Advances in Economics, Business and Management Research (AEBMR), volume 46
1st Economics and Business International Conference 2017 (EBIC 2017)

Utilization of The Sand from Mount Sinabung Eruption as Material for Planting Media

Bode Haryanto
Faculty of Engineering,
Universitas Sumatera Utara,
Medan, Indonesia
Bode.haryanto@usu.ac.id

Eri B BTarigan
Eckaronology
Resources Institute,
KabupatenKaro, Indonesia

Jonathan I Tarigan
Eckaronology
Resources Institute,
KabupatenKaro, Indonesia

Rina Br Bukit
Faculty of Economic and Business,
Universitas Sumatera Utara
Medan, Indonesia

Paham Ginting
Faculty of Economic and Business,
Universitas Sumatera Utara
Medan, Indonesia

***Abstract*–The idea of this study was to descript the output and feasibility of sand utilization from mount Sinabung eruption activities. The sand used as materials to produce planting media for vegetables. The experiment started from collecting the sand with pretreatment then added by certain material such as: waste of coffee skin after fermented as compost with goats manure, the urine of red sugar and liquid phase red sugar and then prepared to make shape by pressure tool. Hydraulic pressure tool applied to construct the matrix media with cylindrical shape variation. In this application, the shape type of matrix media was used to grow different plants such as: onion crop, local red chili,and vanilla plants. The most important result is the possibility to increase the value of sand from Sinabung eruption that can be used as planting media. The media also can be used in the certain place around the living place to increase the income of the people Sinabung victims. This idea is possible to increase the productivity of the people around the mount Sinabung.**

Keywords –Sinabungsand; matrix media; productivity; planting media

I. INTRODUCTION

FIGURE 1.Mount Sinabung Eruption [2]

Sinabung is the name of a mount in Karo highland Sumatra Utara, recently eruption. The eruption activities are giving problems to the society around the eruption area but one can look for the possible potential from the mountSinabungactivities. The eruption activity is ongoing since 2010 [1]. Figure 1 is the mount Sinabung [2].

One of the eruption products is sand [3]. Figure 2 shows the sample that sand occupied the eruption area [2]. The sand was reported has a complex chemical compound that possible to apply in many applications. It was reported that sand was used as the filler on high concentrate [4] and as additive for paving block [5].

FIGURE 2. Sand around the eruption area [2]

In this study the sand was used as basic compound to produce planting media. Energy productivity ratio (EPR) was applied to measure the possibility base on the equal energy of input used and output produced [6,7,8]. Energy requirements of a production activity can be defined as energy inputs. The output is the primary product energy plus its by-product energy. The total output is the raw materials, electricity and others energy used and the tools process depreciation. The ratio of the energy output value to the energy input is defined as the productivity of the production activity.The calculation is based on the product capacity per year or the total product

produced.The productivity energy of ratio (EPR) is formulated as in equation 1.

$$EPR = \frac{\textbf{Ouput Energy (OE)}}{\textbf{Input Energy (IE)}} (1)$$

The EPR formulation is as shows in equation 2 with takes consideration to the side-product (OESP) as output.

$$EPR = \frac{\textbf{OE}}{\textbf{IE}-\textbf{OESP}} (2)$$

The energy ratio is 1 > 1, the product production has a potential and can be continued. However, if the energy ratio of 1 < 1, the production may become loss and tend to not a feasible [6]. Calculation of equal energy was based on value unit of rupiah price for 1 liter diesel price and its energy equal.

The purpose of this paper as an information to assist in analyzing the performance, productivity and feasibility of the sand as planting media based on the assessment of the value of Energy Productivity Ratio (EPR) with mechanical processing around the Sinabungeruption area, Karo highland, Sumatera Utara.

II. EXPERIMENTAL METHOD

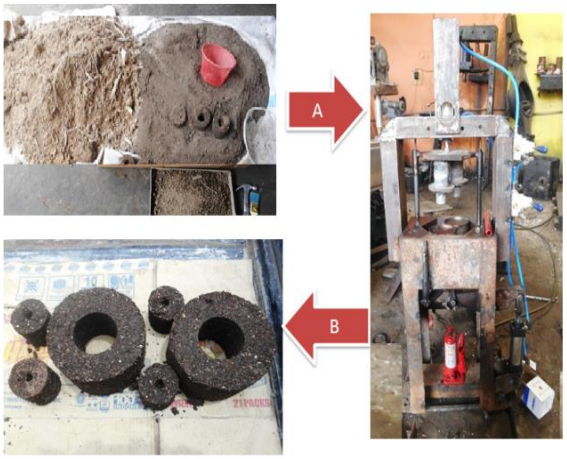

FIGURE 3.Flow research activities

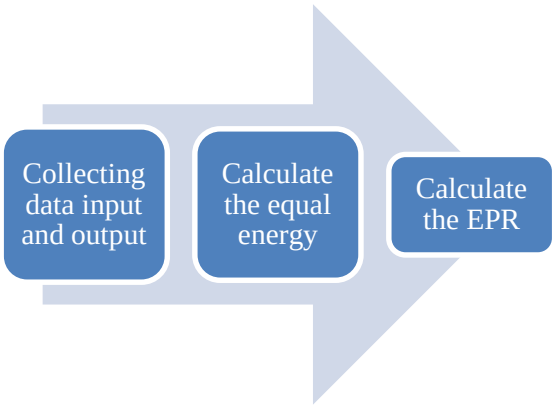

FIGURE 4. Flow research activities

The input energy was the energy needed base on the cost to produce the planting media and the tool depreciation. As shown in Figure 3, there are three steps to produce the planting media. Collecting the sand and supporting material and press tool operation (A), then to produce the planting media (B).

Research steps in calculating the EPR is shown in Figure 4. The first was collecting data relate to all price as output needed and output produced. The data was then calculated as equal energy for each input and output in the processing of sand into planting media (2) and then calculation of the energy productivity ratio (EPR) with equation 1. The equal energy for value rupiah price was used base on 1 liter diesel with price Rp 5,650,- [9] with energy equal to 42.96 MJ/kg [10].

III. RESULTS

3.1 Input Energy:

The following data is used to find equal energy input with working time for 100.000 products of planting media. Table 1 shows the cost for resource of the price for the tool and the electricity and fuel was used. The detail of component data for the tools shows in Table 2.

TABLE 1.The information on input cost for the tools base on price

No	The input resource	The Price or Energy Used(Rp)
1	Price of tools	23,200,000,-
2	Annual electricity usage /gasoline	7,500,000,-
	Total Price	*30,200,000,-

TABLE 2.Detail data and cost for the tool

No	Description of Tools and Supplies	Cost(Rp)
1.	Iron Plate and Cylindrical Pipe	5,000,000,-
2.	Hydraulic Pneumatic I	2,500,000,-
3.	Hydraulic Pneumatic II	2,000,000,-
4.	Hydraulics Static	200,000,-
5.	Equipment of Pneumatic Pressure Control	3,000,000,-
6.	Compressor	5,000,000,-
7.	Hose and Pressure Panels	2,000,000,-
8.	Manufacture cost	3,500,000,-
	Total	23,200,000,-

TABLE 3.Input cost for sand and materials base on 500 product plating media base on price.

No	The input resource	Price (Rp)
1.	Base Material such as: soil, carbon and sand	10,000,-
2.	Coffee skin and chemical	19,500,-
3.	Equipment and extra activities	140,000,-
	Total (500 products)	169,500,-
*	Total base on 100.000. products	33,900,000,-

The following data is used to find equal energy input for material compounds used with working time for 500 product of planting media. Table 3 shows the cost for resource the price of the material and extra activities that were used. The detail of component data for the tools is showed in Table 4.

3.2 Equal energy

Total energy input base on price 100,000 product is Rp. 64,100,000,-. Calculation of equal energy:

$$\text{Equal Energy} = \frac{\text{Rp. } 64{,}100{,}000,}{\text{Rp } 5{,}650,-} \boldsymbol{x}\ 42.96\ \text{MJ/Kg}$$

= 487,386.90 MJ/kg

= 487.39 MJ/ton

TABLE 4.Detail data for material base on 500 products of planting media

No	Material Used	Unit/Dose	Cost(Rp)
1.	Top Soil	3500 gr	5000,-
2.	Fine Sand - Biological - Charcoal - Sand Mount	3500 gr	5000,-
3.	Fermented Coffee Skin	3500 gr	3500,-
4.	Chemical Starter - NPK - CaCO3 - Organic Granular	 200 gr 200 gr 600 gr	 2000,- 2000,- 2.000,-
5.	Fluid Ingredients - Urine Livestock - Starter Glucose - Water Nutrition	 1000 ml 1200 ml 800 ml	 2000,- 8000,- 2000,-
6.	Print Tray	1	10,000,-
7.	Drying Tray	1	10,000,-
8.	Additional cost	1	120,000,-
	Total		171,500,-

3.3 Energy output and equal energy

The types of planting media show in Figure 5. Output energy is based on selling price of product plating media. The variation of selling price of the product wasbased on the 100,000 number of product.If it is possible to sellwith the price Rp. 1000,- per each product then the energy input price is Rp. 100,000,000,-

FIGURE 5.Samples of planting media product

Calculation of equal energy, for value of unit of rupiah price used base of 1 liter diesel with price Rp 5650 [9] with energy equal to 42.96 MJ/kg [10], then:

$$\text{Equal Energy} = \frac{\text{Rp.}100{,}000{,}000.}{\text{Rp } 5{,}650.} \boldsymbol{x}\ 42.96\ \text{MJ/Kg}$$

= 760,353.98 MJ/kg

= 760.35 MJ/ton

From the above calculation results obtained the total input energy equal to 487.39 MJ/ton and the total output energy equal to 760.35 MJ/ton.

Once can equalize the input and output energy, the next will be calculating the EPR (Energy Productivity Ratio).

$$\text{EPR} = \frac{\text{Ouput Energy}}{\text{Input Energy}}$$

$$\text{EPR} = \frac{760.35\ \text{MJ/ton}}{487.39\ \text{MJ/ton}} = \mathbf{1.56}\ \text{times}$$

Increasing the selling price of product become Rp. 1500,- per planting media will increase the value of EPR significantly. Table 5 shows the possibility to increase the EPR by increasing the selling price of the products.

TABLE 5.The EPR results base on productvariationprice.

The Product Selling Price	The EPR
Rp. 1000	**1.56**
Rp. 1500	2.35
Rp. 2000	3.12

IV. CONCLUSIONS

The input output energy in producing planting media from the Sinabung sand was obtained >1 that EPRvalue was 1.56. The EPR result indicates that the activities to produce the planting media will provide benefits. To improve EPR can be performed even better by increasing the efficiency of the use the tool and materials needs in the processing.In addition, by increasing the selling price of product planting media may increase the EPR significantly.This study can be concluded that the processing of sand Sinabung eruption into planting media meets the feasibility of production and can provide profits.

References

[1] https://id.wikipedia.org/wiki/Gunung_Sinabung
[2] D. Miller, “Rock awe IndonesianvolcanoMountSinabungspews lava ash continueseruptfourthsuccessiveday”, news/article-2787764, October, 2014, www.dailymail.co.uk
[3] B.Oskin, Ash Explosion at Indonesia's Mount Sinabung, Livescience, October 24, 2013
[4] R. Karolina, Syahrizal, M.A. Putra and T.A.Prasetyo, Optimization of the use Volcanic ash of mount Sinabung eruption as the substitution for fine aggregate, Procedia Engineeing, 2015, 125, pp. 669-675,
[5] I.S.Sembiring and I. P .Hastuty, “Sinabung Volcanic Ash Utilization As The Additive for Paving Block Quality A and B, Materials Science and Engineering”2017, 180, 012142
[6] S.E. Batchelor, E.J. Booth and K. C. Walker, “Energy Analysis of Rape Methyl Ester (RME) Production from Winter Oilseed Rape”, Industrial Crops and Products an International Journal. UK 1995, 4:2, pp. 193-202, Elsevier
[7] B. Haryanto,“StudiNeracaEnergiPembuatan Biodiesel dariMinyakSawit”, Thesis Magister, ITB,2000
[8] H. Uysal and G. Saner, “Energy balance and cost analysis for raisin production in Aegean Region in Turkey”, 39th World Congress of Vine and Wine, 2016, 7, 03020
[9] Pertamina. HargaBahan Bakar Minyak. 2016.www.pertamina.com

[10] D.Felten, N. Fröba, J. Fries and C.Emmerling, "Energy Balances and Greenhouse Gas Mitigation Potentials of Bioenergy Cropping Systems (Miscanthus, Rapeseed, and maize) Based on Farming Conditions in Western Germany", Renewable Energy an international Journal Germany:201355,160-167,Elsevi