Planting media with material composition variation of Sinabung sand using mechanic press toll

Bode Haryanto*, Muhammad Arifin, Rina Bukit, Ahmad Perwira M Tarigan and Eddy Suranta Surbakti

1Department of Chemical Engineering, Faculty of Engineering, Universitas Sumatera Utara Medan 20155
2Department of Mechanical Engineering, Faculty of Engineering, Universitas Sumatera Utara Medan 20155
3Department of Accounting, Faculty of Economy, Universitas Sumatera Utara Medan 20155
4Department of Civil Engineering, Faculty of Engineering, Universitas Sumatera Utara Medan 20155
5Karang Tarun, Karo District, Indonesia

*Email: bode.haryanto@usu.ac.id

Abstract. The inspiration of this investigation was to descript the output analysis of product plantation media from sand material from mount Sinabung eruption. The Sinabung volcanic sand with chicken manure and natural soil were mixed and used as materials to produce planting media. The experiment started from collecting the materials with pre-treatment then added by certain variation material prepared to make shape by mechanic pressure tool to construct the matrix media with cylindrical shape. The surface characteristic and hardness of the planting media products were analyzed to get the best variation of materials. The increasing percentage of Sinabung sand will decrease the strength of mixed materials plantation media from 61.9 N to 40.9 N and to 32.6 N for 20%, 40% and 60% Sinabung volcanic sand. The product planting media can be used in the area that needed reforesting such as: around the mount Sinabung, toba lake, ect.

1. Introduction

Sand of Sinabung was reported use as material to produce planting media. The product is applied to grow the vegetable plants [1]. Sand as natural material has macro-porous and meso-porous structures [2]. As a part of soil, sand has porosity that mostly is influenced by particle size, uniformity, and rock type and assortment [3]. Soil as solid materials with the porosity can be classified as intra-particle and inter-particle porosities. The porosity present between particle sands is inter-particle porosity. The porosity within sand particle is intra-particle porosity. With the pores characteristic, soil has not only a wider surface area, but also has possibility and ability for reaction and adsorption [4]. On the other side, the porous characteristics could be a kinetic limitation to a material desorption from the surface at pore side [5].

Chicken manure is used as fertilizer. The chemical compound as fertilizer may improve the goodness of materials as planting media [6]. A Sinabung mountain eruption activity is produce some material as a solid phase. One of the products is dust/sand, the sand has characteristic to assess properties and
impacts on soil. Press tools instrument are often used to produce the sheet solid components such as planting Media. Generally press tools can be categorized based on the type of operation performed by the tool, such as blanking, bending, forming, forging, etc.

The purpose of this study was to analyze the effect of composition variations of material in producing planting media with manual press tool. The characteristics the planting media product was then investigated by using TENSILON on wall rigidity. The characteristic of the surface used Micro Capture e-Plus. This study is the continuous step in using the raw material of sand from Mount Sinabung eruption, Karo Highland, Sumatera Utara.

2. Method
In this study the material used was as certain composition as shown in Table 1. The component of raw material was collected from Tanah Karo such as: ash/sand eruption of Sinabung mountain, chicken manure and natural soil.

### Table 1. Variation composition of materials.

| No. | Product | Sand of Sinabung | Chicken Manure | Natural Soil |
|-----|---------|------------------|----------------|-------------|
| 1   | A       | 20%              | 30%            | 50%         |
| 2   | B       | 40%              | 30%            | 30%         |
| 3   | C       | 60%              | 30%            | 10%         |

Figure 1 was the step activities in this study. The activities were started by preparing the raw materials then mixing as the variable material composition and then using the mechanical press tool manually. The next step was to dry the product openly by sunlight. And then was to analysis the product rigidity (wall hardness) and the surface characteristic of the products.
The measurement on strength of composition materials planting media was referring to the ASTM C31 compressive strength testing (compression test) on the product analysis by TENSILON RTF Series 1325 instrument as shown in Figure 3 [10]. Micro Capture e-Plus was used to identify surface characteristic of products. The both instrument analysis is at Unit Operation Laboratory, Chemical Engineering Department, Universitas Sumatera Utara (USU) Medan.

3. Results and discussions

The planting media product is shown in Figure 4 with the composition: 60% of Sinabung ash/sand, 20% of chicken manure and 20% of natural soil. Figure 4.A shows the form of planting media as a hollow cylinder-shaped product. Figure 4.B shows the surface before it is dry and Figure 4.C shows a surface that has dried.

![A](image)

![B](image)

![C](image)

**Figure 4.** A. Product of planting media; B. Surface before drying; C. Surface after dried.

The effect of Sinabung sand volume percentage on the material mixture greatly influences the hardness of the planting media product. The results of the hardness test of the planting media sample are presented in Table 2. Variation of material composition shows that the presence of chicken manure on Sinabung sand composition variation and natural soil is significant enough to influence the hardness of the walls of the produced planting media.

| No | Product Sample | Force (N) |
|----|----------------|-----------|
| 1  | A (20%, 30%, 50%) | 61.9      |
| 2  | B (40%, 30%, 30%) | 40.9      |
| 3  | C (60%, 30%, 10%) | 32.6      |

Figure. 5 shows the hardness measurement samples of planting media products. With a fixed composition of 30% chicken manure for each sample and variation of natural soil (50%; 30%; 10%) and Sinabung sand (20%,40%,60%) have reduces compressive strength of the product. From the material hardness test, the best hardness is found in sample A with a composition of a mixture of 20% Sinabung sand, 30% chicken manure, 50% natural soil, with a pressure level reaching 61.9 N. While the lowest material hardness is sample C with composition: 60% Sinabung sand, 20% chicken manure and 20% natural soil. Sinabung sand affects the level of hardness of the planting media product, the higher the percentage of the composition of the composition of the material, the level of hardness of the planting media will decrease.
Photo of the surface structure of the planting media are as shown in Figure 6. The results of observing the material by testing the structure using a digital microscop at magnification 150 times are seen in Figure 6.A that the arrangement is very tight. This is very different from Figure 6.C. Figure 6.B has a slightly more tenuous surface structure than Figure 6.A. This can be used to confirm that the hardness of sample A material with 20% volcanic sand has a higher hardness compared to the mixture of 40% and 60% sand.
Figure 6. Photo of the surface structure of the planting media with 150 x magnification: A. 20% volcanic sand; B. 40% volcanic sand, C. 60% volcanic sand.

4. Conclusions
Sand material from mount Sinabung eruption has potential to use as product plantation media. The mixing materials with Sinabung volcanic sand and chicken manure and natural soil were used to investigate the physical properties of strengthen wall materials of planting media. The certain variation material prepared to make shape by mechanic pressure tool to construct the matrix media with cylindrical shape. The surface characteristic and hardness of the planting media products were analyzed to get the best variation of materials. The increasing percentage of Sinabung sand for 20%, 40% and 60% will decrease the strength of mixed materials plantation media from 61.9 N to 40.9 N and to 32.6 N. The surface structure sample material with 20% volcanic sand is very tight compared to the mixture of 40% and 60% sand.

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