Composting Mud Cake by *Trichoderma Viride* Apt01

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***Abstract*—** *This research was carried out in order to utilize mud cake from sugar factory and cattle feces waste to make compost. Composting process was accelerated by addition of isolate called* Trichoderma viride *APT01. The study was conducted according to a completely randomized design with three replications with mud cake and cattle feces ratio: 100/0, 75/25, 50/50, 25/75, and 0/100. Each mixture of organic matter was added with isolate of* Trichoderma viride *APT01. Quantitative data was analyzed using variance analysis with alpha 0:05. Among those compositions, it was shown that the value of C / N ratio between 14.6 to 18.3 with the level of acidity, pH 6.62 to 7.36 was the best product. Compost produced for composition of mud cake and cattle feces 25/75 has a value of C/N = 14.6 and pH = 6.78. This result was in accordance with The Bureau of Indian Standards.*

***Keywords*— Mud Cake, Compost, Trichoderma Viride, C/N Rati.**

I. INTRODUCTION

The interest of public to improve soil fertility is by applying compost as an organic filler. Farming communities are encouraged to convert agricultural waste such as corn stalks and grasses used as raw material to make compost. Quality of compost produced depends on the raw materials and the treatment of the composting process [1]. Previous research [2] showed that raw materials which have a C/N ratio > 60: 1 will produce poor quality compost. Therefore, organic material with high carbon content is required to be mixed with low-carbon organic material, in addition to high levels of nitrogen.

The mud cake containing cellulose about 3.8% of milled cane. Organic matter content in the mud cake about 75-80% which is mainly in the form of cellulose. The mud cake waste is largely taken by farmers for groundfill or dumped in open fields which can cause air pollution and unpleasant smell around the area [3].

Processing of organic material into compost can be considered as a sustainable technology because it is in accordance with conservation of environment. In addition, the use of compost (organic fertilizer) can reduce chemical fertilizers application [4].

Utilization of raw materials that yield high organic carbon will cause the composting process becomes longer for maturation. If this maturation process has not been completed and immediately incorporated into the soil, then the absorption of nitrogen and oxygen that comes from the ground. The absorption of nitrogen and oxygen is used for the microorganisms growth in decomposing the organic compounds such as cellulose [5].

Main content in the mud cake is organic polymer especially a cellulose. Generally, cellulose decomposed to glucose after a few months. Cellulose compounds that present in natural materials is difficult to be decomposed into simpler compounds. In order to speed up the process of decomposition or composting, involvement of microbes such as *Trichoderma* sp. is required. Moreover, it is also able to reduce the ratio of C/N initial organic material that will be used as compost. The main problem at the moment, cellulosic materials requires biodegradation agricultural complex before it can be used by microbes for growth. Microorganisms require simple compounds to grow and develope. This growth resulted in the formation of several enzymes that can hydrolyze organic polymer compounds. Microbes are a potential agent for the decomposition of cellulose. The decomposition process results have a monomer compound that is ready for growth. *Trichoderma* sp. has a cellulolytic microbe and capable to change the polymer compound of cellulose to glucose monomers [6].

Trichoderma sp. have been studied as enzyme to degrade cellulosic material into glucose. Some *Trichoderma* species have been isolated from various media in nature such as *T. harzianum, T. koningii and T. viride* which have been known to produce cellulolytic enzymes. This cellulolitic enzyme play an important role in the interaction with organic material around the roots of plants [7].

II. METHODS

The experiment was conducted according to a completely randomized design with three replications. The combination of the mud cake with cattle feces was 100/0, 75/25, 50/50, 25/75, and 0/100. Each combination of material was added with *Trichoderma viride* APT01 to decompose the organic polymer of cellulose to glucose.

The mud cake and cattle feces were air dried for a week. The size was reduced using a ball mill and then heated in an oven for 1 hour at a temperature of 105 ^{0}C. This material was then sieved into 80 mesh. Each material was mixed accordingly with appropriate treatment to have 10 kg biomass. After that, distilled water was added into the mixture. The distilled water containing conidia of *Trichoderma viride* APT01 with the density 10^7 conidia / ml to obtain 60% moisture. The mixture was inserted into the plastic barrel and incubated for one month at room temperature. The parameters of TOC, C/N ratio, pH, temperature and total microbes were measured and calculated during the incubation period. The parameters were analyzed quantitatively during composting using variance (ANOVA) with alpha of 5%.

III. RESULTS AND DISCUSSION

Preliminary data parameter from a mixture of mud cake and cattle feces are presented on Table 1.

TABLE 1
DATA PARAMETER FROM A MIXTURE OF MUD CAKE AND CATTLE FECES

Mud cake : Cattle feces Parameter	100 :0	75:25	50:50	25:75	0:100
TOC (%)	50.6	46.2	43.7	37.6	35.8
C:N	43.8	38.7	32.9	26.8	20.9
pH	4.38	4.87	5.19	5.28	5.47
Temperature (^{O}C)	36.3	35.7	34.7	34.3	33.7
Total microbe (cfu/g) x 10^6	37.8	28.9	22.7	14.9	5.1

Meanwhile, parameter data from a mixture of mud cake and cattle feces with the addition of Trichoderma viride APT01 are presented on Table 2.

TABLE 2
DATA FROM A MIXTURE OF MUD CAKE AND CATTLE FECES WITH ADDITION OF ISOLATE

Mud cake : Cattle feces Parameter	100:0	75:25	50:50	25:75	0:100
TOC (%)	36.8	29.5	26.6	22.7	23.3
C/N	18.3	17.5	15.3	14.6	18.2
pH	7.36	7.26	7.17	6.78	6.62
Temperature (^{O}C)	33.7	33.3	33.3	32.3	33.7
Total microbe (cfu/gr) x 10^9	4.0	4.2	5.3	6.6	3.2

The content of total organic carbon (TOC) amounted to 50.6% of the mud cake affects the decomposition rate of organic matter. In the course of composting material mud cake only result in a decrease of 27.3% TOC levels. Combination treatment of mud cake with cattle feces objected to minimize the C/N ratio of raw material compost. The greater the composition of cattle feces combined with the mud cake, the smaller is the ratio of C/N initial mixture before the composted material. Cattle feces containing nitrogen as much as 1.71%. The addition of cattle feces is expected to decrease the TOC

and C/N ratio of organic material. The minimum of nitrogen content that is used as energy source of a compost is 0.8%. This was confirmed by the results Eiland et al. [8] which concluded that for the organic material with a C/N ratio lower decomposes at 40-60%, while for materials with C/N ratio is only higher by 10-20%. Beside that, addition of cattle feces used to increase nitrogen source for microbes to support the process of polymer decomposition into simpler compounds.

Test analysis of the value of C/N ratio and total organic carbon (TOC) of mud cake initially is 43.8 and 50.6% respectively. The mud cake containing about 1.15% nitrogen. Results of this analysis is in accordance with several researchers results that previously stated the total organic carbon contained in the mud cake is high (>50%). The high organic carbon as a result of the sulphitation process in producing sugar [9]. The composting process materials that yield a high TOC should be followed by the addition of organic material that have high nitrogen levels. Cattle feces contain a high protein. The amount of proteins related to nitrogen contained in the material. Protein will be hydrolyzed into amino acids. The compound of amino acid will be used as a nitrogen source in the process of the microorganisms growth. Various combination treatment of mud cake and cattle feces producing nitrogen 1.19; 1.33 and 1.40% respectively.

Table 2 shows that the compost produced from this research has a value of C/N ratio ranged from 14.6 to 18.3. The value of C/N ratio gives an indication that the compost is ready to be applied into agricultural land. This is confirmed by the results of composting research conducted by Benito et al. [10] stating that the compost produced from organic material can be directly used when the value of C / N ratio between 14 and 24.

In the composting process, parameters that need to be considered include the total organic carbon, C/N ratio, acidity, pH, temperature and environmental conditions. The condition and quality of organic materials will be able to produce good quality compost. A compost acidity has a neutral or slightly acidic, according to the environmental condition of agricultural land. The results of various treatment combinations mud cake with cattle feces showed the value of acidity, pH between 6.62 and 7.36. The value of acidity level according to Najera et al. [11] could be categorized as a state slightly acidic (6.1 to 6.5), neutral (6.6 to 7.3) and slightly alkaline (7,4- 7,8). Overall, the compost produced from various combinations of these treatments is neutral. Comparison of quantitave analysis result of each data caused by isolate addition can be seen on following figure.

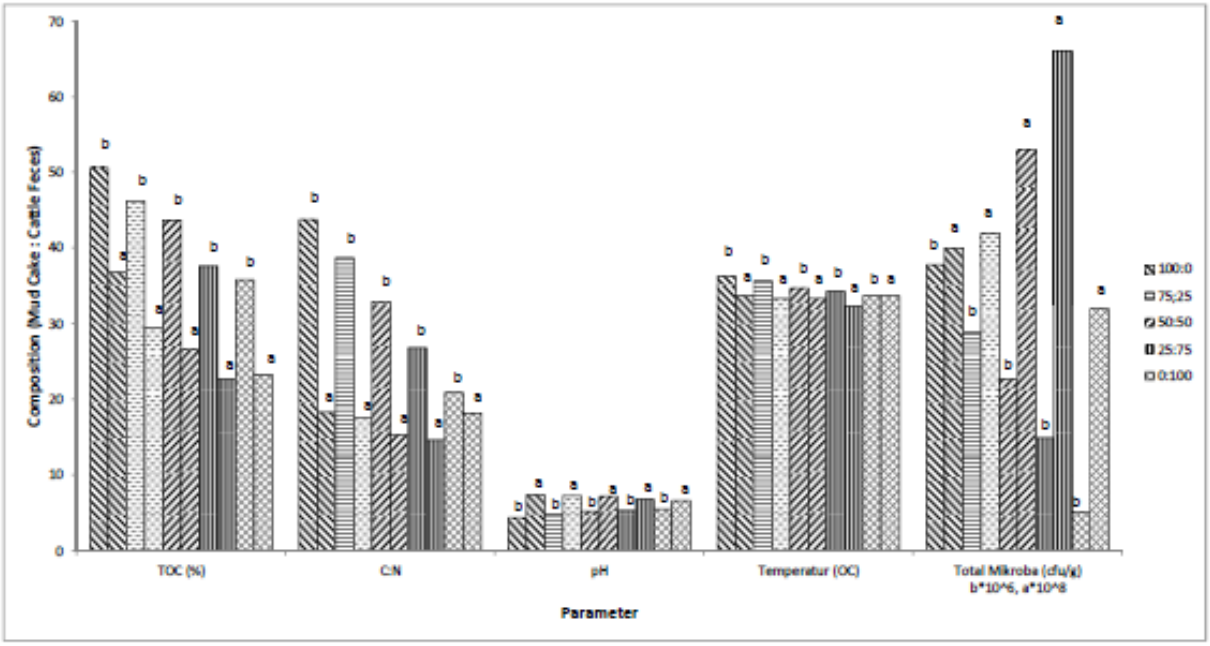

FIGURE 1. QUANTITATIVE ANALYSIS RESULTS (A) WITH ISOLATE AND (B) WITHOUT ISOLATE

IV. CONCLUSION

Data from the study of various treatment combinations mud cake and cattle feces with addition of *Trichoderma viride* APT01 analyzed with variance (ANOVA) by alpha 0:05. Results of the data analysis shows the value of C/N ratio is between 14.6 to 18.3 with the acidity level, pH from 6.62 to 7.36. Compost produced for comparison mud cake and cattle feces 25/75 has a value of C/N ratio = 14.6 and pH = 6.78. Quantitative value of composting result is in accordance with the compost recommended by Bureau of Indian Standard [12].

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