

Training on Making and Testing the Efficacy of Hand Sanitizers from Lime and Sweet Orange Essential Oils for Pharmacy Students at Al-Muhtadin Vocational School Bekasi, West Java, Indonesia

Reza Anindita^{1*}, Intan Kurnia Putri², Maya Uzia Beandrade³, Anisa Rachmita Arianti⁴, Chilyati Eky Futihat⁵

¹⁻⁴ Department of Pharmacy, Sekolah Tinggi Ilmu Kesehatan Mitra Keluarga, Bekasi, West Java, Indonesia

*Corresponding author: rezaanindita@stikesmitrakeluarga.ac.id

Received:
17 March 2025

Revised:
24 May 2025

Accepted:
29 May 2025

Abstract

Community analysis shows that Al-Muhtadin Pharmacy Vocational School, Bekasi students are interested in making pharmaceutical products from natural ingredients. However, their desires are often hampered by the lack of knowledge regarding manufacturing pharmaceutical preparations from natural ingredients. Therefore, the solution is to hold training in hand sanitizers with natural ingredients from essential oils of lime and sweet orange peels. This Community Service activity (CSA) aims to provide training in making and testing hand sanitizers for Al-Muhtadin Pharmacy Vocational School students in Bekasi. The CSA participants numbered 62 students of Al-Muhtadin Pharmacy Vocational School, Bekasi. The activity methods include providing material on Clean and Healthy Living Behavior (CHLB) and making hand sanitizers, training in making and testing hand sanitizer products, and evaluation in the form of concept tests (pre-test and post-test) and skills tests. The paired t-test results showed that the calculated t-value was smaller than the t-table ($-4.952 < -2.013$), or there was a significant difference in the average value of knowledge about CHLB and making hand sanitizers between before and after being given the material. In contrast, the practical exam showed the average percentage value of participants' skills in making hand sanitizers of 90.57%, while the efficacy testing skills were 93.44%. Testing of the antibacterial efficacy of hand sanitizer products by respondents showed that they were able to inhibit and kill bacteria on the hands. This CSA concludes that all participants have learned the concept and skills regarding manufacturing and testing hand sanitizers from a combination of lime and sweet orange peel essential oils.

Keywords: community; hand sanitizer; oils; orange; pharmaceutical

Soeropati with [CC BY-SA](#) license. Copyright © 2025, the author(s)

Introduction

According to Anugrah & Winanta (2022), the curriculum of Pharmacy Vocational Schools is more focused on clinical pharmacy, which has job prospects in hospitals in the pharmaceutical services division. Vocational school students need to be introduced to the

field of pharmacy, which has the potential to create entrepreneurial opportunities. Rachmania and Wardani (2019) explained that Pharmacy Vocational School students need to be given discourse that can foster creative ideas in entrepreneurship. The pharmaceutical sector is one example of a place where vocational school students can foster an entrepreneurial spirit from an early age because the pharmaceutical industry shows an average positive growth of 5.59% annually (Kusaendri, 2023).

Referring to the above problems, implementing a community service program is necessary to target vocational high school students by providing material on Clean and Healthy Living Behavior (CHLB) and how to make pharmaceutical products that can be practiced independently or in groups. The pharmaceutical product chosen as the training material is Hand sanitizer. The selection of this community service activity idea refers to the problems faced by partners, namely Al-Muhtadin Pharmacy Vocational High School students, Bekasi, who are interested in making pharmaceutical products from natural ingredients. However, their wishes are often hampered because they do not know how to make pharmaceutical preparations from natural ingredients. In addition, Al-Muhtadin Vocational High School students have poor CHLB knowledge in washing hands, even though Al-Muhtadin Vocational High School is located close to the Bantar Gebang Integrated Waste Management Site (WMS). Therefore, the solution is to hold training in making hand sanitizers with natural ingredients from lime peel essential oil, which is more effective as an antibacterial agent and is safe for the skin. During the training, education was provided regarding CHLB and correctly washing hands.

The report on the CS hand sanitizer training activity has been published by Astuti et al. (2023) For 28 participants from Tegalsari, Kulonprogo, to prevent the spread of Covid-19. The PKM report of Mayangsari et al. (2020) This provides knowledge and training on making natural hand sanitizers from betel leaves and lime. However, the previous CSA lasted one day and was more dominantly carried out online during the COVID-19 pandemic.

Based on partner problems and the results of previous community service activities, STIKes Mitra Keluarga tried to hold community service on training in making hand sanitizers from a combination of sweet orange and lime essential oils. The innovations of this community service activity include being carried out on SMK Pharmacy partners, a 2-day training duration, a skills test on CS participants, and a test of the efficacy of products made

by community service participants. This CS activity aims to provide discourse to SMK students regarding CHLB and the skills of making pharmaceutical products from natural plant materials in hand sanitizers. This CSA is expected to improve the skills of Pharmacy Vocational School students in making hand sanitizer products from a combination of sweet orange and lime peel essential oils, with an average score of 75.

Method

This community service activity was carried out on February 8, 2025, and February 12 at SMK Al Muhtadin, Bekasi. The facilities and infrastructure needed for this community service include a laboratory room with a capacity of 30 people, LCD projector, whiteboard and markers, sterile petri dishes, sterile swabs, PEG 400 5 ml as a surfactant, Glycerol 2 ml as a skin moisturizer, ethanol 96% 18 ml as a solvent, lime, and sweet orange essential oils as natural antibacterial ingredients (2 ml each).

The preparation stage for the Community Service Activity (CSA) was carried out by discussing the theme for the CSA with the principal of SMK Al-Muhtadin, Bekasi. STIKes then planned transportation funds, tools, materials, and consumption. The implementation stage of this activity includes providing materials and practicing skills in the laboratory. The provision of materials uses lecture and demonstration methods, while training is carried out as practicums with the contextual instruction method. Participants in the implementation were students of Al-Muhtadin Pharmacy Vocational School in Bekasi City. Participants gathered in the school hall to be given materials focused on CHLB and making hand sanitizers. The evaluation stage of this CSA was carried out by collecting all data, including documentation, photos, interview results, pre-test scores, post-test scores, and skills test scores

Results and Discussion

Based on the planning of community service activities for hand sanitizer making training, 61 SMK participants participated in the community service activity. Table 2 describes the number of participants who participated in this community service activity.

Table 1. Description of the number of trainees at Al-Muhtadin

Class	Number	Percentage
10	10	16.39 %
11	32	52.45 %
12	19	31.14%
Total	61	100 %

Based on Table 1, the number of training participants for class 10 was 10 (16.39%) students, class 11 was 32 (52.45%), and class 12 was 19 (31.14%). The results of interviews with participants provided information that participants were enthusiastic about participating in community service activities.

The community service activity began with CHLB counseling and education by the speaker, Mrs. Apt. Anisa Rachmita Arianti, M.Farm., in the form of a PowerPoint using an LCD projector. The material includes Understanding Clean and Healthy Living Behavior (CHLB), Benefits of Washing Hands, Principles of Good Hand Washing, Ten Steps to Washing Hands Properly, and Important Times to Clean Hands. Counseling and Education were delivered because of the low awareness of Al-Muhtadin Vocational School students regarding CHLB, especially in washing hands properly and correctly. Counseling was carried out by providing knowledge about CHLB to increase participant awareness so that changes in attitudes and behaviors for clean and healthy living were formed. (Larira et al., 2021)

Regarding understanding CHLB, the speaker refers to the Ministry of Social Affairs of the Republic of Indonesia (2020) module, which states that CHLB is the practice of clean and healthy living behavior to avoid various infectious diseases, thereby improving the quality of public health. The speaker conveyed the principle of washing hands to the community service participants in simple language, namely that it must be able to kill germs that cause disease. According to Ulya et al. (2022), washing hands with water is insufficient to kill germs. Washing hands must be done with hand sanitizer or soap. Using hand sanitizer to wash hands for 20 seconds can kill bacteria and other microorganisms. Still, if the amount of dirt on the hands is too much, hand sanitizer is ineffective in killing bacteria and other microorganisms. Hand sanitizer liquid is generally used before and after touching the surface of objects and before entering and leaving public facilities, including hospitals. This CS education also simulates 10 steps for washing hands properly and correctly, and the speaker demonstrates these steps using animated video media displayed on an LCD projector. The

hand-washing demonstration carried out by the speaker was then followed by PKM participants with the assistance of students, as shown in Figure 1.



Figure 1. CHLB education on steps for washing hands properly and correctly

Table 2. Steps for washing hands

No	Hand washing steps
1	Wet hands with running water
2	Rubbing hands with enough soap
3	Rubbing the palms of one hand against the other
4	Rubbing the back and between the fingers of the hand with soap
5	Rubbing the palms and between the fingers
6	Doing a finger-locking movement
7	Doing a thumb rotation movement
8	Doing a finger-tip rotation movement
9	Rinsing with clean water
10	Drying hands

The hand-washing steps shown in Table 2 are by the World Health Organization (WHO) guidelines in the Ministry of Health of the Republic of Indonesia regarding the Handwashing with Soap Guidelines, which state that 10 steps of washing hands with soap correctly for at least 40-60 seconds have been proven to be effective in killing germs that cause infectious diseases. However, the hand washing steps in Table 3 are only effective if CHLB facilities are available, carried out at important times, and carried out correctly. The important times to clean hands include before eating, after defecating and using the toilet; before, during, and after preparing food; after sneezing or coughing; touching the eyes, nose, and mouth; after touching the surface of objects: doorknobs and tables after touching animals, garbage, hands that look dirty or oily, before/after visiting the hospital. This CS

activity model refers to CS Yati et al. (2022), which uses image and video media to educate SMK Muhammadiyah Cariu students regarding properly and correctly washing hands. According to Nofita et al. (2014), training in making hand sanitizers must be accompanied by education on clean living behavior so that participants can practice using hand sanitizers to wash their hands properly and correctly.

The second material by apt. Maya Uzia Beandrade, M.Sc., regarding the manufacture of hand sanitizers from a combination of lime and sweet orange essential oils. The material used a demonstration method, which was carried out by mentioning the tools and materials and demonstrating the technique of mixing the ingredients to make hand sanitizers, which was followed by the participants directly. According to Giridharan & Raju (2016) Demonstrations are one of the learning strategies expected to encourage students to be active in following learning materials and interacting with each other. Demonstration is a form of teaching that combines explanation with the use of tools, materials, or real objects. (Mutende et al., 2021) Planning and applying efficient demonstration methods can help students retain concepts in long-term memory and improve their learning skills. (Hussain, 2020). According to Nwalo & Eze (2021) The demonstration method naturally encourages intensive interaction between students and teachers, helping students understand science and arousing curiosity. Demonstrations also provide a clear picture of subjects and ideas that are difficult to understand if only through lecture methods. This is proven in the research of Basheer et al. (2017) Who reported that learning with the demonstration method made it easier for students to remember biology and chemistry concepts than the conventional method.



Figure 2. Presentation of CSA material on making hand sanitizers

Based on Figure 2. Training on hand sanitizers begins with providing material on the definition of hand sanitizers, knowledge of natural plant materials that can be antibacterial, and basic formulas for making hand sanitizers. According to Hutapea & Ambarwati (2024) Hand sanitizers are innovative antiseptic compounds that can inhibit and kill microorganisms (this CSA focuses on the inhibition and killing power test on bacteria). They are practical and easy to carry. Correct use can break the chain of transmission of infectious diseases caused by pathogenic bacteria. (Fernando et al., 2024) Hand sanitizer formulas generally contain 60-90% alcohol, softeners, moisturizers, and other antibacterial agents. (Darmayani et al., 2023). The hand sanitizer formula in this CSA consists of 5 ml of PEG 400 as a surfactant, 18 ml of 96% ethanol as a solvent and antibacterial, 2 ml of Glycerol as a skin moisturizer, and three active antibacterial compounds (2 ml of lime and sweet orange peel essential oils, and 2 ml of H₂O₂). The reason for using lime and sweet orange peel essential oils is that they are widely cultivated in Indonesia, easy to obtain, and abundant if you want to use them as raw materials for pharmaceutical products. (Manzur et al., 2023), have the properties to inhibit and kill *Escherichia coli*, *Staphylococcus aureus*, and *Salmonella* sp. bacteria, where these properties are more effective on gram-positive bacteria than negative (Ibrahim et al., 2024), contain 85% - 99% volatile components that have aromatherapy properties with a fresh and anti-inflammatory aroma (Agarwal et al., 2022) Citrus essential oils' dominant content is monoterpenes, specifically limonene. Cytotoxicity tests showed low toxicity when applied to human skin. (El Hachlafi et al., 2024)

Liquid hand sanitizers in this CSA are included in the category of Alcohol-Based Hand Sanitizers using the WHO (2010) recommended formula for local production used on hands to deactivate and suppress the growth of microorganisms, both in hospitals and in community environments where public hand washing facilities are not available. Alcohol-based hand Sanitizer liquid is a form of antiseptic product innovation that effectively prevents infectious diseases caused by microorganisms. The recommended use of alcohol is 60% - 85% because denaturation of microorganism proteins is effective if there is water, so the use of concentrations > 90% in various studies results in a decrease in the inhibition of the number of bacteria and fungi (Egner et al., 2023). Glycerin used in this CSA prevents oxidation or hydrolysis of oil and moisturizes the skin. Polyethylene Glycol (PEG) 400 is an ionic surfactant that is stable, easy to mix with other components, non-toxic, non-irritant,

and effective with a wide pH range. The presence of PEG can reduce the tension of the water and oil phases, thereby maintaining the stability of the hand sanitizer preparation (Mirya, 2018), while hydrogen peroxide plays an important role in deactivating various microbial spores contained in the hand sanitizer formula (Jasmine et al., 2022)

The third material is a practical test of the efficacy of hand sanitizer guided by Mr. Reza Anindita, M.Sc. The material uses a demonstration method that includes an introduction to tools and materials and the procedure for swabbing bacterial samples from the palms of hands before and after washing hands using hand sanitizer. Sampling was carried out on the same day, and then the total plate count (TPC) of bacteria on the palms of the hands was examined to see if there was an increase or decrease in the number of bacteria. (Saputra et al., 2023).



Figure 3. Demonstration and practice of the hand sanitizer efficacy test

Based on Figure 3. The provision of material is carried out using the demonstration method. The success of the knowledge of this community service activity is then evaluated based on the results of the post-test shown in Table 3.

Table 3. Concept score before and after training

No	Question	Pre-test		Post-test	
		True (%)	False (%)	True (%)	False (%)
1	One of the active substances that acts as an antibacterial	30 (49,18%)	31 (50.81%)	60 (98,36%)	1 (1,63%)
2	The role of PEG in hand sanitizer formulas	17 (27,86%)	44 (72,13%)	60 (98,36%)	1 (1,63%)
3	A substance that acts as a moisturizer in hand sanitizer formulas	9 (14,75%)	52 (85,24%)	59 (96,72%)	2
4	The function of ethanol in hand sanitizer formulas	55 (90,16%)	6 (9,83%)	61 (100%)	0 (0%)
5	A substance that can	20 (32,78%)	41 (67,21%)	55 (90,16%)	6 (9,83%)

	function as an antibacterial in hand sanitizers				
6	Understanding CHLB	61 (100%)	0	61 (100%)	0 (0%)
7	The right duration to clean hands with hand sanitizer	14 (22,95%)	57 (93,44%)	46 (75,40%)	15 (24,59%)
8	The right time to clean hands with hand sanitizer	37 (60,65%)	24 (39,34%)	55 (90,16%)	6 (9,83%)
9	Proper and correct hand-washing procedures	34 (55,73%)	26 (42,62%)	56 (91,80%)	5 (8,19%)
10	Effective choices for cleaning hands when soap and water are not available	60 (98,36%)	1 (1,63%)	61 (100%)	0 (3,27%)

Based on Table 3, it can be seen that there are 10 questions as indicators of the success of knowledge or concepts regarding the manufacture of hand sanitizers. The results of the pre-test assessment show that out of 10 statements, only questions no. 4, 6, 8, 9, and 10 can be answered by more than 50% of CSA participants, while other questions are still below 50%. After the post-test, all participants could answer all questions related to the manufacture of hand sanitizers. The average pre-and post-test scores can be seen in Figure 4.

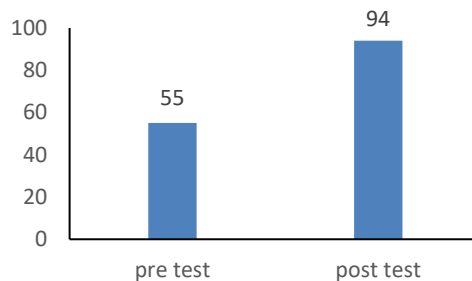


Figure 4. Average pre and post-test scores

Based on Figure 4, it can be seen that the average pre-test concept Score of the CSA hand sanitizer training activity was 55; after the provision of material and training, there was an increase in the post-test value of 94 or an increase of 70.90%. The results of the paired t-test showed that the calculated t value was smaller than the t-table ($-4.952 < -2.013$), so that H_0 was accepted or there was a significant difference in the average knowledge score regarding CHLB and making hand sanitizers between before and after being given training material.

The success of this community service activity was also measured by assessing the skills of making and testing the efficacy of hand sanitizer products. Each participant was assessed for skills in making and testing hand sanitizers. The implementation of the skills test can be seen in Figure 5.



Figure 5. Scene of the skill test for making and testing the efficacy of hand sanitizers

Figure 5. shows that participants who have practiced making and testing hand sanitizers are evaluated individually for the skills test. The results of the skills test are in Table 4.

Table 4. Results of the evaluation of the skills assessment (N = 61)

No	Skills	Score (%)	
		True	False
Making hand sanitizer			
1	Preparing tools and materials	61 (100%)	0 (0%)
2	Measuring volume	52 (85,24%)	9 (14,75%)
2	Homogenizing the bass	50 (81,96%)	11 (18,03%)
3	Mixing all ingredients properly	58 (95,08%)	3 (4,91%)
Test antibacterial efficacy			
4	Swabbing of the hand	61 (100%)	0 (0%)
5	Streak plate	61 (100%)	0 (0%)
6	Aseptic procedure	49 (80,32%)	12 (19,67%)

Based on Table 4, it can be seen that the indicators of hand sanitizer-making skills include preparation of tools and materials, measurement of materials, and mixing of all materials. In contrast, antibacterial efficacy testing skills focus more on the ability to swab from the hand to the bacterial growth medium in a sterile manner. The average percentage of participant skills in making hand sanitizers was 90.57%, while efficacy testing skills were

93.44%. The efficacy test of the hand sanitizers that have been made by CSA participants on the number of bacteria (CFU/cm³) can be seen in Table 5.

Table 5. Number of bacterial colonies on the hand before and after washing hands with hand sanitizer

Sample	Number of bacterial colonies (CFU/cm ³)		Difference (X-Y)	Percentage decrease (%)
	Before (X)	After (Y)		
1	245	0	245	100
2	45	0	45	100
3	58	2	56	96,55
4	435	1	434	99,77
5	541	0	541	100
6	20,5	0	20,5	100
7	18,5	5	18,5	13,5
8	37	0	37	100
9	24	7	17	70,83
10	15	6	9	60
11	20	0	20	100
12	25	0	25	100
13	23	0	23	100
14	33	2	33	100
15	36	5	31	86,11
Average	105,06	3,5	10,67	88,45

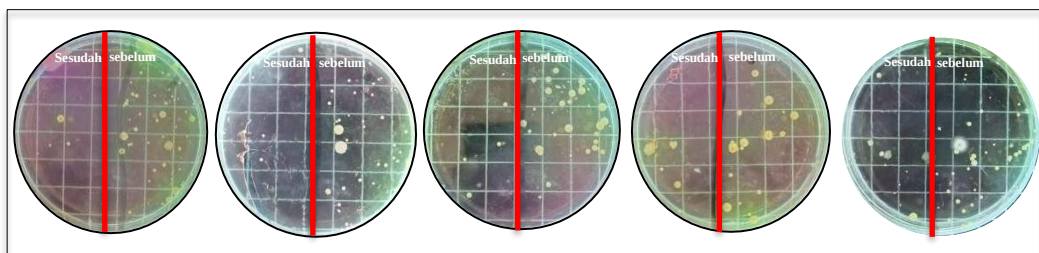


Figure 6. Results of the efficacy test of the number of bacteria before and after washing hands using hand sanitizer

Based on Table 5, it can be seen that the average number of bacterial colonies on the palms of 15 vocational high school students before washing their hands was 105.6 CFU/cm³; after washing their hands for 30 seconds using hand sanitizer, there was a decrease in the number of bacterial colonies on the same student samples by 3.5 CFU/cm³ or a decrease in the number of bacteria by 88.45%. The use of hand sanitizer products by participants

effectively inhibited and killed bacteria, as indicated by the reduced number of bacterial colonies on the palms of the hands. This effectiveness is due to the active ingredients in hand sanitizers that function as antibacterials, such as 96% alcohol, lime, and sweet orange essential oils (Artanti et al., 2024). The results of this CSA product were also tested for inhibition against *E. coli* and *S. aureus* bacteria, as seen in Table 6 and Figure 7.

Table 6. Results of the antibacterial activity test of hand sanitizer products

Treatment	Inhibition zone diameter(mm)	
	<i>S. aureus</i>	<i>E.coli</i>
Base	0	0
Hand sanitizer	29,5	12

Table 6. shows that administering orange essential oil hand sanitizer can inhibit *S. aureus* bacteria with an inhibition zone diameter of 29.5 mm, while *E. coli* has a diameter of 12 mm. Figure 4 describes the bacterial growth inhibition zone.

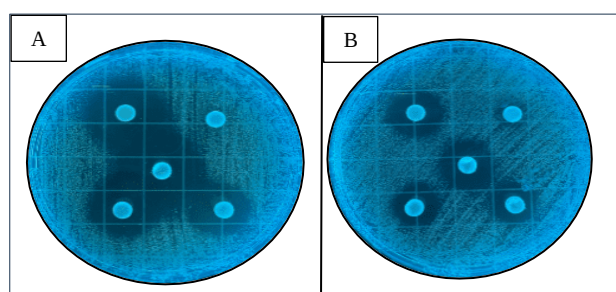


Figure 7. Inhibition zone diameter. A . *S. aureus*. B *E. coli*

Based on table 6. and figure 7. The ability of hand sanitizer in this CSA is better in inhibiting *S. aureus* bacteria than *E. coli*. According to Perwitasari et al. (2023), essential oils are generally a group of monoterpenes that can disrupt the integrity and function of cell membranes, change membrane potential, cause cytoplasmic damage, and inhibit the respiratory chain in both gram-negative and positive bacteria. However, gram-positive bacteria are more sensitive to the administration of essential oils than gram-negative bacteria. According to Anindita et al. (2024)), the sensitivity of gram-positive bacteria is because these bacteria do not have an outer membrane that directly protects the cell wallAs

a result, an antibacterial compound such as essential oils can easily destroy the cell wall and cytoplasm, which results in cytoplasmic leakage. This contrasts with gram-negative bacteria, which have an outer membrane that protects the cell wall. The presence of an outer membrane in the form of phospholipids can be a barrier to the entry of many antibiotic and antibacterial molecules. In addition, the presence of enzymes in the periplasmic space of gram-negative bacteria is thought to be able to break down antibacterial molecules such as essential oils.

This community service activity has limitations, including that it is only carried out in one school, product commercialization activities have not been carried out, and product stability tests have not been carried out. However, it has advantages, including training, evaluation of CSA participant skills tests, and testing products for antibacterial efficacy.

Conclusion

Implementing this community service activity began with providing material on clean and healthy living behavior (CHLB). It continued with training on making and testing the efficacy of hand sanitizer products. This activity was carried out for 2 days and was attended by 61 Al-Muhtadin Vocational School students majoring in Pharmacy. The paired t-test results showed that the calculated t-value was smaller than the t-table ($-4.952 < -2.013$), or there was a significant difference in the average value of knowledge about CHLB and making hand sanitizers between before and after being given the material. The practical exam evaluation showed that all respondents were skilled in making and testing hand sanitizer products, as indicated by the average percentage score of participant skills in making hand sanitizers of 90.57%, while the efficacy testing skills were 93.44%. Based on the antibacterial efficacy test of hand sanitizer products by respondents, it was shown to inhibit and kill bacteria on the hands.

Acknowledgments

The author would like to thank Sekolah Tinggi Ilmu Kesehatan Mitra Keluarga for providing a community service grant No. 014/STIKes.MK/SK-LPPM/II/2025. The author would also like to thank SMK Al-Muhtadin's principal, who permitted the author to carry out community service activities at SMK Al-Muhtadin's pharmacy Department.

References

- Agarwal, P., Sebghatollahi, Z., Kamal, M., Dhyani, A., Shrivastava, A., Singh, K. K., Sinha, M., Mahato, N., Mishra, A. K., & Baek, K. H. (2022). Citrus Essential Oils in Aromatherapy: Therapeutic Effects and Mechanisms. In *Antioxidants* (Vol. 11, Issue 12, pp. 1–45). MDPI. <https://doi.org/10.3390/antiox11122374>
- Anindita, R., Uzia Beandrade, M., & Kurnia Putri, I. (2024). Bioprospecting Test of Piper betle Leaf Essential Oil Against Staphylococcus aureus and Escherichia coli-Antibiotic Resistant. *Biosfer: Jurnal Biologi Dan Pendidikan Biologi*, 9(2), 163–171. <https://doi.org/https://doi.org/10.23969/biosfer.v9i2.19303>
- Anugrah, R. A., & Winanta, A. (2022). Penyuluhan Teknologi Farmasi Untuk Siswa Jurusan Farmasi Smk Muhammadiyah Minggir. *Prosiding Seminar Nasional Program Pengabdian Masyarakat*, 699–705. <https://doi.org/10.18196/ppm.42.622>
- Astuti, E., Sugihartini, N., Zainab, & Rachma Novitasari, P. (2023). Community Service Based on A Training Method for Making Liquid Hand Sanitizers to Prevent The Spread of COVID-19 in Tegalsari Kulon Progo. *SPEKTA (Jurnal Pengabdian Kepada Masyarakat Dan Aplikasi)*, 4(1), 107–116. <https://doi.org/10.12198/spekta.v4i1.7821>
- Basheer, A., Hugerat, M., Kortam, N., & Hofstein, A. (2017). The effectiveness of teachers' use of demonstrations for enhancing students' understanding of and attitudes to learning the oxidation-reduction concept. *Eurasia Journal of Mathematics, Science and Technology Education*, 13(3), 555–570. <https://doi.org/10.12973/eurasia.2017.00632a>
- Darmayani, S., Anitasari, B., Nirawati, R., & Br Karo, M. (2023). Training on Making Hand Sanitizers Made from Local Plants to Prevent the Spread of COVID-19 (Case Study in Kambu District Kendari City). *Carmin: Journal of Community Service*, 3(1), 11–21. <https://doi.org/https://doi.org/10.59329/carmin.v3i1.52>
- Egner, P., Pavlačková, J., Sedlářková, J., Pleva, P., Mokrejš, P., & Janalíková, M. (2023). Non-Alcohol Hand Sanitiser Gels with Mandelic Acid and Essential Oils. *International Journal of Molecular Sciences*, 24(4), 1–5. <https://doi.org/10.3390/ijms24043855>
- El Hachlafi, N., Elbouzidi, A., Batbat, A., Taibi, M., Jeddi, M., Addi, M., Naceiri Mrabti, H., & Fikri-Benbrahim, K. (2024). Chemical Composition and Assessment of the Anti-Inflammatory, Antioxidant, Cytotoxic, and Skin Enzyme Inhibitory Activities of Citrus sinensis (L.) Osbeck Essential Oil and Its Major Compound Limonene. *Pharmaceuticals*, 17(12), 1–18. <https://doi.org/10.3390/ph17121652>
- Fernando, O. D., Ramdhania, N. A., Mauludia, M., Putri, R. A. A., & Ahfas, A. (2024). Increase in Community Interest in Making Aloe Vera-Based Hand Sanitizer. *Indonesian Journal of Cultural and Community Development*, 16(1). <https://doi.org/10.21070/ijccd.v16i1.1156>
- Giridharan, K., & Raju, R. (2016). Impact of Teaching Strategies: Demonstration and Lecture Strategies and Impact of Teacher Effect on Academic Achievement in Engineering Education. *INTERNATIONAL JOURNAL OF EDUCATIONAL SCIENCES*, 14(03), 174–186. <https://doi.org/10.31901/24566322.2016/14.03.01>
- Hussain, M. A. (2020). Effectiveness of Demonstration Method to Teach the Abstract Concepts to the Children Between the Age of Six to Ten. An Experimental Research. *International Journal of Education (IJE)*, 8(2), 23–32. <https://doi.org/10.5121/ije.2020.8203>
- Ibrahim, F. M., Shalaby, E. S., El-Liethy, M. A., Abd-Elmaksoud, S., Mohammed, R. S., Shalaby, S. I., Rodrigues, C. V., Pintado, M., & Habbasha, E. S. El. (2024). Formulation and

- Characterization of Non-Toxic, Antimicrobial, and Alcohol-Free Hand Sanitizer Nanoemulgel Based on Lemon Peel Extract. *Cosmetics*, 11(2). <https://doi.org/10.3390/cosmetics11020059>
- Indonesia, K. S. R. (2020). Perilaku hidup bersih dan sehat (PHBS) penguatan kapabilitas anak dan keluarga. In *Penguatan Kapabilitas Anak dan Keluarga*.
- Jasmine. P. A, S., Wijaya, I. M. M., & Suwariani, N. P. (2022). Uji Efektivitas Hand Sanitizer Gel Organik Berbahan Dasar Arak Bali Terhadap *Staphylococcus aureus*. *JURNAL REKAYASA DAN MANAJEMEN AGROINDUSTRI*, 10(2), 161–172. <https://doi.org/10.24843/jrma.2022.v10.i02.p04>
- Kusaendri, D. (2023). *Pengaruh Profitabilitas, Keputusan Investasi, dan Keputusan Pendanaan terhadap Nilai Perusahaan dengan Kebijakan Dividen Sebagai Variabel Moderasi*.
- Manzur, M., Luciardi, M. C., Blázquez, M. A., Alberto, M. R., Cartagena, E., & Arena, M. E. (2023). Citrus sinensis Essential Oils an Innovative Antioxidant and Antipathogenic Dual Strategy in Food Preservation against Spoilage Bacteria. *Antioxidants*, 12(2), 1–18. <https://doi.org/10.3390/antiox12020246>
- Mariana Larira, D., Rasmiati, K., & Mien. (2021). Pembelajaran Dini Perilaku Hidup Bersih Sehat (PHBS). *Karya Kesehatan Journal of Community Engagement*, 1(2), 16–20. <https://doi.org/https://doi.org/10.46233/k2jce.v2i01>
- Mayangsari, B., Fatmawati, D., Setiawan, I., Furi, R. M., & Sofana, P. R. (2020). Training in Making Natural Hand Sanitizer From Betel Leaf and Lime in The Community of Brebes Ketanggungan Village. *Indonesian Journal of Devotion and Empowerment*, 2(2), 11–14. <https://doi.org/https://doi.org/10.15294/ijde.v2i2.41024>
- Mirya, A. La. (2018). *Optimasi Kosurfaktan Polyethylene G Lycol 400 (PEG 400) Pada Formulasi Nanoemulsi Ekstrak Daun Teh Hijau (Camellia sinensis)*. Universitas Brawijaya.
- Mutende, R. A., Akala, W., & Imonje, R. K. (2021). Connecting theory and practice: Pre-service science teachers' adoption and implementation of the demonstration method. In *International Journal of Learning, Teaching and Educational Research* (Vol. 20, Issue 5, pp. 189–210). Society for Research and Knowledge Management. <https://doi.org/10.26803/IJLTER.20.5.11>
- Nofita, Rahayu, D., Lestari, D., & Wijayanti, F. (2014). Pelatihan Pembuatan Hand Sanitizer Alami Sebagai Upaya Peningkatan Pola Hidup Sehat Di SDN 2 gadingrejo utara kabupaten pringsewu. *jurnal Pengabdian Farmasi Malahayati*, 7(2), 220–231. <https://doi.org/https://doi.org/10.33024/jkpm.v7i1>
- Nwalo, C. N., & Eze, I. T. (2021). Comparative effectiveness of project and demonstration teaching methods in improving students' retention ability in basic electricity in technical colleges. *International Journal of Educational Policy Research and Review*, 8(1), 1–7. <https://doi.org/10.15739/IJEPRR.21.001>
- Parida Hutapea, H., & Ambarwati, S. (2024). Pelatihan Pembuatan Handsanitizer Bersama Posyandu Remaja Desa Gedangan Kabupaten Sukoharjo. *Jurnal Abdimas Musi Charitas (JAMC)*, 57(1), 57–64. <https://doi.org/https://doi.org/10.32524/jamc.v8i1.1160>
- Perwitasari, M., Anindita, R., Uzia Beandrade, M., Dwi Nathalia, D., Nurani Hasmar, W., & Putri, K. I. (2023). Anti-Bacterial Activity of Etanolic Extract and Essential Oil of Basil (*Ocimum sanctum*) on Growth *Staphylococcus aureus* *Salmonella thypii* and *Eschericia*

- coli. *Jurnal ILMU DASAR*, 24(2), 143–150.
<https://doi.org/https://doi.org/10.19184/jid.v24i2.31367>
- Rachmania, R. A., & Wardani, E. (2019). Pelatihan Pembuatan Virgin Coconut Oil (VCO) Bagi Siswa Siswi SMK Dan SMA Mutiara 17 Agustus. *SEMAR (Jurnal Ilmu Pengetahuan, Teknologi, Dan Seni Bagi Masyarakat)*, 8(1), 30–34.
<https://doi.org/10.20961/semar.v8i1.18140>
- Saputra, D. N., Lamri, & Tiara Dini Harlita. (2023). Gambaran Angka Kuman Sebelum Dan Sesudah Pencucian Tangan Menggunakan Sabun Antiseptik Dan Hand Sanitizer. *Jurnal Kesehatan Tambusai*, 4(4), 5797–5802.
- Ulya, U., Mulfah, L., Nuha, U. A., Nursapitri, M., Affia, R. M., & Rahman, I. (2022). Program Edukasi 6 Langkah Mencuci Tangan Pada Anak Di MI Al – Hidayah Kelurahan Cirendeu. *Seminar Nasional Pengabdian Masyarakat LPPM UMJ*, 1–5.
<https://doi.org/http://jurnal.umj.ac.id/index.php/semnaskat>
- Yati, K., Efendi, K., & Dwitianti. (2022). Pelatihan Pembuatan Hand Sanitizers Bagi Siswa Smk Dalam Menghadapi Pembelajaran Tatap Muka Di Masa Pandemi COVID-19. *JMM (Jurnal Masyarakat Mandiri)*, 6(3), 2303–2311.
<https://doi.org/https://doi.org/10.31764/jmm.v6i3.8496>