustry, i.e. an interrelated value chain entities from farming, to agro-processing industry and then to the end-customers. In fact, the design of agroindustry is complex and involves many factors and large data bases and more importantly, needs a good intelligence to process data and information to good decisions. Therefore, the way to design and manage agroindustry should be improved in order to meet the design objectives.

Agroindustries consume quite significant amount of energy on one side, on the other side they generate sizable amount of industrial wastes and its utilization as a captive energy resource is a kind of potential. Based on our study, a plywood industry with the production capacity of 200.000 m^3/year could generate 32 percentage of solid waste. If this amount of waste used as an energy alternative, it may result on the saving of 131.037.768.597 rupiah per month. Similar to plywood industry, sugarcane industry with the production capacity of 480 ton per hour could generate 154 ton per hour of waste (bagasse) and this amount of waste contribute to the saving of energy consuming by 19.250 Kwh. Recent study we conducted, indicated that cassava starch industry may contribute to a significant amount of waste. It has also potential usage as an energy resource. Based on our study the conversion of its waste into energy will contribute to the saving of energy usage of 4100 liter biogas per ton material.

The three industries mentioned is only examples of how potential the role of agroindustrial waste as an alternative resource in replacing the conventional energy resource as its presence will be significantly reduced. The new, incremental energy contributions that can be obtained from waste biomass will depend on future government policies, on the rates of fossils fuel depletion, and on extrinsic and intrinsic economic factors, as well as the availability of specific residues in areas where they can be collected and utilized. All of these factors should be in detail examined to evaluate the development of the industrial waste contribution. Hope this conference will also discuss this issue in more detail as it is an important matter for all of us. We should no more think just how to produce high value product but it is also necessarily important how to keep our live in good quality by understanding following old saying…" only when the last tree has been cut, only when the last fish has been angled, and only when the last river has been polluted, then we realized that we could not eat money".

I do not to take up any more of your time with these opening remarks. Let me simply thank you once again for sharing your thoughts with us. Here's wishing every success for the conference. May Allah bless all of us.

Thank you for your kind attention,
Wassalamu'alaikum Warohmatullahi Wabarokatuh

AGENDA of
2nd International Conference on Adaptive and Intelligent Agroindustry (ICAIA)

Time	Activities	Room
Day 1 (16 September 2013)		
08.00 – 09.00 (60’)	Registration	
09.00 – 10.00 (60’)	Opening Ceremony • Welcoming Address: Prof. NastitiSiswiIndrasti (Head of Dept TIN, Fateta, IPB) • Conference Opening: Prof. HerrySuhardiyanto(Rector of IPB) o ABET Certification announcement and short ceremony o Launching International Double Degree Master Program in Innovation and Technopreneurship in Cooperation with University of Adelaide, Australia o Soft-launching Master in *Logistik Agroindustri* (Agroindustrial Logistics)	Ballroom
10.00 – 10.45 (45’)	Opening Speeches: Prof. IrawadiJamaran (Agroindustry Guru, IPB: 25’) Prof. Eriyatno (Industrial and System Engineering, IPB: 20’)	Ballroom
Session 1		
10.45 – 11.15 (30’)	Keynote Speech Dr. YandraArkeman (IPB)	Ballroom
11.15 – 12.00 (45’)	Keynote Speech Prof. Kenneth De Jong (George Mason University, USA)	Ballroom
12.00 – 13.30 (90’)	Lunch Break	
Session 2		
13.30 – 15.15 (105’)	Moderator: Prof. EndangGumbiraSa’id (IPB) Invited Speakers (1-4) (4 x 20 minutes) Discussion (25 minutes) Tentative Schedule: Prof. Kim Bryceson (Australia), Prof. SyamsulMa’arif (IPB), Prof. KudangBoro Seminar (IPB), Prof. HaruhiroFujita (Japan)	Ballroom
15.15 – 15.45 (30’)	Break	
15.45 – 17.30 (105’)	Moderator: Prof. Marimin (IPB) Invited Speakers (5-8) (4 x 20 minutes) Discussion (25 minutes) Tentative Schedule: Dr. Gajendran (UK), Prof. Noel Lindsay (University of Adelaide), Dr. KuncoroHartoWidodo (UGM), Prof. UtomoSarjonoPutro (ITB)	Ballroom
Day 2 (17 September 2013)		
08.00 – 08.30 (30’)	Registration	
08.30 – 10.15 (105’)	Moderator: Prof. KudangBoro Seminar (IPB) Invited Speakers (9-12) (4 x 20 minutes) Discussion (25 minutes) Prof. Egum (IPB), Prof. Marimin (IPB), Dr. AgusBuono (IPB), Dr. HeruSukoco (IPB)	
10.15 – 10.30 (15’)	Coffee Break	
10.30 – 12.30 (120’)	Parallel Session 1 Moderator: Prof. Fujita (7 paper @ 15 minutes) Discussion (15 minutes) Parallel Session 2 Moderator: Prof. Ono Suparno (7 paper @ 15 minutes) Discussion (15 minutes) Parallel Session Moderator: Prof. Suprihatin (7 paper @ 15 minutes) Discussion (15 minutes)	

12.30 – 13.30 (60’)	Lunch Break	
13.30 – 15.00 (90’)	Open Discussion (Open Forum) with Prof. Kenneth De Jong Topic: Foundations and Applications of Genetic/Evolutionary Algorithms	Ballroom
15.00 – 15.30 (30’)	Conference Closing	Ballroom
15.30 – 17.00 (90’)	Indonesian Agroindustry Association (AGRIN) National Congress (PIC: Prof. Suprihatin)	Ballroom
17.00 – 17.45 (45’)	Refreshment and Closing of AGRIN National Congress	Ballroom

CONTENT LIST

Co-Composting Process Of Bagasse And Sludge From Sugarcane Industry With Influence Of Difference Initial C/N Value And Aeration

Andes Ismayana
Department ot Agroindustrial Technology
Bogor Agricultural University
andesismayana@ymail.com

Nastiti Siswi Indrasti
Department of Agroindustrial Technology
Bogor Agricultural University
nastiti.indrasti@yahoo.co.id

Tori Sane
Department ot Agroindustrial Technology
Bogor Agricultural University
torisane@gmail.com

ABSTRACT

The purpose of this research was to utilize bagasse and sludge of the sugarcane industry through co-composting processes for producing compost and determine the influence of aeration and C/N ratio. In composting process, bagasse and sludge combination were composted at C/N value of 30, 40, and 50 and aeration flow rate were set on 0.4 l/minutes.kg and 1.2 l/minutes.kg. The research was carried out two stages, that was preliminary research to determine the composition of raw materials mixture, and primary research for determining C/N value during composting. Parameters monitored during composting were temperature done every day, pH and C/N determined every week. The result showed that aeration treatment did not give noticeable effect on C/N value and compost with initial C/N value of 30 gave the fastest decomposition process in co-composting stages.
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Keywords:bagasse, sludge, co-composting, C/N ratio, aeration

1. INTRODUCTION

The sugar industry is one of the industries that support the needs of Indonesia society. Most of the sugar industry used sugarcane plants as the main raw material for producing sugar. On production sugarcane industry generated solid waste, such are bagasse, filter cake, boiler ash, and sludge from wastewater treatment.Bagasse is the solid waste from milling station that totaling overflow than others waste. Utilization of bagasse in sugar factories are generally done by directly sending it to the boiler station and the rest have not been handled properly. Sludge is waste resulting from the treatment of wastewater, sludge usually not utilized again. The amount of sludge is expected to continue to rise, along with the growing industry. Sludge processing cost is not a little, about 50 percent of the cost of wastewater treatment can be siphoned off to tackle waste silting that occurs (Ariffudin 2001).

The treatment of solid wastes are generally only limited as the disposal on land that has been prepared (land filling). A large quantity of solid wastes require extensive land area as temporary placeholders. However, this heap of waste would pose environmental problems when no further handlers (Fauzi 2005). The utilization of solid waste as compost is one of the alternative solutions which can be done as an effort for the management and utilization of industrial solid waste in order to synergize with the environment. Composting is an simple and better alternative for handling solid waste. In addition, eco-friendly composting also costs investments that are relatively cheaper and can be profitable for the company.

Co-composting is an aerobic degradation control of organic materials using more than one raw materials (sludge or other organic solid wastes). Co-composting between bagasse and sludge are potentially to reduce the amount of solid waste and convert it into organic fertilizer. Bagasse has high content of carbon, phosphorus, and minerals however nitrogen content is very low so it is worse if composted directly without any other organic material. Whereas sludge contains high organic ingredients, crude fiber, minerals and proteins with high nitrogen content. Blending of bagasse and sludge produces nutrients for microorganisms that decompose organic materials.

Some factors that affecting composting process is value of C/N and aeration rate. The value of C/N is defined as the ratio between the amount of carbon with nitrogen contained in materials. Carbon and nitrogen are used as an energy source by microorganisms and cells forming the body. This was the one that caused the value of C/N in the composting process becomes a very important factor. Comparison of the amount of C and N were used during the composting process should not be too low or high because it can cause the decomposition process will be slow.Aeration aimed to supply oxygen for microorganisms that will create aerobic conditions for accelerating materials decomposition process. Beside to provide oxygen, air flow is given to remove carbon dioxide produced as a by-product of decomposition process organic ingredients.

The purpose of this research was to utilize baggase and sludge of the sugarcane industry through co-composting technic and to determine the influence of aeration and material combination to composting process.

2. MATERIALS AND METHODS

2.1 Characteristic and Formulation

Preliminary research consisted of characterization of raw materials and the determination of initial C/N value in composting materials. Parameters that Analyzed in characteristics of raw materials were moisture content, ash content, carbon, and nitrogen. Whereas, the determination of initial C/N value have done with weigh calculation of bagasse and sludge for any value of C/N that have been set (30, 40, and 50). Formulations for initial C/N value of materials used were:

$$\text{C/N value} = \frac{(\%\ \text{C Bagasse} \times \text{Weight}) + (\%\ \text{C Sludge} \times \text{Weight})}{(\%\ \text{N Bagasse} \times \text{Weight}) + (\%\ \text{Sludge} \times \text{Weight})}$$

2.2 Co-Composting Process

The composting process was done with static aerated pile method by mixing bagasse and sludge entered in reactors for aerobic conditions used modified air flow coming from aerator. The mixing of two different materials was done to combine contents of C/N value of each material, so it could created good condition for decomposition of organic materials. The material for composting based capacity of 5 kg for each reactor.

Weight of each ingredient was determined based on the value of carbon and nitrogen for each composting materials that were incorporated in the calculation of formulation with C/N value has determined for 30, 40, and 50. The aeration on process of composting was done 1 hours/day for each reactor starting on initial week with aeration level of 0.4 and 1.2 l/minute.kg ingredients. The stages of composting bagasse and sludge, can be seen on flowchart in Figure 1.

2.3 Experiment Design

Research design was done using method of Random Design with two treatment factors; were initial C/N value and aeration treatment. The initial C/N value consisted of three levels that were 30, 40, and 50, whereas aeration treatment consisted of two levels, 0.4 and 1.2 l/minutes.kg. The mathematical models used in this research was:

$$Y_{ijk} = \mu + A_i + B_j + AB_{ij} + \boldsymbol{\varepsilon}_{ijk}$$

Description:

Yijkl = measured variable
μ = general average or actual average
Ai = Influence factor A (initial C/N value) to-i (i = 1, 2, 3)
Bj = Influence factor B (aeration treatment) to-j (j = 1, 2)
AB_{ij} = effect of the interaction of factor A and B
$\boldsymbol{\varepsilon}_{ijk}$ = error

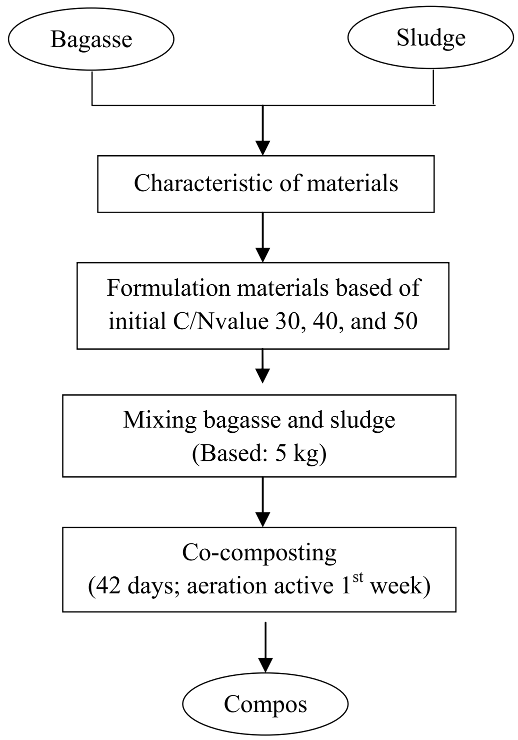

Figure 1 : .Reseach stage of Co-composting baggase and sludge

3 RESULT AND DISCUSSION

3.1 Characteristics Of Raw Materials

Bagasse and sludge analysis results were used in this study are shown in Table 1.

Table 1. The content of bagasse and sludge

Parameter	Bagasse	Sludge
Ash (%)	1.399	49.473
Nitrogen (%)	0.075	0.704
Carbon (%)	29.315	13.039
Water (%)	45.171	26.090
C/N Value	387.256	18.512
Phosporus (%)	0.170	1.755
Calcium (%)	1.050	0.385
Potasium (%)	0.034	0.119
Iron (%)	0.312	0.097
Alumunium (%)	0.269	0.068
Manganese (%)	0.029	0.002
Magnesium (%)	0.002	0.047

Bagasse had a high carbon content (29.315%) but low levels of nitrogen (0.075%). Bagasse had a high carbon content as it was sugar cane mill waste which still contained lots of fiber and cellulose. While sludge was used as raw material for composting had high enough levels of nitrogen (0.704%) with a low carbon content (13.039%).

The combination of these two ingredients were expected to produce optimum conditions for co-composting process. Bagasse had a high carbon content as a source of energy while sludge providing enough nitrogen for microorganism to synthesize protein for their growth. In addition, bagasse had characteristics of a good bulking agent so it made easy to circulate and air flow into the pile at the moment co-composting process taken place (Lavarack et al 2002).

3.2 Formulation of Initial CN Ratio

Mixing of raw materials was done as one method for obtaining optimum formulations of composting materials. The determination of C/N value was initial step to combine the best composition between main ingredient, bagasse and sludge. Determination of initial C/N used also as one way to get the value of the content of C/N materials in order to reach approximates value of C/N that was good in composting process.

According to the Djaja (2008) ideally compost raw material selected and mixed in proper proportions to produce high quality compost. In addition, the characteristics of the ingredients looked for mixing of raw materials was comparison of the amount of carbon (C) and nitrogen (N). The composition of bagasse and sludge to initial C/N of 30, 40, and 50 could be seen in Table 2.

Table 2. The initial composition of the materials

Initial C/N value	Total Weight (Kg)	Bagasse (kg)	Sludge (kg)
30	5	1.2	3.8
40	5	1.5	3.5
50	5	1.9	3.1

In the Table 2, could be seen that composition of the sludge on the mixed of materials was greater than bagasse. But the bagasse had a characteristic as bulking agent that was high enough so that it could balancing the mixing. Bulking agent was useful aspect facilitated circulation and air flow that entered into composting materials piles. Moisture content and low nitrogen on bagasse could be covered by sludge. Sludge had moisture content and nitrogen were supporting the process of degradation organic materials.

3.3 Co-composting Process

Temperature

Change in temperature was one of indicators for degradation process on organic material by microorganisms during the process of co-composting. Temperature measurement was carried out regularly to find out condition of composting, that was going well or not. Measurement results of temperature with aeration treatment of 0.4 and 1.2 l/minute.kg of materials shown in Figure 2 and 3.

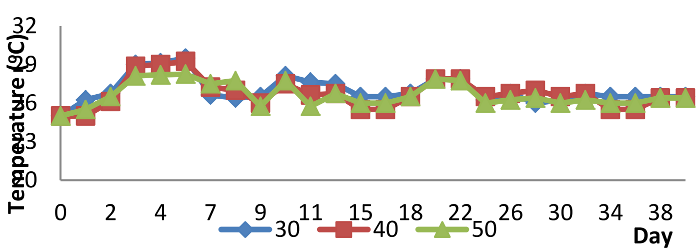

Figure 2 : Change of temperature in aeration of 0.4 l/minute.kg materials

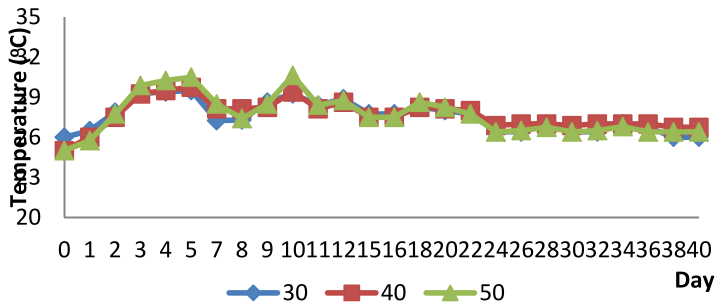

Figure 3 : Change of temperature in aeration treatment of 1.2 l/minute.kg materials

This indicated that activities of microorganisms in organic materials decreased. However, after few days temperature increased again. It indicated that presence of microbial activity was still on, but not as much as activities that happened in first week. On the day of 24th until the 40th, temperature of composting became constant. The condition of constant and stable temperatures indicated that compost was in maturation phase.

On this composting process, thermofilik conditions with a temperature of 45°C-65°C could not be reached. It was influenced by the dimensions of the composting material. Compost piles high in this research was only around 30 cm, while the ideal height of the pile was about 1 meter. According to Indrasti and Wimbanu (2006), the temperature of the compost that did not reach a temperature of thermofilik due to the dimensions of the pile was too small so that the heat generated from the process of degradation was not stuck in the pile. From the observations, aeration treatment of 0.4 and 1.2 l/min.kg did not give significant influence of temperature changes during the process of co-composting. This could be shown in Figure 2 and 3.

pH

pH was a factor that played important role in the process of co-composting. At the time of composting, occurred physical and chemical changed. pH changed as a result of microorganisms activity in composting showed of organic materials degradation. pH measurement was carried out every week to control pH conditions during decomposition process of raw materials. pH changed during the composting process, shown in Figure 4 and 5.

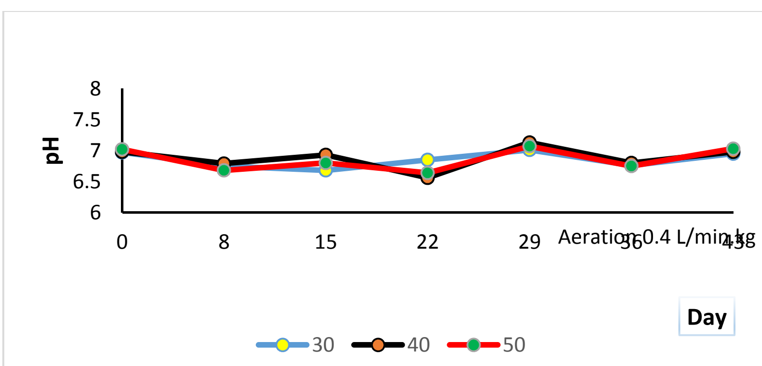

Figure 4 : Change of pH in aeration treatment of 0.4 l/minute.kg materials

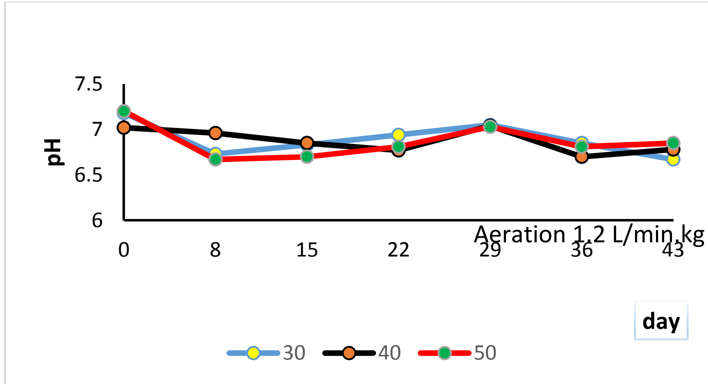

Figure 5 : Change of pH in aeration treatment of 1.2 l/minute.kg materials

The changed of pH in Figure 4 and 5 showed a decrease at the beginning of composting process for compos with initial C/N value of 30, 40, and 50 with both aeration treatment. According to Harada et al. (1993) the pH that tent to decrease at the beginning of composting process indicated of weak organic acid formation such lactic acid, butyric acid, propane acid, and acetic acid. Ingredients mixing with initial C/N of 40 had greater pH change than compos with initial C/N value of 30 and 50. On aeration treatment of 0.4 and 1.2 l/min.kg, decreased pH occurs from the beginning of time until the first week of composting. After going through the first week of composting period pH increased.

The increase in pH during composting process caused by changed on organic acids into CO_2. The decrease in organic matter caused a decrease in carbon content, meanwhile nitrogen transformed to NH_3. The Gas was generated in form of NH_3,bound with water, and formed an alkaline pH conditions. Aeration treatment 0.4 and 1.2 l/min.kg of material influenced significantly on change of pH during composting period. Giving of limited aeration rate during composting limited high or low pH change which could slow composting, with this method organic acid could be produced and would lower pH value and didn't caused too lower decrease in pH (Isroi 2008).

On a comparison of interaction between difference level of aeration treatment with C/N value showed early results that it was not different significantly. The third composition with initial C/N, 30, 40 and 50 had the same pattern in pH changes. However, compost which initial C/N of 40 experienced higher pH change compared to other composts. According to the CPIS (1992), when pH was too high causing the nitrogen element on the compost material was transformed into ammonia, otherwise on the condition low pH (acid) could cause microorganisms died. The easiest way to overcome the high pH value on the compost was limiting the aeration rate. Through this way, organic acid could be produced and would lower pH.

CN Ratio

The effective CN ratio for composting process was between 30 and 40. On CN ratio of 30-40 microbes got enough C to synthesize energy and N for protein synthesis. If the CN ratio is too high, microbes would lack of N for protein synthesis so that decomposition process was slow (Isroi, 2007). If the CN ratio was too low, it would cause formation of ammonia, so nitrogen was easily lost in the air (Harada et al. 1993). On process of composting, carbon content was reduced because it decomposed into CO_2, H_2O, and heat, whereas organic nitrogen was relatively fixed. This condition caused C/N ratio during composting down (Haug 1985).

Nitrogen was used as a source of cell growth for microorganism. The amount of nitrogen contained in co-composting material of bagasse and sludge were fewer compared to organic carbon content. Changed of the CN ratio during co-composting could be seen in Figure 6 and 7.

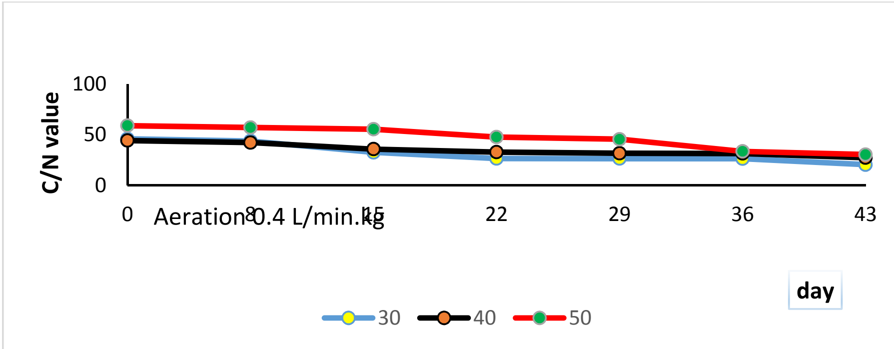

Figure 6 : Change of CN ratio in aeration treatment of 0.4 l/minute.kg materials

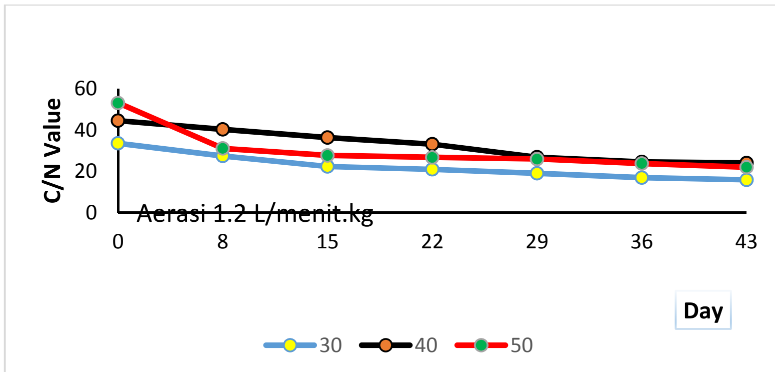

Figure 7 : Change of CN ratio in aeration treatment of 1.2 l/minute.kg materials

The change levels of organic carbon and nitrogen have an impact on changed in value of C/N. Organic carbon in compos mixing continued to decrease due to degraded by microorganisms and increased of nitrogen levels would cause C/N ratio decreased each week. Composition of compost with initial C/N of 50 had reduced rate in decomposition which is quite high when compared to mixture of ingredients that had initial CN ratio of 30. This condition happened because mixture material with initial C/N of 50 contained higher organic ingredients when compared to mixing of initial C/N of 40 and 30. The decreased in CN ratio due to occurrence of biodegradation materials into CO_2, H_2O and heat (Isroi, 2008). The more organic contained in compos material, heat also raised in compost pile. This condition had accordance with data where a mix of materials with initial C/N of 50 had higher temperatures if compared to others compost. On the graphics above, could be seen that CN ratio had decreased quite significantly each week. Entering week 4 until week 6 decreased rate slowed down and tend to be constant.

Aeration treatment had influence in process of decreasing the CN ratio. According to Indrasti and Elia (2004), process of aeration helped microorganisms which required oxygen in decomposition of organic materials, so speed in decomposition of organic materials done more optimum. Activity of microorganisms which degraded organic matter increased so that C/N ratio, nutrient elements, humus, and energy of co-composting material closer to composting process that produced expected compost quality. Djaja (2008) cites that many microbes in composting process were consuming oxygen, during the process of composting, materials that were easily broken down could be parsed quickly. Therefore, it taken a lot of oxygen in the process of degradation of organic materials. Aeration was done again to supply oxygen to the pile of compost material. Granting of aeration would actively speed up decomposition process of organic materials because many microorganisms consume oxygen and increase its activity so that produce energy, humus, and the desired nutrient elements (Metcalf and Eddy, 1991).

On aeration treatment of 0.4 and 1.2 l/min kg of materials, compost with initial CN ratio of 30 had the least level of decreased CN ratio until maturity of the compost that was approaching

20. Content of organic materials that were not too high on compost material degradation process lead to run quickly so drop in CN ratio also went fast. Mixing ingredients with composition of C/N 50 on aeration 0.4 l/minute.kg had the slowest changes of C/N ratio. A decrease from week 0 to 4 only reached CN ratio of 28.5, but after entering week 5 and week 6 change happened significantly. Therefore, compos with initial CN ratio of 40 had change between 30 and 50. Matched in amount of organic material in the compost mixture was caused a decrease in C/N ratio was not too fast or slow.

Aeration treatment of 1.2 l/min gave significant influence towards change C/N ratio on material compos with initial C/N of 50. Significantly decrease occurred in the first week followed by constant changed each week. The addition of 1.2 l/minutes.kg aeration also affected change in CN ratio during co-composting process. The final of CN ratio on compost with initial C/N of 50 was 21.8. Compos with initial CN ratio of 40 produced final C/N of 23.9, whereas a mixture of materials with initial C/N 30 had the smallest result to 15.8. These results indicated that level of aeration treatment affected rate of decrease in CN ratio, where aeration 1.2 l/minute.kg ingredients had greater influence compared with aeration 0.4 l/minute.kg ingredients.

4. CONCLUSIONS

Co-composting is one of the alternative solutions in the utilization of industrial solid waste, especially bagasse and sludge from waste water treatment which still has not put in good use. Bagasse and sludge could be combined for co-composting materials because it had characteristics that complement each other. Difference between initial C/N in composting process gave a real influence on decrease of CN ratio. The higher initial CN ratio caused C/N decrease higher but it toke a long time when compared to the material composition of low C/N. Compost with a combination of initial C/N 50 has decreased the C/N is great but need a long time until it reaches the value of C/N is ideal. While the compost with a C/N early 30 require less time to reach a value of C/N is ideal.

Treatment aeration 0.4 and 1.2 l/minute.kg material did not gave significant influence towards a decrease in the value of C/N. However, aeration 1.2 l/min kg material help speed up the composting process on materials with a value of C/N. Based on statistical tests, the combination of materials with a value of C/N 50 gives a real influence on the drop in value of C/N. While the interaction between the granting of aeration with a combination of C/N the beginning shows the relationship that has no effect.

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