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Antibacterial activity of galam soap (*Melaleuca cajuputi*) against *Salmonella typhi* as a form of ethnoscience based learning

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Article Information	Abstract
<p>Keyword: Galam soap; Antibacterial; <i>Salmonella typhi</i>; Ethnoscience-based learning</p> <p>Kata Kunci: Sabun galam; Anti bakteri; <i>Salmonella typhi</i>; Pembelajaran berbasis etnosains</p> <p>History: Received : 28/06/2022 Accepted : 21/09/2022</p>	<p>Central Kalimantan has abundant biodiversity, one of which is galam which is often found in swampy areas in Central Kalimantan. One example of the use of galam is processing it into soap products as an effort to manage plant-based waste typical of Central Kalimantan. This study aims to determine the antibacterial activity of galam soap (<i>Melaleuca cajuputi</i>) against <i>Salmonella typhi</i> bacteria, where the results of this study have the potential to be developed as a learning resource for the application of ethnoscience-based learning. This study used an experimental research method using the disc method and the research design was a Completely Randomized Design (CRD). The results showed that galam soap was effective in inhibiting the growth of <i>Salmonella typhi</i> bacteria. The results of these studies can be used as a learning resource in lecture activities as a form of implementation of ethnoscience-based learning using the results of recent research, because ethnoscience-based learning is expected to help create meaningful learning activities.</p>

Abstrak

Kalimantan Tengah memiliki keanekaragaman hayati yang melimpah, salah satunya berupa galam yang seringkali ditemui pada wilayah rawa di Kalimantan Tengah. Salah satu contoh pemanfaatan galam diantaranya diolah menjadi produk sabun sebagai upaya untuk pengelolaan limbah berbasis tumbuhan khas yang ada di Kalimantan Tengah. Penelitian ini bertujuan untuk mengetahui aktivitas anti bakteri sabun galam (*Melaleuca cajuputi*) terhadap bakteri *Salmonella typhi*, dimana hasil penelitian tersebut sangat berpotensi untuk dikembangkan sebagai sumber belajar untuk penerapan pembelajaran berbasis etnosains. Penelitian ini menggunakan metode penelitian eksperimen dengan menggunakan metode cakram serta desain penelitiannya berupa Rancangan Acak Lengkap (RAL). Hasil penelitian menunjukkan bahwa sabun galam terbukti efektif dalam menghambat pertumbuhan bakteri *Salmonella typhi*. Hasil penelitian tersebut dapat dimanfaatkan sebagai sumber belajar pada kegiatan perkuliahan sebagai bentuk implementasi dari pembelajaran berbasis etnosains menggunakan hasil-hasil penelitian terkini, karena pembelajaran berbasis etnosains diharapkan dapat membantu menciptakan kegiatan pembelajaran yang bermakna.

A. Introduction

Indonesia, with its diverse and large biodiversity, is spread over all regions such as the one in Central Kalimantan Province. The province of Central Kalimantan with the center of government in Palangkaraya City has an area of 267,851 Ha and has high biodiversity, dominated by peatland areas. one of the dominant vegetation such as Galam Plant (*Melaleuca cajuputi*) (Azhari & Lesmana, 2022).

Galam plants (*Melaleuca cajuputi*) are generally used by the community to meet the needs of life, for example in development activities. The main use of Galam plants is more dominant in the stem and causes other plant biomass to be wasted and becomes waste (leaves). Leaves Galam plants if managed properly can produce essential oils (secondary metabolism) that can be utilized by the community (Azhari et al., 2020).

Galam plant leaf biomass has good potential if used properly. For example, processing Galam plant leaf biomass into health products and commercial products in the form of hand soap (solid and liquid) (Azhari & Novrianti, 2021).

The processing of Galam leaf biomass into soap products can be a solution in environmental management (Galam leaf biomass of waste). The effectiveness of essential oils used as soap products needs to be tested first, such as tests on *Salmonella typhi* bacteria. *Salmonella typhi* is a gram-negative bacteria that can cause types fever (Cita, 2011). Types of fever are diseases that can be transmitted through contaminated drinks and food (Nuruzzaman & Syahrul, 2016), therefore the use of soap is expected to be a means to maintain personal hygiene.

Scientific exploration of the antibacterial activity of galam soap can be used as a learning resource by applying ethnosience-based learning. Ethnosience is a distinctive knowledge possessed by a society in a certain area (Muttaqiin et al., 2021). This special knowledge is also known as local potential. Utilization of local potential as a source of learning in lecture activities can make lecture activities meaningful (Sunarsih et al., 2020), as well as a means of character education (Misbah et al., 2020).

The use of local potential as a learning resource to make meaningful learning activities can be applied to one of the courses in the primary school teacher education study program. This is an effort to improve the ability of prospective elementary school teachers in delivering science material in particular and make it easier for students to understand the material (learning process). This effort is also known as ethnosience-based learning.

The application of ethnosience-based learning as a learning resource in lecture activities needs to be adapted to the characteristics of the course to help improve cognitive aspects, affective aspects and aspects of student skills. One of them can be applied to the Basic Science Concepts course which is presented at the Muhammadiyah University of Palangkaraya Elementary School Teacher Study Program.

Another application is as a lecture material at the Environmental Engineering Study Program, University of Muhammadiyah Palangkaraya. Based on this description, the purpose of writing the article is to explore the antibacterial activity of galam soap (*Melaleuca cajuputi*) against *Salmonella typhi* bacteria to be developed as an ethnosience-based learning resource.

B. Material and Method

This research is an experimental study to test the anti-bacterial activity of galam soap against *Salmonella typhi* bacteria using the in vitro method of disc technique. Galam leaves that were used as samples were obtained from the City of Palangka Raya, which were then processed into soap. The culture of *Salmonella typhi* was obtained from the Microbiology Laboratory of the Faculty of Health Sciences, University of Muhammadiyah Palangkaraya.

Research with galam soap aims to analyze the anti-bacterial power obtained by measuring the inhibition zone for the growth of *Salmonella typhi* bacteria on NA medium using the disc diffusion method. An in vitro study for anti-bacterial testing was carried out during June 2022 at the Microbiology Laboratory at the Faculty of Health, Muhammadiyah University, Palangkaraya.

The research design used the RAL model (Completely Randomized Design) with 12 replications. The results of the research were analyzed descriptively quantitatively in the form of classifying antibacterial inhibitors. Classification of antibacterial activity based on the size of the diameter of the inhibition zone, namely very strong category if the inhibition hole is 20 mm or more, strong category if the diameter of the inhibition zone is 10-20 mm, moderate category if the diameter of the inhibition zone is 5-10 mm and weak category if the diameter of the inhibition zone is 5-10 mm 5mm or less.

The results of research related to the antibacterial activity of galam soap are very useful if applied as a learning resource in lecture activities, especially galam is one of the typical plants of Central Kalimantan so that it is a form of

exploration of local potential which is called the application of ethnoscience-based learning. The implementation of the research results in learning activities will be applied to further research using the experimental method.

C. Results and Discussion

The antibacterial activity of galam soap against *Salmonella typhi* was determined based on the diameter of the inhibition zone through the disc diffusion method. The inhibition zone formed surrounded by disc diffusion holes indicates the inhibition zone for bacterial growth. The inhibition zone for the growth of *Salmonella typhi* bacteria in the treatment and replication with a sample of galam soap are presented in Figure 1, and the results of measuring the diameter of inhibition zone are presented in Table 1.

Table 1 Inhibitory Zone Diameter of *Salmonella typhi* against Galam Soap

Treatment and Repeat	Inhibitory Zone Diameter (mm)	Category
I	5	Medium
II	6	Medium
III	3	Weak
IV	9	Medium
V	6	Medium
VI	4	Weak
VII	6	Medium
VIII	13	Strong
IX	5	Medium
X	10	Strong
XI	6	Medium
XII	12	Strong



Figure 1 Inhibitory Zone of *Salmonella typhi*

Exploration of the Potential of Galam Soap as Anti-Bacterial

The results showed that galam soap had antibacterial activity, especially against *Salmonella*

typhi bacteria. *Salmonella typhi* is a bacterium that can cause typhoid fever, which is one of the most common systemic infectious diseases found in all countries (Sandika & Suwandi, 2017).

The results of this study can certainly be a useful finding to be one of the efforts in preventing typhoid fever by utilizing the biomass of galam leaf waste into a product in the form of soap. Galam has various other potentials, one of which is as a natural pesticide. Galam extract has been proven to be effective in tackling cabbage crop pests (Asikin, 2017).

Regarding the activity of galam as an antibacterial, the results of previous studies also showed that galam was tested to effectively suppress the development of *Escherichia coli* bacteria and inhibit the development of the fungus *Candida albicans* (Isnaini et al., 2021).

Information related to the potential of galam leaf waste can be a potential source of learning to be applied to lecture activities. These efforts need to be made in order to create more meaningful lecturing activities.

Utilization of Research Results as an Effort to Implement Ethnoscience-Based Learning

The development of science and technology tends to have positive but also negative impacts, one of which is the impact on the environment. Various natural disasters that appear are a sign of negative impacts on the environment, as evidence of the declining public awareness of environmental sustainability. One of these problems needs to be addressed in the field of education.

Communities who care about environmental sustainability have an important role, a very meaningful process if they apply learning resources based on local potential (Andriana et al., 2017). This is an effort for the community to be more appreciative of nature and local culture (Nisa et al., 2015) and to introduce the cultural richness that exists in Indonesia (Imaduddin, 2018).

Education should be a bridge between formal knowledge (subject material in school) and non-formal knowledge (knowledge acquired in everyday life) so that it becomes a unified whole. Efforts can be made, for example by utilizing the knowledge gained in everyday life and proven through research activities as a learning resource. In essence, various research results in the fields of biology and science can have a wider influence if the results are applied to the field of education (practical and correlation).

The use of research results as learning resources can be applied to teaching materials, textbooks, popular scientific books and so on which

are used in lecture activities as a form of contextual learning. Contextual learning is applied using empirical data from research results to help improve learning outcomes, focuses on the importance of student activities (Suárez et al., 2018).

The results of previous studies indicate that the use of research-based learning resources, especially those based on local potential, known as ethnoscience-based learning, is important to implement. For example, the use of textbooks based on research results can have a good influence, such as effective application in improving learning outcomes and getting a positive response from users (Lestariningsih et al., 2021).

In addition, it is also a form of implementing education for sustainable development to increase public awareness of environmental sustainability. One of them is by utilizing research results in the form of medicinal plants as a learning resource (Zannah & Dewi, 2021).

The application of ethnoscience-based learning is a must at this time. In addition to introducing various local potentials that exist in an area, it is also to increase a sense of care for the biological wealth that exists in its environment. This is supported by the results of previous research showing that the use of local potential-based learning tools has a positive impact on learning activities (Hartini et al., 2018), on students competency (Usmeldi & Amini, 2020), scientific literacy (Perwitasari et al., 2017) and on students' critical thinking skills (Hikmawati et al., 2020).

Exploration of various potential natural resources such as the potential of galam leaves as anti-bacterial soap is also a form of implementation of ethnoscience-based learning activities. It is necessary to continue to do so in order to increase knowledge and improve the quality of learning based on various reference studies that have been described previously.

D. Conclusion

The results showed that the biomass of galam leaf waste has potential in the health sector to become galam soap. The galam soap produced plays a role in inhibiting the activity of *Salmonella typhi* bacteria. The results of the research are expected to be a source of learning in lecture activities with ethnoscience learning methods with evidence of scientific application in research and laboratory activities.

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