

Preliminary Study on Forging Planting Media with Variation of Raw Materials by Manual Press Tool

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Abstract: This idea to introduce the ability of a mechanical press tool manually. Three types of raw materials were used 100% clay, 100% sand and mixture of both 50% plus 50%. This is done in order to measure the time needed to produce the planting media using the press tool machines. The time needed for every different raw material, which are clay, sand and mixed materials are 3 minutes, 0.4 minutes and 1.2 minutes, respectively. The wetness of clay increases the time needed to form it into a growing medium because it becomes more muddy. It has a higher strength value compared to sand and a mixture of both ingredients. Sand and mixture materials are definitely need a binding compound to increase the bond of mixture raw of material.

1 INTRODUCTION

Sand has natural macro-porous and meso-porous structures [Chen et al, 2017]. Porosity of soil is mostly influenced by particle size, uniformity, and rock type and assortment [Fetter, 1994]. The porosity in solid materials can be more classified into intra-particle and inter-particle porosities. Inter-particle porosity is the porosity present between particle sand. Intra-particle porosity is the porosity within a sand particle. Pores have not only a greater surface area, but also a higher selectivity for reaction and adsorption [Kaneko, 1994]. On the other hand, the porous characteristics of sand surface could be a kinetic limitation to material desorption from porous sites [Casas et al., 2006].

Clay is a finely-grained natural rock or soil material. This material combines one or more clay minerals with possible traces of quartz (SiO₂), metal oxides (Al₂O₃, MgO etc.) and organic matter. Geologic clay deposits are mostly composed of phyllosilicate minerals containing variable amounts of water trapped in the mineral structure. Clays are like plastic due to particle size and geometry as well as water content. Clays become hard, brittle and non-plastic upon drying or firing [Guggenheim and Martin 1995; London's Geology, 2016]. Clay is depending

on the soil's content in which it is found, clay can appear in various colours from white to dull grey or brown to deep orange-red [Wikipedia, 2018]

Press tools are often used in hydraulic, pneumatic, and mechanical presses to produce the sheet solid components in large volumes. Generally press tools are categorized by the types of operation performed using the tool, such as blanking, bending, forming, forging (Figure 1.), etc (Cyril et al, 1972).

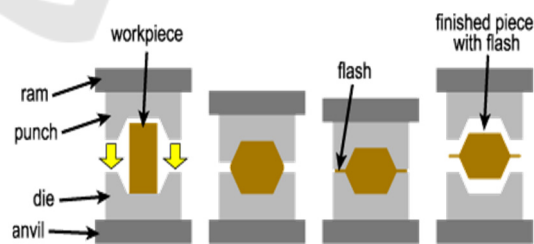


Figure 1. Machine Forging (<https://www.quora.com/>).

The purpose of this study is an introduction in analyzing the performance of manual press tool operation in producing planting media base on composition variations of material. The time needed to produce the planting media with its physical properties was then investigated. This is a preliminary study before a study using the raw

material of sand from mount Sinabung eruption, Karo highland, Sumatera Utara.

2 METHODOLOGY

In this study the material used was from clay and sand around Medan city. The component of raw material was originally used as raw materials and mixed 50% : 50% of the sand and clay. The step activities are shown in Figure 2. The activities were started by preparing the raw materials then by using the mechanical press tool manually. The press tool is as shown in Figure 3. The strenght measurement is at the removing step of the tool to dry step. The result was shown as in the camea photos and timer.

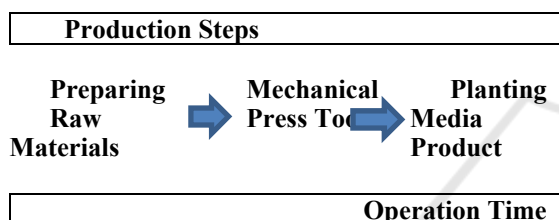


Figure 2. Operation steps to produce planting media from sand.



Figure 3. Press tool manual.

After preparing the raw materials, it has four steps in operating the mechanical oress tool. The fist is loading the raw material (1) then (2) adjusting to molding space (3) pressing and (4) flow out of the product. Then the next step is to put the planting media to dryer place.

3 RESULTS

The ability of a mechanical press tool manually is as follow. Tree types of raw materials were used 100% clay, 100% sand and mixture of both 50% plus 50%. Then we measure the time needed to form molds in planting media machines. The time for each different raw material is 3 minutes, 0.4 minutes and 1.2 minutes, respectively. The wetness of clay increases the time needed to form into a growing medium because it becomes more clay. But it has a higher strength value compared to sand and a mixture of both ingredients. Sand and mixture materials are definitely needed a binding compound to increase the bond of raw material mixture.

Table1. The Operation Time.

No.	Raw Type	Percentage	Operation time (minutes)
1.	Clay	100%	3
2.	Sand	100%	0,4
3.	Mixed Clay and Sand	50% + 50%	1.2

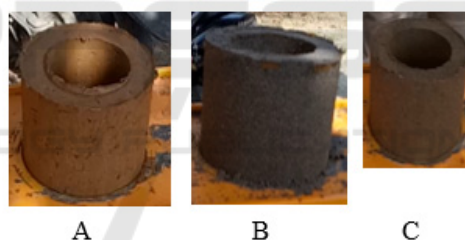


Figure 4. The planting product: A. Clay, B. Sand, C. Mixed 50% and 50%.

Using mechanical press tool manually, tree types of raw materials were used 100% clay, 100% sand and mixture of both 50% plus 50% (Figure 4). In order to measure the time needed to form molds in planting media machines. The each different raw material is 3 minutes, 0.4 minutes and 1.2 minutes, respectively. The wetness of clay increases the time needed to form into a growing medium because it becomes more clay. But it has a higher strength value compared to sand and a mixture of both ingredients. Sand and mixture materials are definitely needed a binding compound to increase the bond of raw material mixture.



Figure 5. Drying steps.

Figure 5 shows the step to dry clay planting media product. The drying is still using the natural sun light energy. The comparison study related to drying step will be done in the next study. Sand from Mount Sinabung eruption will be the raw material used in the next investigation.

4 CONCLUSIONS

Chemical compound type of a raw material impacted the operational activities in producing planting media. The clay needed longer time to mold because the wetting impacted the material control time to operate the mechanical pressure until pack as product. Using 100% clay need time about 3 minutes in compare to sand 100% about 0,4 menite and mixture of both 50% plus 50% was about 1,2 minutes. The strength structure of clay product is better than sand and mixed material. More future study is needed to get the suit composition of clay and sand to produce the sand materials.

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