**Antibacterial Effectivity Test of Banana Peel and Banana Bud Extract of Muli Banana (*Musa acuminata*) Against Growth of *Echerichia coli***

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**ABSTRACT**

Banana peel and banana bud is one part of banana plant can be used as an antibacterial because it can inhibit microbial activity. The aim of this study was to know the antibacterial potency of banana peel and banana bud extract of Muli banana (*Musa acuminata*) on growth of *Escherichia coli* bacteria. The antibacterial activity was monitored by using agar diffusion method on Nutrient Agar medium with 24 hour incubation period. The diameter of the inhibitory area formed was measured using a caliper. The antibacterial activity test was done with descriptively qualitative. The results showed that banana peel and banana bud extract of Muli banana had potential as antibacterial to *Echerichia coli* bacteria. Banana peel extract of Muli banana was able to inhibit the growth of *E.coli* bacteria with the diameter of inhibitory area 6.45 mm, and banana bud extract of Muli banana was able to inhibit the growth of *E.coli* bacteria with the diameter of inhibitory area 5.63 mm with medium antibacterial activity.

**Keywords:** *Antibacterial, banana peel and banana bud, Musa acuminata, and Echerichia coli*

**INTRODUCTION**

Indonesia is one of country that has a lot of banana that makes Indonesia as one of the biggest banana exportir. One kind of banana that we often found that is Muli banana (*Musa acuminata*). Bananas are the world's major agricultural products are grown and consumed by more than 100 countries whos tropical and sub-tropical (Heslop-Harrison and Schwarzacher (2007) in Nur et al., (2013)). The results showed that phytochemical analysis banana is contained of whose katekulamin, serotonin and depamin (Waalkes et al., 1958), carbohydrates (Anhwange 2008), saponins, tannins, alkaloids, phenols, flavonoids and quinones (Sarasawati, 2015).

Banana plant is one kind of plant is known to be used an antibacterial because it can be inhibitor for microbial activity. Banana plant consists of several parts, roots, stems, leaves, flowers/banana bud, and fruit. The utilization banana produced wastes become problems for environment, especially the banana peel there is 40% of the total weight of banana is peel that can not be used optimally (Nagarajaiah and Prakash, 2011). Banana peel itself has non-nutritional content of polyphenols and flavonoids (Lee et al., 2010). While banana bud contains alkaloid compounds, saponins, tannins, flavonoids and total phenols (Mahmood et al., 2011). Polyphenols compounds are potential source of antioxidants and antimicrobials to most of the pathogenic bacterias, and potential agents to prevent disease (Karou et al., 2005). Tannin and saponins can be used as an antiseptic (Djulkarnain, 1998), as well as antibiotics (Priosoeryanto et al., (2006) in Nur et al., (2013)). This compounds can inhibit the growth of bacteria and also can be kill pathogenic bacteria one of them is *Echerichia coli* bacteria.

*Escherichia coli* bacteria is a group of spoilage bacteria damaged fresh food into rotten and can produce toxins (Djaafar and Rahayu, 2007). Foodstuff are often contaminated by *E.coli* there are chicken, beef, pork meat during slaughter, seafood, eggs and dairy products, vegetables, fruits, juices, and milk. The impact of *Echerichia coli* bacteria can be appear many diseases there are diarrhea, urinary tract infections, pneumonia, and meningitis for baby (Karsinah et al., 1994). Based on World Health Organization (WHO) data there are 2 billion cases of diarrhea in adults worldwide every year. In the United States, the incidence of diarrhea cases reaches 200 million to 300 million cases per year (Amin, 2015). The morbidity survey conducted by the Ministry of Health from 2000 to 2010 showed that an increase in cases of diarrheal diseases, ie in 2000 Diarrhea 301/1000 population, in 2003 rose to 374/1000 population, in 2006 rose to 423/1000 population and in 2010 that is 411/1000 inhabitants (Bakri et al., 2015).

Based on the above reviews, can be known that *Echerichia coli* bacteria pathogens can cause infection and cause some cases of disease in humans. Previously been found compounds contained by Kepok banana peel (Musa balbisiana) capable of inhibiting the growth of Propionibacterium acne causes acne disease (Saraswati, 2015) and the compounds contained in yellow kepok banana bud (Musa paradisiaca Linn.) was able to work as an antibacterial against *S. Aureus* and *E. coli* (Ningsih et al., 2013). This study uses banana peel extract and banana bud extract (Musa acuminata) to determine the effect of antimicrobials that can inhibit the growth of *Escherichia coli* bacteria is one of the bacteria that is known as the cause of infectious diseases in humans.

**MATERIALS AND METHODS**

**Materials and tools**

The materials used are banana peel and banana bud of Muli banana, *Echerichia coli* bacterial culture, 70% alcohol, 96% ethanol, aluminum foil, cotton, paper Wattman, H2SO4, BaCl2, NaCl physiological, and media Nutrient Agar (Oxoid). The tool used are an analytical balance, pan, oven, vacuum rotary evaporator, hotplate, laminar air flow, petri dish (Normax), test tubes, test tube rack, vortex, autoclaves, incubators, micropipette, pipette, caliper, Erlenmeyer (Pyrex), Beaker glass, measuring cylinder, tweezers, and spatula.

**Research methods**

Preparation of peel extract and Muli banana bud was done by maceration method using 96% ethanol solvent and we got viscous extract. Banana peel extract and banana bud extraxt are dripped on disc paper until saturated condition and then put on medium Nutrient Agar solid which has been added bacteria suspense. The antibacterial activity was monitored by using agar diffusion method on Nutrient Agar medium with 24 hour incubation period at 37°C. The diameter of the inhibitory area formed was measured using a caliper. The antibacterial activity test was done with descriptively qualitative.

**RESULTS AND DISCUSSION**

The results of antibacterial activity test showed that banana peel and banana bud extract of Muli banana had antibacterial activity against *Echerichia coli* bacteria. Antibacterial activity of banana peel extract of Muli banana was indicated with clear zone formation around the disc paper. The clear zone area formed by banana peel extract was 5.63 mm (Figure 1A) while banana bud extract was 5.63 mm (Figure 1B) . On disc paper with negative control treatment there was no clear zone (Figure 2). According to Pradana (2013) in Saraswati (2015), based on clear zones antibacterial activity can be classified into several groups: the weak antibacterial activity (clear zone <5 mm), medium (clear zone between 5-10 mm), strong (zones between 10-20 mm), and very strong (inhibit zone> 20 mm). The clear zone formed by Muli banana peel extract and Muli banana bud was categorized as medium antibacterial activity.



 A B

Fig 1. Apperance of clear zone around disc paper

formed by Muli banana peel extract (A), Muli banana bud extract (B),



Fig 2. Apperance negative control treatment around disc

 paper

Research conducted by Saraswati (2015), showed that banana peel extract can inhibit the growth of *Staphylococcus aureus* bacteria with clear zone area was 12.4 mm. The difference clear zone area in this study with that done by Saraswati (2015) , is caused by the plant variety and type of bacteria used. This study used Muli banana peel extract and *Echerichia coli* bacteria, while performed by Saraswati (2015) used Kepok banana peel extract and *Staphylococcus aureus* bacteria. *Staphylococcus aureus* bacteria, included bacteria group of Gram-positive cell wall composed of polar peptidoglycan so it was easily penetrated by polar compounds, whereas Gram-negative bacteria (*Echerichia coli*) cell wall structure consists of three components (lipoprotein, lipopolysaccharide, and lipids) so hard to penetrate. This statement was reinforced by Nur et al., (2013) that porin in lipoproteins in the outermost membrane of Gram-negative cell wall bacteria have a hydrophilic characteristic that causes molecular components not easily to enter in bacterial cells.

Research conducted by Ningsih et al., (2013) showed that banana bud had an antibacterial potency to inhibit the growth of *E. coli* bacteria with clear zone was 11.4 mm at concentration of 200 mg / ml. The difference clear zone diameter in this study with that done by Ningsih et al., (2013) is caused by several things, among which was different bacterial strains and plant varieties used. Different bacterial strain will have different effects in fight against antibacterial substances even though belong to the same species. Research conducted by Poeloengan et al., (2007) showed that there was difference clear zone between isolated bacteria and ATCC bacterial isolates even though it was from the same bacterial species. Similarly, different plant varieties also affected type and quantity of antibacterial produced. According to Babu et al., (2012) in Saraswati (2015) is known that four different varieties of banana plants have different phenols, polyphenols and alkaloids.

Factor that also affected weak or no ability to suppress bacterial growth by banana peel extract and banana bud extract on growth of *E. coli* was the concentration suspension of bacterial pathogens that resisted quite high (in accordance with the standards of Mc. Farland 0.5) i.e 1.5x108 CFU/ml. According to Fardiaz (1989) in Saraswati (2015), the ability of an antimicrobial agent is influenced by several factors, one of which was microbial properties which include type, concentration, age and microbial state.Several studies on antibacterial activity against certain antibacterials are usually diluted bacteria until the concentrations of bacteria 105 and 106. This statement is also reinforced by Pelczar and Chan (1988) that more the number of microorganisms

then the more time it takes to kill it. The high density of these cells is likely to affect the action of anti-bacterial active substances contained in the extract of the Muli banana bud.

The growth of *E.coli* bacteria proved to be inhibited because in samples of banana peel extract and banana bud extract of Muli banana there was secondary metabolite compounds that act as antimicrobial compounds. Based on the results of research conducted Saraswati (2015) that waste of banana peel extract kepok proved positive had secondary metabolite included that alkaloids, flavonoids, saponins, tannins and quinones as an antimicrobial agent. The statement was also reinforced by Lee et al., (2010) that banana peels contain non-nutrients, included polyphenols and flavonoids. Similar to banana peels, the banana bud of Muli banan also contained secondary metabolite compounds that act as antimicrobial compounds. This was accordance with the statement of Mahmood et al., (2011) which states that the banana peel contained alkaloid compounds, saponins, tannins, favonoid and total phenol. Secondary metabolite compounds contained in banana peel and banana bud of Muli banana may not be much different from the secondary metabolite compounds contained in other banana varieties. This was accordance with the opinion of Babu et al., (2012) that the content of antimicrobial compounds such as phenols, polyphenols and alkaloids found in several varieties of banana plant was not much different.

The presence of antibacterial substances contained in banana peel and banana bud extract of Muli banana will prevent the formation or transport of each component of the cell wall that resulted in weakness of structure accompanied with removal of cell walls and release of cell contents that eventually will kill or inhibit the growth of bacterial cells. According to Prasetyo et al., (2008) that saponin is a secondary metabolic compound that serves as an antiseptic that has antibacterial ability. The same thing is proposed by Cannell (1998) that saponin compound will form complex compounds with cell membranes through hydrogen bonds, which can destroyed the cell wall permeability and ultimately can cause cell death.

In banana peel there was also phenol compound that can worked as antibacterial that was by binding to proteins through hydrogen bond so the structure of protein becomes damaged.Most cell wall structures and bacterial cytoplasmic membranes contain protein and fat. The instability of the cell wall and the bacterial cytoplasmic membrane leads to a selective permeability function, the active transport function, the control of the bacterial cell protein structure to be disturbed, which will result in the release of macromolecules and ions from the cell. That bacterial cell become defective and lysis occurs (Nur et al., 2013).

The content of flavonoids in banana obtained by Saraswati (2015) was very effective to inhibit the growth of Gram-positive bacteria. This showed that resulting inhibitory diameter was greater for Gram positive bacteria than Gram negative. Another thing was also obtained by Dewi (2010) that the flavonoid was polar so easier to penetrated the peptidoglycan layer which was also polar in Gram positive bacteria than nonpolar lipid layer. In gram-positive cell wall contained polysaccharides (teric acid) was a water-soluble polymer which serves as positive transfor ion for in and out. It was this soluble nature showed that Gram positive cell walls are more polar. The inhibitory activity by phenol compound caused the disruption of cell wall function as giver of cell shape and protected cells from osmotic lysis. With the disruption of the cell wall will caused lysis in the cell.

Fig 3. Histogram comparison of the result of measurement of the inhibitory diameter (mm) of banana peel extract and

Muli banana bud extract (*Musa acuminata*) against the growth of *Escherichia coli* bacteria.

The comparison histogram of the inhibitory diameter measurement in Figure 3 showed that diameter of inhibitory area formed by banana peel extract of Muli banana was greater than diameter of inhibitory area formed by banana bud extract of Muli banana. This is probably caused by a total of secondary metabolite compound that act as antimicrobials in each of extract was different. In banana peel extracts was suspected to have a total of antimicrobial compound greater than banana bud extract so the ability to inhibit the growth of t bacteria is greater. The ability of banana peel extract and banana bud to inhibit the growth of *E.coli* bacteria showed less effective result because it had moderate antibacterial activity. Thus banana peel and banana bud extract of Muli banana can be useful for antibacterial and potentially enough to be developed into antibacterial product against *Echerichia coli* bacteria.

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Based on research that has been done can be concluded that banana peel and banana bud extract of Muli banana had potential as antibacterial to *Echerichia coli* bacteria. Banana peel extract of Muli banana was able to inhibit the growth of *E.coli* bacteria with the diameter of inhibitory area 6.45 mm, and muli banana bud extract Muli banana was able to inhibit the growth of *E.coli* bacteria with the diameter of inhibitory area 5.63 mm with medium antibacterial activity.

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