

Utilization Of Agung Semeru Banana Peel Extract As Natural Hand Sanitizer

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ABSTRACT

Hand sanitizers generally contain Ethyl Alcohol 62%, softener, moisturizer and anti-bacterial compounds such as tryclosan, glycerol, tannin, saponins and other antimicrobial agents. This study aimed to determine the effect of Agung Semeru banana peel extract as a natural hand sanitizer to inhibit fungal growth of *Candida albicans*. The antifungal activity test is carried out using the disk diffusion method. The use of this method is shown to measure the diameter of the area of resistance that occurs around paper discs that already contain antifungal in accordance with the concentration in each treatment. The results showed that Agung Semeru banana peel is effective as a natural Hand sanitizer that was indicated by differences in treatment. Utilization of Agung Semeru Banana peel Extract as a natural basic material hand sanitizer showed that no significant difference between treatments in inhibiting the growth of fungi *Candida albicans*, but a concentration of 7% ($1,315 \pm 0.0035^c$) showed better results compared to a concentration of 1% (1.2 ± 0.0^a); concentration of 5% ($1,208 \pm 0,0023^b$) and 0% ($1.2 \pm 0,0^a$).

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Introduction

Infectious diseases in the digestive tract are caused by several factors, one of which is by pathogenic microorganisms such as *Candida albicans* which can indirectly enter the human digestive tract through the mouth (Rosenthal, 2005). *Candida albicans* is a type of yeast pathogenic fungus most found in the digestive tract, skin surface and in the female reproductive tract which often results in excessive vaginal discharge and odor (Hawkins, 2011; Zubier *et al.*, 2010). In addition, *Candida albicans* is also able to form biofilms that can carry out the process of host cell invasion and has the ability to be resistant to antifungal compounds

(Kusumaningtyas, 2015). One effort to prevent diseases caused by *Candida albicans* is by providing antifungal which can inhibit and disrupt the growth of *Candida albicans* (Febriani, 2014).

Various studies have been carried out to reduce the prevalence of disease caused by pathogenic microorganisms, one of which is by maintaining hand hygiene through washing hands using soap which is proven to reduce the number of microorganisms that cause disease (Rachmayanti, 2013). Along with the busyness of the community, various soap replacement innovations have been found such as hand sanitizers which contain

antiseptic compounds and are used to kill pathogenic microorganisms in the hands and inhibit the growth and metabolic activity of microbial disease (Radji *et al.*, 2012).

Use of handsanitizer too much over time makes the skin dry, because it contains alcohol, so it needs the addition of moisturizer and emollient substances that make the skin stay soft. In addition, alcohol content as a basic ingredient in hand sanitizers causes skin and eye irritation (Retnosari, 2007) due to the highly flammable nature of alcohol (Dyer *et al.*, 2000). Recent research revealed that the use of alcohol-based hand sanitizers from chemicals turned out to have a considerable impact on health, in addition to flammable alcohol-based hand sanitizers can also increase the risk of viral infections that trigger inflammation of the digestive tract (Fadhilah, 2017). Therefore we need other alternatives that are friendly and safe for the environment, especially the skin with the basic ingredients of natural hand sanitizer one of which is by using the Agung Semeru banana peel extract of Lumajang variety.

Banana variety of Agung Semeru Lumajang is one type of banana found in Lumajang Regency, East Java. The characteristics of Agung Semeru banana varieties can be seen from the color of the stems (bright red), the formation of unique fruit, the number of tillers 1-2 tillers / clumps, in addition to the size of large fruit (around 19 cm) and length (33-36 cm), the number of comb 1-2 comb / bunch with a weight of 10-20 kg / bunch (Prahardini, 2010).

According to Sari (2017) the potential content of phytochemical compounds found in the peel of Agung Semeru banana Lumajang are phenolic, terpenoids, saponins, and alkaloids. This is also supported by research by Ehiowemwenguan *et al.* (2014) which states that banana peels contain glycosides, alkaloids, saponins, tannins, flavonoids, terpenoids and phenols which can inhibit the growth of pathogenic microbes.

Various researches on the potential of Agung Semeru banana variety Lumajang peel extract have been widely carried out, one of which is used as a herbal skin cream formulation from Agung Semeru banana peel (Sari *et al.*, 2017), but no research has been done that utilizes Agung Semeru banana peel extract Lumajang varieties are natural ingredients for making hand sanitizers. Therefore, this research aimed to determine the effect of Agung Semeru banana peel extract as a natural hand sanitizer to inhibit fungal growth of *Candida albicans*.

Materials and Methods

This research is an experimental study conducted at the Biology Laboratories of FPMIPA IKIP PGRI Jember which uses a Completely Randomized Design (CRD) with various concentrations of treatment 0%, 1%, 5%, 7% (Aponno *et al.*, 2014). Data obtained by direct observation and counting techniques. Observation was carried out to observe or find out whether Lumajang banana peel was effective as a natural hand sanitizer and counting was done to determine the diameter of the inhibitory zone of *Candida albicans* growth.

Tools and Materials

The tools used in this study are: a set of maceration tools, rotary evaporator, waterbath, autoclave, Laminar Air Flow (LAF), analytical scales, ose needles, incubators, petri dishes, test tubes and tube racks, measuring cups, Erlenmeyers, stirrers, and tube racks, sonicator baths, freeze dryer, stirrers. The materials used are: peel of Agung Semeru banana variety Lumajang, *Potatoes Dextrose Agar* (PDA), spiritus, cotton, Aluminum foil, sterile distilled water, markers, label paper, 70% alcohol, tissue, wood paper, rubber bands, physiological salts and fungi *Candida albicans*.

Sterilization of Tools and Materials

All tools and materials to be autoclaved are washed and dried first, Erlenmeyer's mouth, test tube and measuring cup are covered with cotton, while the petri dish,

tube rack is wrapped in wood paper, then put into the autoclave at 121°C and a pressure 1 atm with time for 1 hour (Manan and Kharisma, 2012)

Preparation of Banana Peel Extract

Semeru banana peel is cleaned and then cut into small pieces, aerated until slightly dry, after drying then mashed by way of ground and then sieved with a 10 mesh sieve to obtain a dry simplicia of Semeru banana skin variety Lumajang, after that weigh as much 150 g. Then the simplicia was put into Erlenmeyer and dissolved with 1125 mL of sterile Aquades with a ratio of 1: 7: 5. Then the solution is stirred until homogeneous and put into an ultrasonic cleaning bath with a frequency of 42 KHz and left for \pm 2 hours (Fuadi, 2012). The extraction results are then filtered using filter paper to get pure liquid extract. The liquid extract was then put into a freeze dryer for \pm 1x24 hours (Sari *et al.*, 2018; Zakiyah *et al.*, 2017) to obtain a dry extract of Semeru banana peel. The peel extract was further diluted back into 4 concentrations namely 0%, 1%, 5%, 7%.

Preparation of Gel Hand Sanitizer basis Na-CMC

The heated water is put in a beaker (homogenizer), then enter the Na-CMC, let it rise for about 15 minutes, while stirring until it thickens slightly. Add propylene glycol, glycerin and distilled water, stir until it forms a gel. Then enter the banana peel extract dissolved in beaker glass and stir until homogeneous, mixed using low-speed homogenizer until thick and homogeneous (Hasyim *et al.*, 2012).

Gel Formulation Of Banana Agung Semeru peel Extract

For the manufacture of the Agung Semeru banana peel extract formulation follows the standard. According to Hamzah *et al* (2007), making the standard formula of Hand Sanitizer with banana peel extract has a percent increase (%). So that from the formulation obtained by Agung Semeru banana peel extract with various concentrations of 0%, 1%, 5%, and 7% concentration.

Preparation of PDA Media

Total of 20 g of PDA (*Potatos Dextrose Agar*) was dissolved in Erlenmeyer with 500 ml distilled water. Heated on a hot plate while stirring until the solution becomes homogeneous. Homogeneous medium was sterilized in an autoclave at 121°C, 2 atm pressure for 15 minutes. (Sari *et al.*, 2017).

Fungal Subculture

The medium PDA which has been sterilized in an autoclave, is then poured into several test tubes that have been sterilized and tilted and then left to harden. Fungi colonies were taken from pure cultures that were available, carried out aseptically with an ose needle and etched on the media so that it was tilted and then incubated in an incubator (Rostinawati, 2009).

Antifungan Activity Measurent of Hand Sanitizer

The antimicrobial activity test was carried out using the diffusion method, on PDA medium. 1 ml mircobial suspension were inoculated, then poured into a petri dish. Then the paper disk / disk paper that has been immersed in a gel solution mixed with banana peel extract with a concentration of 0%, 1%, 5%, and 7%, respectively, are placed in a petri dish which contains PDA and microbial suspense media. Incubated 2x24 hours at 37°C, then observed and measured the area of inhibition formed (Sari *et al.*, 2018).

Data Analysis

The parameters observed in this study are the diameter of fungal growth inhibition of *Candida albicans* (cm), then the data previously will be tested using homogeneity, normality, then continued to Kruskall Wallis test at 95% ($\alpha = 0,05$) using SPSS version 23

Results and Discussion

Results

The results of the diameter of the inhibitory growth zone of *Candida albicans* at various concentrations of Agung Semeru banana peel extract as a natural Hand Sanitizer material using the *Kurskall Wallis*

5% showed that there is a significant difference (Table 2, Figure 2).

Table 1. Average of inhibition zones of *Candida albicans* (cm) at various concentrations of Agung Semeru banana peel extract of Lumajang variety

Concentration of Banana peel extract of Agung Semeru Variety Lumajang	Average of inhibition zones of <i>Candida albicans</i> (cm)
0% (Kontrol)	1,200 ± 0,0000 ^a
1%	1,200 ± 0,0000 ^a
5%	1,208 ± 0,0023 ^b
7%	1,315 ± 0,0035 ^c

Table 2. Kruskal-wallis test's

Clear Zone Diameters	
Chi-Square	18.363
Df	3
Asymp. Sig.	.000

Description: Asymp Value. Sig = 0'000 α (0.05) means that there is a difference between treatments for the diameter of the growth inhibition zone

Statistical testing of the utilization of a natural hand sanitizer was performed using

Table 3. Formulation of Hand Sanitizer

Formulation Gel of Hand Sanitizer	Concentration Of Banana Peel extract (%)			
	0	1	5	7
Extract (gr)	0	0,25	1,25	2,25
Na-CMC (gr)	1,25	1,25	1,25	1,25
Glycerin (gr)	2,5	2,5	2,5	2,5
Propilen-glikol (gr)	1,25	1,25	1,25	1,25
Aquadest (mL)	25	25	25	25

After 4 weeks of observation, it showed that there was no change in the liquid contained in the hand sanitizer. this shows that the gel has been made quite stable which causes no chemical changes to the handsanitizer components. However, storing the handsanitizer at a temperature of more than 370C causes the liquid to easily undergo oxidation to change color and become more liquid. The gel component contained in the handsanitizer at cold temperatures causes the handsanitizer gel formula to be more stable than at hot temperatures.

the *Kruskall Wallis* level at 95% ($\alpha = 0,05$) (Table 2) due to the Homogeneity and Normality Test results that the diameter of the *Candida albicans*.

The antifungal activity test of Agung Semeru banana peel extract as a natural Hand sanitizer was carried out on *Candida albicans* fungi, with different concentrations. The results of antifungal activity test of Agung Semeru Hand banana peel extract natural sanitizer can be seen in Figure 2, wich there are differences in inhibition zone diameter in each treatment.

The formulation of hand sanitizer made from Agung Semeru banana peel extract (Table 3) produced will then be organoleptically tested with all concentration treatments (1%, 5% 7%) with the result in the form of pH 6 (adjusted to the pH on the market), has forms such as gel / semisloid, clear brown color due to Agung Semeru banana peel extract is slightly brownish in color and has a distinctive aroma of banana peel because it is not added with synthetic aroma.

The antifungal activity test is carried out using the disk diffusion method which is marked by the formation of a clear zone around the disc paper. The use of this method is shown to measure the diameter of the area of resistance that occurs around paper discs that already contain antifungi in accordance with the concentration in each treatment. Agung Semeru banana peel extract as a natural Hand sanitizer was tested on *Candida albicans* using PDA (Potatos Dextrose Agar) and 1.2 cm diameter paper discs on petri dishes, shown in Figures 1 and 2.

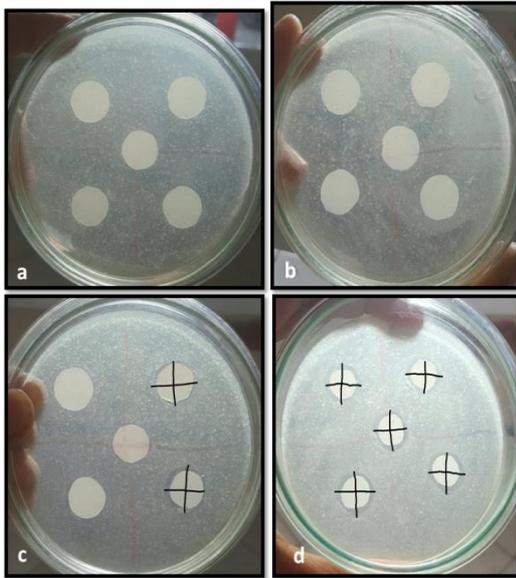


Figure 1. Test results of antifungal activity of Agung Semeru banana peel extract as a natural Hand sanitizer against *Candida albicans* fungi at each treatment concentration 0% no clear zone, 1% concentration no clear zone, 5% concentration in petri dish (C) = 1, 21 cm (clear zone), and 7% concentration in petri dishes (B) averaged = 1.32 cm (clear zone), in petri dishes (C) averaged = 1.315 cm (clear zone).

Based on analysis results and concentration graphs (Figure 2) shows that the higher the concentration, the greater the diameter to inhibit the *Candida albicans*. A concentration of 1% (1.2 ± 0.0^a) showed no significant difference with a concentration of 0% (1.2 ± 0.0^a) and a concentration of 7% (1.315 ± 0.0035^c) was the greatest concentration.

Discussions

Based on the results of statistical tests using Kruskal-wallis in the antifungal test of the banana peel extract of Agung Semeru variety Lumajang as a natural hand sanitizer has the effectiveness to inhibit the *Candida albicans*, this is indicated by the presence of inhibition zones or clear zones formed in the area around disc paper (Figure 1).

Based on the average statistical test, there was a significant difference between treatments even though the 1% concentration did not differ from the control concentration of 0% (figure 2, table 1). This

is probably due to the soaking of paper disks that are too fast so that it affects the inhibitory growth of *Candida albicans*. The results of the average inhibition zone diameter is at a concentration of 7% can increase the inhibition of fungi, as evidenced at an average concentration of 7% DHP which is 1,135 cm greater than the concentration not given extract or control that is equal to 1,200 cm. So this shows that the higher concentration of banana peel extract as a hand sanitizer shows the greater inhibitory diameter results (Figure 2). This shows that the higher the concentration of banana peel extract as a hand sanitizer, the greater the diameter of the zone of inhibitory growth of pathogenic microbes (Kholifah, 2017).

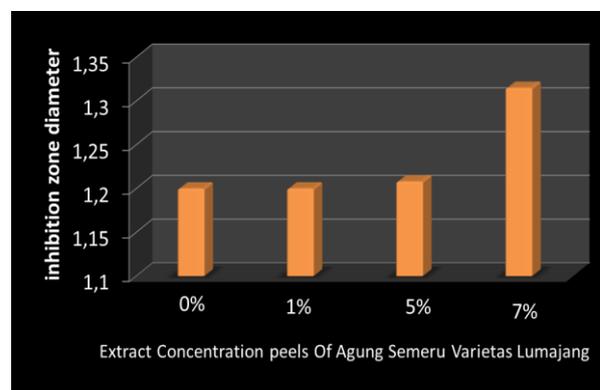


Figure 2. Diameter of growth inhibition zone (cm) Agung Semeru banana variety Lumajang peel extraction against *Candida albicans* at various concentration treatments

Even though the addition of the Agung Semeru banana peel did show a significant difference between treatments, the mean diameter of the *Candida* (Table 1) did not show too much difference. Agung Semeru banana peel extract contains secondary metabolite compounds such as are phenolic, terpenoids, saponins and alkaloids (Sari, 2017).

The results of the average diameter of the inhibition zone to grow *Candida albicans* produced are not very visible, this is likely influenced by several factors such as the extraction method, the type of solvent

used and the sample concentration (Tyasrini, 2006).

In addition, *Candida albicans* are a type of fungi that have virulent pathogenic causes and have morphological and tissue adhesion abilities so that they are more resistant to the administration of antifungal compounds contained in Agung Semeru banana peel extract of Lumajang variety.

Hand sanitizer is an antiseptic product that has an active ingredient in the form of 70% alcohol, so it can reduce the number of bacteria when used. As an antiseptic alcohol has the advantage of being volatile, so it does not require a long time to dry when applied on the hands. But this also becomes a weakness, because its effectiveness is only in the short term, so that bacteria can only be reduced in a short time after the use of antiseptics.

Hand sanitizer uses natural ingredients of Agung Semeru banana peel extract which has antifungal ability, as evidenced by the inhibition zone diameter at the highest concentration treatment. The antifungal effect on the hand sanitizer is due to the banana peel containing phytochemical compounds, namely phenolic, terpenoids, saponins and alkaloids (Sari and David, 2017). The mechanism of action of saponins by reducing the surface tension of cell membranes resulting in increased cell permeability or leakage and causing intracellular compounds to come out (Saroja *et al.*, 2012).

In addition, Saponin is a secondary metabolic compound that has an antiseptic function so that it is capable of being an antibacterial. Saponin compounds will form complex compounds with cell membranes through hydrogen bonds, so that the permeability properties of cell walls can be destroyed and cause cell death (Nur, 2013). Research conducted by Dinastuti (2015) that banana peel extract contains several active compounds that can be useful as antifungal, where the active compounds can affect the structure and function of *Candida albicans* cells such as cell walls and cell membranes.

The mechanism of action of alkaloid compounds is by disturbing the peptidoglycan component in the cell so that the cell wall layer is not fully formed, causing cell death (Saraswati, 2015). Phenol compounds are a group of tannin compounds and have natural antimicrobial activities that work by interacting with microbial cells through absorption processes that involve hydrogen bonds so that they can disrupt the mechanism of action of active transport on cells (Saefudin *et al.*, 2011).

The inhibitory response based on the inhibition category according to Greenwood (1995 in Fitri 2010) is as follows: Diameter of the inhibition zone ≤ 10 mm is categorized as very small in inhibiting the growth of the tested microbes (N), diameter 11-15 mm is categorized as weak (W), diameter 16-20 mm as medium (M) and a diameter > 20 mm as strong (S). The results of this study indicate that the peel extract of Agung Semeru banana has a strong ability (S) to inhibit the growth of *Candida albicans* (Table 1). really able to inhibit *Candida albicans*.

Conclusion

Utilization of Agung Semeru Banana peel Extract as a natural basic material hand sanitizer showed that no significant difference between treatments in inhibiting the growth of fungi *Candida albicans*, but a concentration of 7% ($1,315 \pm 0,0035^c$) showed better results compared to a concentration of 1% ($1,2 \pm 0,0^a$); concentration of 5% ($1,208 \pm 0,0023^b$) and 0% ($1,2 \pm 0,0^a$).

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