CHAPTER 1

INTRODUCTION

1.1 Problem Background

The amount of unmanaged municipal solid waste causes various environmental and social problems. Improper municipal solid waste treatment causes all types of pollution which are air, soil, and water that caused by the decomposition of waste into constituent chemicals in open space. from social aspect, municipal solid waste treatment operation in Indonesia has fund deficit from its requirement due to improper tariff structures, and low concern from both people and local governments against waste, to repay the service equivalent to the respective obligation (Damanhuri, 2008). Low social concern leads to reckless waste dumping into the environment which contaminates surface and groundwater supplies nearby housing area, and it also gives puddle that creating stagnant water for insect breeding and floods during rainy seasons (Pervez Alam &, 2013).

According to the Environmental statistics of Indonesia, in 2016 - 2017, around 45000 m^3 of waste- was collected from the capital city from each province. The waste collected was categorised as organic waste, inorganic waste, and hazardous waste. The percentage waste collected is presented in figure 1.1

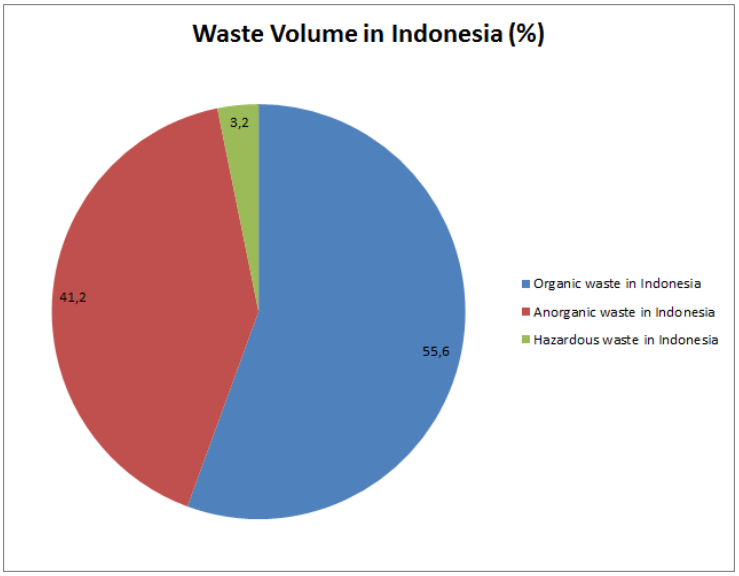

Figure 1.1. the percentage composition of waste collected in Indonesia in 2016 (Winda Sartika Purba, Pramudya Ajeng Safitri, Riska Andianti, 2017)

The proportion of The organic waste was highest with 55.6% following by in-organic waste with the second largest fraction around 41.2%, while the hazardous waste with 3.2% was the lowest proportion of the collected waste. The most common treatment methods used in the developing world such as Indonesia is dumps and landfill, which often is incineration, open burning and biological conversion (Lo Re L Mohamad Tarhin, 2013) (LeBlanc, 2017), ("Waste Treatment Definition," 2018).

Composting is the most economic method for organic waste treatment, since require minimum installation for setup for the process. According to Kitakyushu Urban Centre in 2009, Indonesia had started composting installation practice in six cities, which are Surabaya, Jakarta, Palembang, Balikpapan, Makassar, Jakarta, and Tarakan. The composting installation practice of these cities were started with composting education and campaign community practical activities (Institute for Global Environmental Strategies of Kitakyushu Japan, 2009). The composting activity in indonesia started at city of Surabaya in December 2004, the activity was distribution of 16,000 the composting basket to households for organic waste reduction in city until year of 2008; the distribution of baskets was started in Pusdakota as the first composting centre, then the composting centre were increased to 13 centre around the city. The 4 years project of composting in Surabaya accomplish waste reduction from over 1,500 tons/day to around 1,000 tons/day (Institute for Global Environmental Strategies of Kitakyushu Japan, 2009). In 2008, The programme of the composting buckets distribution in Surabaya was continued in Palembang, Balikpapan, Makassar, Jakarta, and Tarakan; the programme was shared in Surabaya as conference with involvement of Ministry of Environment (KLH), National Development Planning Agency (BAPPENAS), and Public Works (PU).

In Palembang, the composting setup started with 17 communities and PT. PUSRI, fertilizer company, involvement which reduce the waste to 1,100 tons/day with population of 1.5 million.

In Balikpapan, 330 tons/day of organic waste in 600,000 populations was reduced with the one or two communities composting activities in each sub-district.

In Makassar, the five models of composting communities were involved for distributing 100 composting buckets per households, and built composting centre nearby the vegetables traditional markets; the impact of activities reduce the organic waste to 1,100 tons/day in 1.2 million populations.

In Jakarta, the composting communities already existed, in Central Jakarta, which then increased from Central Jakarta to other regions and led to reduction of organic waste generation

In Tarakan, more than 2 composting communities were built in three years; the composting activities were resulting reduction of 130 tons/day for organic waste in population of 200,000.

According to Risnandar (2018), the composting method which usually used by farmers and in household environment in Indonesia are basic aerobic composting, bokashi anaerobic composting, vermicomposting, and liquid fertilizer composting. Based on the composting methods, which is commonly used in Indonesia, bokashi anaerobic and liquid fertilizer composting that use bio-activator or liquid culture for composting, which are EM (Effective Microorganism) and liquid fertilizer respectively.

1.2 Composting Bio-activators and Composting Quality

A compost is considered mature when the energy and nutrient-containing materials are stabilized in the organic mass by the activity of the microorganisms. The final compost is usually dark brown material and the the initial constituents are no longer identifiable and no further decomposition is observable. The length of the time needed to achieve such compost can vary depending on various factors and the process can take couple of weeks or over a year. Before adding the compost to the soil it should be guaranteed that a compost is finished since Application of an unfinished, carbonaceous compost could have a negative influence on the plant growth. Additionally, immature composts using nitrogen-rich feedstocks are usually high in ammonium and thereby toxic to plant growth. That is the reason that the compost Quality reflects the chemical makeup of a given compost. A compost can be mature (i.e., fully composted) but can be of poor quality due to low nutrient levels (Frank Mangan, Allen Barker, Steven Bodine, and Peter Borten, 2013). The parameters to determine the compost quality are the analysis of macro elements (nitrogen [N], phosphorus [P], and potassium [K]) in organic, C:N ratio, and buffering capacity and pH.

EM (Effective Microorganism), which found by Dr. Teruo Higa in 1968 at Japan, are the microbes solution that contain photosynthesizing bacteria, lactic acid bacteria, yeasts, actinomycetes, and fermenting fungi. The current function of EM are for improving the diversity of the soil microorganism, suppressing the soil pathogens, and composting (Towett, 2016).

The Takakura composting bio-activator was introduced at 2005 in Surabaya, Indonesia, by Koji Takakura from KITA (Kitakyushu International Techno Cooperative Association). Takakura composting method is decomposition of organic matter using cultivation of beneficial microbes,from the environment and eliminating undesired microbes, which are commonly available in natural environment. Above all, the fermentative microbes are the central role in composting. Since fermentative microbes that are suitable to composting the surroundings, anyone can make effective compost by finding and cultivating the microbes. The fermentative microbes also enable to produce compost in and shorter period of time. Moreover, the method is harmless and economical as it requires easily accessible materials.

1.3. Problem Formulation

Currently, composting practitioner, especially farmers, using various commercial culture product which is Effective Microorganism (EM) solution as bio-activator with specific defined microorganisms in the composting process. Takakura; a home method composting, introduce bio-activator, which is cultivated using food waste with sugar and salt.. The microorganisms in these kind of bio activator are unknown. Furthermore, the difference in using these two microbial cultures in a composting process and the compost product quality is still unknown. The composting practitioners and farmers in Indonesia still in confusion, which activator is the best for composting process. Presently there are no studies comparing the compost and the composting process using EM4 and Takakura bio-activator, although the Takakura composting is still practiced in several regions in Indonesia. In addition, the The EM bio-activator is still dominant in most studies found. This study compares the difference in the final compost using Takakura culture which is a self-cultivated bio activator with a compost using commercialized EM4. The results of this study could be beneficial economical point of view which can lead having a more cost effective composting process for farmers using self-prepared Takakura a culture instead of using commercialized EM4.

1.4. Research Objective

The research objective is for comparing the compost produced using a self-cultured takakura bio-activator and commercialized EM4 culture bio-activator.

1.5. Research Scope

This research scope is focused on the comparison of final compost of between Takakura bio-activator and EM bio-activator in term of quality. The quality of final compost are elaborated using C:N ratio, N-P-K (Nitrogen-Phosphorus-Potassium) ratio, calcium carbonate equivalent, moisture content, and bulk density. Also to give a basis for more economical bio-activator usage in farm composting.