YIELD AND ANTIOXIDANT OF SIMPLICIA FROM PEPEROMIA PELLUCIDA USING DRUM DRYER, TRAY DRYER, AND SOLAR DRYER DRYING METHOD

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Abstract: *Peperomia pellucida* is very famous as ethnomedical that has a lot of functionality because has a lot of bioactive compounds. To make a simplicia, Peperomia pellucida need to be dried. Several drying method have been developed recently with some advantages and disadvantages. Therefore, we need a suitable drying method for *Peperomia pellucida* as simplicia.Tray dryer method give the highest result on yield and antioxidant activities of dried *Peperomia pellucida.*

Keywords: Yield, Antioxidant, *Peperomia pellucida,* Simplicia, Drum dryer, Tray dryer, Solar dryer

I. INTRODUCTION

The genus Peperomia is the second largest in the Piperaceae family and comprises more than 600 species widely distributed in Indonesia (Heyne, 1982). This plant known as *sasaladaan* or *suruhan* in Indonesian. *Peperomia pellucida* is very famous as ethnomedical that has a lot of functionality such as to cure asthma and gastric ulcers, inflammation, and exhibit analgesic and also has antibaterial activities (Aziba et al., 2001). The plant is also used for the treatment of fever, contused wound and skin diseases (Hutapea, 1994). The functionality of *Peperomia pellucida* made phytochemical studies on the genus Peperomia increased. Those studies have revealed the presence of a variety of compounds with interesting biological activities, such as flavonoids (Mota et al., 2011), terpenes, arylpropanoids, phenolic compounds (Li et al., 2003) and essential oils (Zoghbi et al., 2005). Those phytochemical reported have antibacterial and analgesic activities on *Peperomia pellucida* (Khan and Omoloso, 2002) and some other studies reported the isolation of bioactive phytoconstituents with strong antifungal and anticancer properties from *Peperomia pellucida* (Xu et al., 2006). Therefore, this plant is very interesting to be explore as natural medicine to cure several diseases. Untill now people think *Peperomia pellucida* is parasite and known as an unwanted plant. This plant is easily to grow everywhere including in yard, or in wet rock crevices, and can be found in whole area in Indonesia (Heyne, 1982). Accordingly, *Peperomia pellucida* has a good opportunity to be used in mass production as alternative medicine.

The preparation of mass production to make an alternative medicine or simplicia, *Peperomia pellucida* need to be dried to prolong self life so it can be easily to storage. Several drying methods have been develop recently, which have each advantages and disadvantages. So we need a suitable drying method for *Peperomia pellucida* as simplicia.

Drying is one of the oldest and a very important unit operation, it involves the application of heat to a material which results in the transfer of moisture within the material to its surface and then water removal from the material to the atmosphere (Akpinar and Bicer, 2005). According to Klemes et al. (2008), there are over 200 dryer types which can be used for different purposes. Also, the drying features for pressure, air velocity, relative humidity, and product retention time vary according to the material and method of drying. During the drying operation phys- ical, structural, chemical, nutritional changes in the vegetables may occur, and that can affect the quality attributes like texture, color, flavor and nutritional value (Di Scala and Crapiste, 2008).
Kudra and Mujumdar (2002) reported that conventional technologies are still widely preferred industrially as compared to novel technologies. This is for multiple reasons, which include simplicity of dryer construction, ease of operation, as well as the status of familiarity (Araya-Farias and Ratti, 2009). One of conventional drying method is solar dryer.

Over time, the models developed have been used in calculations involving the design and construction of new drying systems, optimization of the drying process, and the description of the entire drying behavior including the combined macroscopic and microscopic medium of heat and mass transfer. Thus, it is important to understand the basic idea of modeling the drying kinetics of fruits and vegetables. The drying conditions, type of dryer, and the characteristics of the material to be dried all have an influence on drying kinetics. The drying kinetics models are therefore significant in deciding the ideal drying conditions, which are important parameters in terms of equipment design, optimization, and product quality improvement (Giri and Prasad, 2007). Tray

and drum dryer are the examples of this drying methods.The hot air convective-dryer with tray is the most frequently used method for vegetables or plants sample. Although this method shows operation simplicity and low costs, it leads to products with low quality (Shuhama et al., 2003). Tray dryer also the device used the drying of the wet products of the crude drugs, chemicals, powders or the granules etc.Tray dryer known as indirect solar type dryer. Control of the process is simpler (especially for drying with forced air circulation). Tray dryer has a drying chamber separated from the collectors facilitates the work of loading and unloading and handling of the product. Since the drying chamber is opaque, this system allows dry convenient products that may harm or losing quality of appearance by a direct exposure to the Sun (Finck-Pastrana, 2014).

Drum dryer is a cylindrical dryer. This dryer is used specifically for drying the liquid material derived from agricultural products, such as fruit juice, soy milk, and others. Materials were dried with drum dryers in the form of slurry or solution. The drum rotates on a horizontal axis and is heated internally with steam or other heating medium (Brennan, 1974). Drum dryer consists of two types, namely single drum and double drum. Double drum drying is widely used for drying food products that will be processed into flour. This drying method is direct contact with the drum, before drying begins it has to change the product form to a liquid solution, suspension, and pasta with a certain viscosity only that can be dried. Double drum dryer consists of two hot hollow drums and they were passed by a steam as heating medium. This dryer produce porous and high quality product but sometimes generate browning on products when the raw material cannot stand the hot surface. Thus, it requires filler to prevent browning, to prevent loss of vitamin, color, aroma and other heat-sensitive substances (Setyadjit and Sukasih, 2015). The using of tray dryer and drum dryer expected to make a better result for drying process of *Peperomia pellucida* than conventional drying method such as solar dryer. We are using yield and antioxidant activities to determine wich drying methods is suitable for drying process of *Peperomia pellucida* as medicine.

II. DETAILS EXPERIMENTAL

2.1. Plant Materials

Peperomia pellucida was collected in February 2017 in the locality of Bogor, West Java, Indonesia. Its identification was confirmed by comparison with an authentic voucher of *Peperomia pellucida.*Wet *Peperomia pellucida* then keep in refrigerated condition until it used. Right before drying *Peperomia pellucida* leaves and stems were rinse by flow water and chopped into small pieces.

2.2. Drying method

2.2.1. Solar Dryer

The drying experiments of *Peperomia pellucida* in solar dryer were carried out at room temperature of 30˚-35˚ C for 4 days and each day for 6 hours. Each drying assay was carried out in replicate. The sample was dried until the commercial moisture content (lower than 10%, wet basis). After experiments, the dried samples were ground in a mill, then the samples were packed in plastic bags and stored at ambient temperature.

2.2.2. Tray Dyer

The drying experiments of *Peperomia pellucida* in tray dryer were carried out at air temperature of 65˚ C and air velocity of 2.0 m s^{-1} for 2 hours (Krokida et al., 2003 modifikation). Each drying assay was carried out in replicate. The sample was dried until the commercial moisture content (lower than 10%, wet basis). After experiments, the dried samples were ground in a mill, then the samples were packed in plastic bags and stored at ambient temperature.

2.2.3. Drum dryer

The drying experiments of *Peperomia pellucida* in drum dryer were carried out at air temperature of 120˚ C for 30 minutes. Each drying assay was carried out in replicate. The sample was dried until the commercial moisture content (lower than 10%, wet basis). After experiments, the dried samples were ground in a mill, then the samples were packed in plastic bags and stored at ambient temperature.

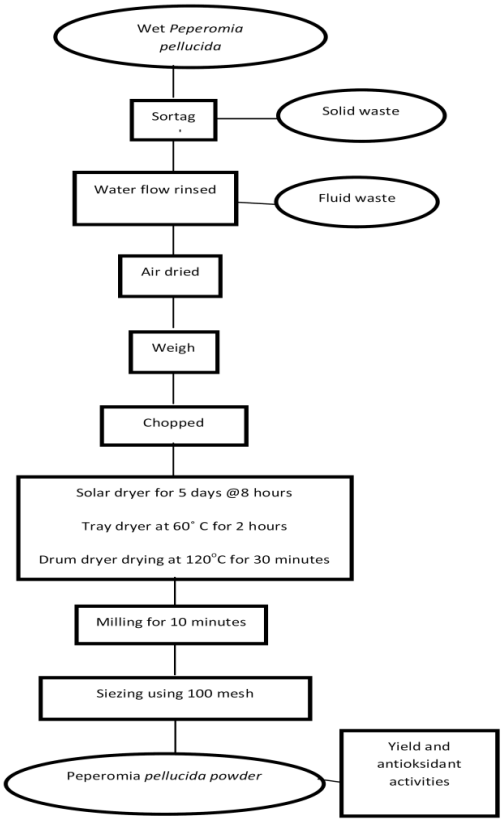

Figure 1. Research chart flow of *Peperomia pellucida* drying methods.

2.3. Analysis

2.3.1. Yield

Yield measurement was done by comparing the intial and end weight. Equation to calculated the yield was as follow :.

$$\text{Yield (\%)} = \frac{\text{W initial}}{\text{W end}} \times 100\%$$

2.3.2. Antioxidant activities (ABTS assay)

This assay was based on the ability of different substances to scavenge 2,2'-azino-bis ethylbenzthiazoline-6-sulfonic acid ($ABTS^{+}$) radical cation. The radical cation was prepared by mixing 7 mM ABTS stock solution with 2.45 mM potassium persulfate (w/v) and leaving the mixture 4-16 h until the reaction was complete and the absorbance was stable. The $ABTS^{+}$ solution was diluted using ethanol until obsorbance 0.700 $\pm$ 0.05 at 734 nm for measuremente. The photometric assay was conducted on 0.9 mL of $ABTS^{+}$solution and 0.1 mL samplemixed for 45 second then determined at 734 nm after 15 minutes. The antioxidant activities was calculated using standard trolox, where the result will be in mM trolox equivalent (Re et al., 1999).

2.4. Data analysis

Results represent the mean±standard deviation (SD), based on triplicates for each parameter. Statistical differences between groups were analyzed by a simple one-way analysis of variance (ANOVA) followed by Tukey's multiple comparison using an SPSS software version 17. Differences were considered significantly different if $p < 0.05$ ($\alpha = 0.05$).

III. RESULTS AND DISCUSSION

3.1. Yield of *Peperomia pellucida* by different drying methods

The result of yield *Peperomia pellucida* by different drying methods can be seen in figure 2. It showed that the highest yield among all drying treatments was tray dryer, and the lowest yield was obtained by drum dryer.

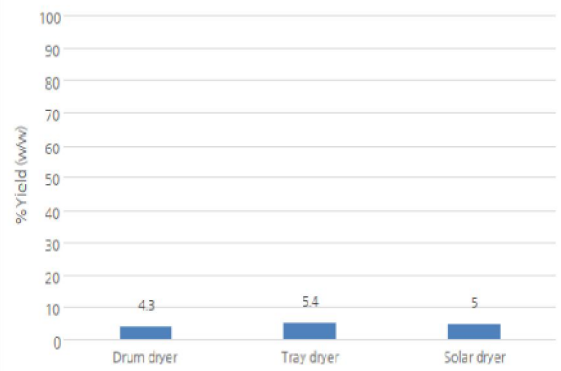

Figure 2. Yield of *Peperomia pellucida* using different drying methods

In statistically showed that tray dryer and solar dryer resulted unsignificantly diferences yield. On the other hand, drum dryer resulted significantly difference between tray dryer and solar dryer. Its because drum dryer methods suitable for slurry sample, which in this reaserch the sample form was small size of leaves and stems. On drum dryer, a lot of sample were wasted so the yield become decrease significantly.

It is known that *Peperomia pellucida* has high water content. As reported by Ooi et al. (2012), the moisture content of fresh whole plant *Peperomia pellucida* was found to be 93.14%, contributed by the bulk tissue weight of fleshy and succulent stem. Therefore the yield of dry *Peperomia pellucida* among different drying method were bellow 5%.

3.2. Antioxidant activities of *Peperomia pellucida* by different drying methods

Peperomia pellucida has high antioksidant activities. These activities were resulted since *Peperomia pellucida* contain a lot of bioactive compounds such as alkaloid, esential oil, tanin, terpenoid and so on. As reported by Weil et al. (2011), the percentage of inhibition on radical compounds slightly increased as the concentration of plant extract increased. The result of antioxidant activities by *Peperomia pellucida* using different drying method can be seen on table 1 bellow.

Table 1. Antioxidant activities dried *Peperomia pellucida* using different drying methods

Drying method	Antioxidant activities (mM trolox eq./100g sample)
Drum dryer	1221
Tray dryer	1561
Solar dryer	1460

Data antioxidant activities in table 1 showed similiar result with yield, which tray dryer and solar dryer obtained higher antioxidant activities than drum dryer method. It can caused by drum dryer method using higher temperature than other method, which up to 100˚ C. Thus, bioactive compounds, which have high antioxidant, were degradation.

The research using different drying method also have been done by Mohammad et al. (2015) showed different drying method used in their study, which is air dried and freeze dried, did not affect the antioxidant and antimicrobial activity and chemical constituents of *Peperomia pellucida*. Therefore, the using of room until cold temperature were suitable to drying *Peperomia pellucida* and protect high antioxidant activities bioactive compounds inside it. From this research also we can conclude that bioactive compounds from Peperomia pellucida were sensitive on high temperature.

This reserach give benefit for people in small medium industry as they do not need to use an expensive machine such as freeze dryer or drum dryer to dry the

Peperomia pellucida. They just can used air dried such as solar dryer or to control the temperature also can use tray dryer, which is cheaper and also can preserved their chemical constituent and their biological activity comparable to drum dryer method.

CONCLUSIONS

Tray dryer method give the highest result on yield and antioxidant activities of dried *Peperomia pellucida.* Bioactive compounds in *Peperomia pellucida*, which have high antioxidant activity, were sensitive to high temperature thus drum dryer method give the lowest antioxidant activities. It suggested using solar or tray dryer method to drying *Peperomia pellucida.*

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