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Antibacterial Effectiveness Test of Shallot Peel (Allium cepa L.) Against The Growth of Staphylococcus Aureus Bacteria

Putri Dian Azqia[1], Rohmi[2], Pancawati Ariami[3], Ida Bagus Rai Wiadnya[4]
[1-4] Jurusan Teknologi Laboratorium Medis, Poltekkes Kemenkes Mataram, Indonesia
dianazqiaaa@gmail.com

ABSTRACT

Background: Escalating bacterial resistance to conventional antibiotics necessitates the exploration of botanical antibacterial agents. Red onion skin (Allium cepa L.) possesses bioactive constituents, including flavonoids, tannins, saponins, and polyphenols, with potential inhibitory effects against Staphylococcus aureus. **Objective:** This study evaluated the antibacterial efficacy of red onion skin decoction in suppressing the in vitro growth of S. aureus. **Methods:** An experimental laboratory design employing the well diffusion technique on Mueller-Hinton Agar (MHA) was utilized. Red onion skin decoction was applied at concentrations of 5%, 7.5%, and 10% (w/v). Inhibition zones were quantified following a 24-hour incubation period at 37°C. **Results:** Decoction treatments at 5%, 7.5%, and 10% (w/v) concentrations produced zero inhibition zones (0 mm) against S. aureus. While the negative control exhibited no inhibitory activity, the positive control generated a marked inhibition zone of 41 mm. **Conclusion:** Red onion skin decoction at tested concentrations (5%, 7.5%, and 10% w/v) demonstrates no antibacterial activity against S. aureus.

Keywords: Boiled water, red onion skin (*Allium cepa L.*), *Staphylococcus aureus.*

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Introduction

Infections caused by microorganisms are still one of the problems in the health sector. Pathogenic bacteria can cause health problems of varying severity. One of the bacteria known to play a role in triggering inflammation in humans is *Staphylococcus aureus.* These Gram-positive bacteria can be related to a number of infectious conditions, including skin infections, pneumonia, osteomyelitis, and sepsis (Azzahra et al. 2022; Cheung et al. 2021).

Antibiotics are one of the main options in the treatment of bacterial infections. However, irrational use of antibiotics, including excessive use, can contribute to the emergence of resistance. This condition is one of the obstacles in controlling infectious diseases and encourages research into other sources of antibacterial products derived from natural materials. Several groups of compounds that are known to have the potential to provide antibacterial activity include flavonoids, tannins, saponins, alkaloids, and phenolic compounds (Khairullah et al. 2022; Putri and Chatri 2024).

Shallots are plants that are often used in life, especially as food. In addition to the value of its use, this plant contains bioactive compounds that have the potential to provide biological activity. Some of the compounds found in shallots include flavonoids, quercetin, tannins, saponins, and phenolic compounds (Edy et al., 2022). The part of the onion skin that is generally not used and ends up as waste still contains bioactive compounds. The flavonoids and phenolic compounds found in these parts are the basis for its use as one of the sources of natural antibacterial ingredients (Sofihidayati 2018).

The inhibition ability of shallot peels against the proliferation *of Staphylococcus aureus has* previously been identified by Misna and Diana (), where the extract preparations have been shown to be effective in suppressing the growth of the pathogen. However, the majority of previous studies have tended to focus on extraction methods using organic solvents, especially ethanol. In contrast, water-based decoccation or boiling techniques offer more practical and cost-effective extraction procedures. This condition prompts the urgency of further testing to evaluate whether the boiled water preparation is able to maintain commensurate antibacterial effectiveness against 2016*Staphylococcus aureus*.

Referring to the description, this research was conducted to test the inhibition of shallot peel (*Allium cepa L.) boiling water* preparations, concentration variations, and on the suppression of $5\%, 7{,}5\%, 10\%$ (b/v) *Staphylococcus aureus culture*. This experimental finding is projected to be able to supply a scientific database regarding the prospects of utilizing shallot peel waste as a natural material-based source of antibacterial.

Research Objectives

1. General Purpose

This study was carried out with the main focus of testing the inhibition of shallot peel (*Allium cepa* L.) boiling water preparations against the suppression of the proliferation of *Staphylococcus aureus bacteria*.

2. Special Purpose

1. Calculate the amount of clear area diameter obtained by the preparation of boiled water for shallot peels at the level of $5\%, 7{,}5\%, 10\%$ (b/v) *Staphylococcus aureus*.

2. Evaluation of the correlation between the variation in the concentration of boiled water of onion peel and the growth *inhibition of Staphylococcus aureus* bacteria.

Research Methods

Laboratory experimental approach based on diffusion method so that the mixture is applied in this study. The test preparation in the form of boiled water of shallot peel (*Allium cepa* L.) was prepared at a range of levels, and with the same number of repetitions for each treatment group, and involved it with cyproflococcin and sterile acuades as control comparisons. Quantitative parameters were obtained by measuring the diameter of the clear zone area in post-incubation 5%7,5%10% (b/v)9 kali*Staphylococcus aureus* cultures in temperature. The data collected were then processed through descriptive analysis by calculating the average inhibition zone and presented in table format.24 jam37°C.

Results and Discussion

1. Results

Quantitative data on antibacterial activity from onion peel (*Allium cepa* L.) boiling water preparations against *Staphylococcus aureus culture* have been collected through the measurement of clear zone area diameter. Details of the experimental output on the concentration treatment variation are presented systematically in the table.4.1

Table 4.1 Clear Zone Data of Shallot Peel Boiled Water (*Allium cepa* L.) Against *Staphylococcus aureus*

	Diameter Zona Hambat (mm)									
	Replikasi									Rata-rata
T	1	2	3	4	5	6	7	8	9	
T1	0	0	0	0	0	0	0	0	0	0
T2	0	0	0	0	0	0	0	0	0	0
T3	0	0	0	0	0	0	0	0	0	0

Description:

T1 : Shallot Peel Stew 5% (b/v)

T2 : Boiled Shallot Peel 7.5% (b/v)

T3 : Boiled Shallot Peel 10% (b/v)

Table 4. 2 Clear zone diameter in the control group

Kelompok	Diameter Zona Hambat (mm)
Kontrol Positif (ciprofloxacin)	41
Kontrol Negatif (akuades steril)	0

2. Discussion

Experimental testing proved that the preparation of boiled water for shallot peels was of the highest level, and was not able to inhibit 5%7,5%10% (b/v) *Staphylococcus aureus*. The average value of the clear zone diameter was greater than in all treatment groups confirming the absence of clear areas around the test well. Theoretically, the shallot layer tissue contains protective substances such as flavonoids, alkaloids, saponins, tannins, and phenolics that have bactericidal effectiveness. However, the bioactive potential is highly dependent on the qualification of the solvent, extraction methodology, temperature regulation, and quantity of dissolved active ingredients. The absence of this clear zone activity indicates that the metabolite levels in the boiled water have not exceeded the 0 mm*Minimum Inhibition Level* (KHM) threshold.

This limited inhibition is also influenced by the use of aqueous solvents that have lower extraction efficiency against non-polar bioactive components when compared to organic solvents. In addition, exposure to high temperatures during heating risks degrading the stability of active molecules. Setiawan et al. () emphasized that the main flavonoid content such as quercetin in shallot peels is very susceptible to variations in extraction techniques, where improper temperature optimization has the potential to reduce its levels and bioactivity (). This finding is contrary to the study of Misna and Diana () who reported that the ethanol concentrate of shallot peel was effective in suppressing 2021*Rifkia* and *Prabowo* 2020; *Setiani* et al. 20172016*Staphylococcus aureus* proportionally according to the increase in concentration. Ethanol solvents were shown to be superior in attracting the polarity of flavonoid and phenolic compounds. Based on these outputs, although the shallot peel has antibacterial potential, the application of the water decoccation method in the concentration range does not show inhibition capacity against 5%10% (b/v) *Staphylococcus aureus*.

Conclusion

A. Conclusion

Based on the results of the research "**Antibacterial Effectiveness Test of Shallot Peel Boiled Water (*Allium cepa L.*) on the Growth of *Staphylococcus aureus*,**" it was concluded that:

1. The clear zone measurement of the boiled water treatment of onion peel (*Allium cepa* L.) concentration, and recorded a value of 5%7,5%10% (b/v)0 mm*Staphylococcus aureus culture*.
2. Increasing the concentration of boiled water of onion peel (*Allium cepa* L.) to the level did not have a significant effect on inhibiting the growth of 10% (b/v) *Staphylococcus aureus*, so it was proven to be ineffective as an antibacterial ingredient.

B. Suggestions

Referring to the research outputs obtained, the next research developer is advised to apply a more concentrated boiling concentration range, optimize the control of temperature parameters and decoction duration, and consider the use of alternative extraction methods with solvents with different polar nuances to maximize the acquisition of active constituents.

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