

BAB V

KESIMPULAN DAN SARAN

5.1 Kesimpulan

1. Ekstrak daun leilem (*Clerodendrum minahassae*) dengan konsentrasi 30%, 40%, 50%, memiliki aktivitas antibakteri terhadap *Salmonella typhi* dengan diameter rata-rata daerah hambatan pertumbuhan $6,6 \pm 0,93$ mm, $8,5 \pm 1,12$ mm dan $10,3 \pm 0,65$ mm.
2. Golongan senyawa metabolit sekunder yang terkandung didalam ekstrak daun leilem adalah flavanoid, tanin, alkaloid, steroid, triterpenoid.

5.2 Saran

1. Penelitian lanjutan perlu dilakukan dengan metode fraksinasi terhadap ekstrak daun leilem (*Clerodendrum minahassae*) untuk memisahkan senyawa berdasarkan tingkat kepolarannya.
2. Penelitian lebih lanjut disarankan menggunakan metode dilusi untuk menentukan nilai Konsentrasi Hambat Minimum (KHM) dan Konsentrasi Bunuh Minimum (KBM), serta metode bioautografi untuk mengidentifikasi senyawa metabolit sekunder yang berkontribusi terhadap aktivitas antibakteri ekstrak daun leilem.

DAFTAR PUSTAKA

- Adekiya, T.A., Adebayo, E.A., Aremu, A.O. & Okoh, A.I. 2023. *Phytochemical Screening and Characterization of Bioactive Compounds in Medicinal Plants: Current Analytical Approaches*, **12(15)**: 2748.
- Akram, J., Khan, A.S., Khan, H.A., Gilani, S.A., Akram, S.J., Maret, F.J. dan Mehboob, R. 2020, Extensively drug-resistant (XDR) typhoid: Evolution, prevention, and its management, *BioMed Research International*, 1–12.
- Anggita, D., Nuraisyah, S. dan Wiriansya, E.P. 2022, Mekanisme kerja antibiotik, *UMI Medical Journal*, **7(1)**: 46–58.
- Apriani, S.P.D., Suhartati, R., Nur, J., Setiawan, D., Istyanto, F., Kartika Dewi, R., Safari, W.F., Ilsan, N.A. dan lainnya. 2023, *Bakteriologi (Materi Morfologi, Struktur dan Fisiologi Bakteri, Pewarnaan Bakteri, Mikroflora Normal, Bakteri Patogen, dsb.)*, STIKes Kesosi, Maret Barat.
- Arianti, V., Adiana, S., Hasanah, A.U., Maulina, D., Adrianto, D., Chandra, P.P.B. dan Amir, R. 2024, *Buku Ajar Fitokimia*, CV. Eureka Media Aksara.
- Bai, Y., Liu, W., Liu, Z., He, X., Jin, H., Xiao, S., Yang, J., Sun, H., Guo, J., Zhang, T., Wang, Q., Wang, Y., Ding, D. dan Liu, W. 2025, Multi-omics analysis of glycolytic reprogramming and ROS dynamics in host-specific response to *Salmonella typhi* infection in mice, *Journal of Advanced Research*.
- Balekundri, A. dan Mannur, V. 2020, Quality control of the traditional herbs and herbal products: A review, *Future Journal of Pharmaceutical Sciences*, **6(1)**: 67.
- Balouiri, M., Sadiki, M. dan Ibnsouda, S.K. 2016, Methods for *in vitro* evaluating antimicrobial activity: A review, *Journal of Pharmaceutical Analysis*, **6(2)**: 71–79.
- Bermula, Y., Potalangi, N.O. dan Tombuku, J.L. 2022, Aktivitas antibakteri ekstrak etanol daun leilem (*Clerodendrum minahassae* Teijsm. & Binn.) terhadap bakteri *Staphylococcus aureus* dan *Escherichia coli*, *Jurnal Biomedik*, **14(2)**: 108–116.

- Bhutta, Z.A. 2006, Current concepts in the diagnosis and treatment of typhoid fever, *BMJ*, **333(7558)**: 78–82.
- Bontjura, S., Waworuntu, O.A. dan Siagian, K.V. 2015, Uji efek antibakteri ekstrak daun leilem (*Clerodendrum minahassae* L.) terhadap bakteri *Streptococcus mutans*, *PHARMACON: Jurnal Ilmiah Farmasi*, **4(4)**: 96–101.
- Bossel Ben-Moshe, N., Hen-Avivi, S., Avraham, R., O'Connor, D., Jin, C., Voysey, M., Stockdale, L. dkk. 2025, Intestinal invasion by *Salmonella typhi* drives a hypoxic immune subset associated with disease outcome, *Nature Communications*, **16**: 6755.
- Brooks, G.F., Carroll, K.C., Butel, J.S., Morse, S.A. dan Mietzner, T.A. 2020, *Jawetz, Melnick, & Adelberg's Medical Microbiology*, 28th ed., McGraw-Hill Education, New York.
- Cita, Y.P. 2011, Bakteri *Salmonella typhi* dan demam tifoid, *Jurnal Kesehatan Masyarakat*, **6(1)**: 42–46.
- Clinical and Laboratory Standards Institute. 2024, *Performance Standards for Antimicrobial Susceptibility Testing*, 34th ed., CLSI Supplement M100, Clinical and Laboratory Standards Institute, Wayne, PA.
- Crump, J.A., Luby, S.P. dan Mintz, E.D. 2015, Epidemiology, clinical presentation, laboratory diagnosis, antimicrobial resistance, and management of invasive *Salmonella* infections, *Clinical Microbiology Reviews*, **28(1)**: 901–937.
- Efiyanti, C. 2024, *Demam Tifoid*, Modul Kuliah, Fakultas Kedokteran IPB University, Bogor.
- European Medicines Agency (EMA). 2025. *Guideline on Good Agricultural and Collection Practice (GACP) for Starting Materials of Herbal Origin – Revision 1*. Amsterdam: European Medicines Agency.
- Handa, S.S., Khanuja, S.P.S., Longo, G. dan Rakesh, D.D. 2008, *Extraction Technologies for Medicinal and Aromatic Plants*, International Centre for Science and High Technology (ICS-UNIDO), Trieste.
- Harborne, J.B. 1987, *Metode Fitokimia: Penuntun Cara Modern Menganalisis Tumbuhan*, diterjemahkan dari bahasa Inggris oleh K. Padmawinata dan I. Soediro, ITB Press, Bandung.
- Harborne, J.B. 1998, *Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis*, 3rd ed., Springer Netherlands, Dordrecht.

- Hudzicki, J. 2009, *Kirby-Bauer Disk Diffusion Susceptibility Test Protocol*, American Society for Microbiology, Washington DC.
- Idrus, H.H., Rinendyaputri, R. dan Fitriana. 2023, *Tinjauan Biologi Molekuler Achras zapota L. terhadap Salmonella typhi*, Eureka Media Aksara.
- Imara, F. 2020, *Salmonella typhi* bakteri penyebab demam tifoid, *Prosiding Seminar Nasional Biologi*, **6(1)**: 1–7.
- Istiqomah, N., Agustina, N. dan Bellamilenia Putri, S. 2023, Deteksi bakteri *Salmonella* sp. dengan kultur darah pada pasien Widal positif di Laboratorium Klinik X, *Journal Syifa Sciences and Clinical Research*, **5(2)**: 338–346.
- Jawetz, E., Melnick, J.L. dan Adelberg, E.A. 2019, *Medical Microbiology*, 28th ed., McGraw-Hill Education, New York.
- Julianto, T.S. 2019, *Fitokimia: Tinjauan Metabolit Sekunder dan Skrining Fitokimia*, Universitas Islam Indonesia, Yogyakarta.
- Kairupan, C.F., Mantiri, F.R. dan Rumende, R.R.H. 2019, Phytochemical screening and antioxidant activity of ethanol extract of leilem (*Clerodendrum minahassae* Teijsm. & Binn.) as an antihyperlipidemic and antiatherosclerotic agent, *IOP Conference Series: Earth and Environmental Science*, **217(1)**.
- Kasim, V.N.A. 2020, *Peran Imunitas pada Infeksi Salmonella Typhi*, CV Athra Samudra, Gorontalo.
- Kementerian Kesehatan Republik Indonesia 2000, *Parameter Standar Umum Ekstrak Tumbuhan Obat*, Direktorat Jenderal Pengawasan Obat dan Makanan, Direktorat Pengawasan Obat Tradisional, Jakarta.
- Kementerian Kesehatan Republik Indonesia 2006, *Pedoman Pengendalian Demam Tifoid*, Keputusan Menteri Kesehatan Republik Indonesia Nomor 364 Tahun 2006, Kementerian Kesehatan Republik Indonesia, Jakarta.
- Kementerian Kesehatan Republik Indonesia 2021, *Peraturan Menteri Kesehatan Republik Indonesia Nomor 28 Tahun 2021 tentang Pedoman Penggunaan Antibiotik*, Berita Negara Republik Indonesia Tahun 2021 Nomor 1116, Jakarta.
- Khanam, Z., Wen, C.S. & Bhat, I.U.H. 2022. *Phytochemical screening and qualitative analysis of bioactive compounds in medicinal plants: A review*. *Molecules*, **27(21)**.

- Klau, M.H.C. 2021, Aktivitas antibakteri ekstrak etanol daun kelor (*Moringa oleifera* Lam.) terhadap *Staphylococcus aureus*, *Jurnal Farmasi dan Sains Indonesia*, **4(1)**: 37–44.
- Krakowska-Sieprawska, A., Kielbasa, A., Rafińska, K., Ligor, M. & Buszewski, B. 2022. Modern methods of pre-treatment of plant material for the extraction of bioactive compounds. *Molecules*, **27(3)**: 730.
- Kuncoro, H., Wahyuni, S., Pratiwi, L. & Fitriani, D. 2023. Phytochemical Screening and Thin Layer Chromatography Identification of Alkaloid Compounds in Medicinal Plants. *Pharmacognosy Journal*, **15(2)**: 245–252.
- Kundera, I.N. 2025, *Salmonella typhi* (Bakteri Penyebab Demam Tifoid dan Dampaknya pada Kesehatan), CV Bravo Press, Malang.
- Kungu, E. 2025, Investigasi penularan *Salmonella typhi* melalui makanan dan sumber kontaminasi, *Newport Journal of Public Health and Pharmacy*, **6(3)**: 1–5.
- Lisboa, C.F., Melo, E.C., Sperotto, N.C.Z., Ávila, M.B.R., Silva, L.C., Aleman, C.C., Carneiro, J.C.S., Coelho, A.P.F. & Silva, C.S. 2022. *Packaging and storage of medicinal plants*. Research, Society and Development, **11(7)**.
- Maciel-Silva, F.W., Lachos-Perez, D., Buller, L.S., Sganzerla, W.G., Pérez, M., Rostagno, M.A. & Forster-Carneiro, T. 2022. *Green Extraction Processes for Complex Samples from Vegetable Matrices Coupled with On-Line Detection System: A Critical Review*. *Molecules*, **27(19)**.
- Madigan, M.T., Bender, K.S., Buckley, D.H., Sattley, W.M. dan Stahl, D.A. 2021, *Brock Biology of Microorganisms*, 16th ed., Pearson Education, New York.
- Microbe-Canvas 2022, *Salmonella Typhi*, diakses 10 November 2025.
- Muller, M., Custers, D., Dlodla, P.V., Muller, C.J.F. & Joubert, E. 2024. Investigating Flavonoids by HPTLC Analysis Using Aluminium Chloride as Derivatization Reagent. *Molecules*, **29(21)**.
- Mulyani, S., Sofiatun dan Retnaningtyas, E.N. 2010, Aktivitas antibakteri ekstrak metanol dan fraksi *n*-heksan:kloroform:asam asetat (7:2:2) dari daun *Melastoma candidum* D.Don terhadap pertumbuhan *Salmonella typhi*, **7(1)**: 254–261.

- Mulyani, S. dan Lakasana, T. 2011, Analisis flavonoid dan tanin dengan metoda mikroskopi mikrokimiawi, *Majalah Obat Tradisional*, **16(1)**: 109–114.
- Noviana, D., Widyastuti, N. dan Pratama, R.A. 2022, Standardisasi ekstrak tumbuhan obat: Parameter spesifik dan nonspesifik sebagai penjamin mutu ekstrak, *Jurnal Farmasi Indonesia*, **19(1)**: 85–95.
- Nugroho, A. 2017, *Teknologi Bahan Alam*, Lambung Mangkurat University Press, Banjarbaru.
- Nugroho, A.E., Riyanto, S. & Martono, S. 2022. Thin Layer Chromatography Profile and Phytochemical Screening of Medicinal Plant Extracts Using Dragendorff Reagent. *Pharmaciana*, **12(3)**: 287–296.
- Nurhayati, L.S., Yahdiyani, N. dan Hidayatulloh, A. 2020, Perbandingan pengujian aktivitas antibakteri starter yogurt dengan metode difusi sumuran dan metode difusi cakram, *Jurnal Teknologi Hasil Peternakan*, **1(2)**: 41–46.
- Plantamor. 2025, *Clerodendrum minahassae*. Diakses pada 10 Desember 2025.
- Pratama, R.A., Noviana, D. dan Hidayat, M. 2025, Standardisasi kultur bakteri dan optimasi kondisi pertumbuhan pada pengujian aktivitas antibakteri, *Indonesian Journal of Pharmaceutical Science*, **8(1)**: 45.
- Pratiwi, D., Fatimawali dan Siampa, J.P. 2023, Analisis aktivitas antioksidan ekstrak dan fraksi daun leilem (*Clerodendrum minahassae* Teijsm. & Binn.) dengan metode DPPH (2,2-difenil-1-pikrihidrazil), *Jurnal Lentera Farma*, **2(1)**: 8–14.
- Puspitasari, A.D. dan Prayogo, L.S. 2017, Perbandingan metode ekstraksi maserasi dan sokletasi terhadap kadar flavonoid total ekstrak etanol daun kersen (*Muntingia calabura* L.), *Jurnal Ilmiah Cendekia Eksakta*, **2(1)**: 1–8.
- Putri, R.N., Wahidah, S.N., Hosiyah, Al Hafidz, I.T. dan Faisal 2023, Uji daya hambat antimikroba secara difusi sumuran dan difusi *paper disk*, *Era Sains: Journal of Science, Engineering and Information Systems Research*, **1(4)**: 28–33.
- Rahmati, E., Khoshtaghaza, M.H., Banakar, A. & Ebadi, M.T. 2022. Decontamination technologies for medicinal and aromatic plants: A review. *Food Science & Nutrition*, **10(3)**: 784–799.

- Riedel, S., Hobden, J.A., Miller, S., Morse, S.A., Mietzner, T.A., Detrick, B., Mitchell, T.G., Sakanari, J.A., Hotez, P. and Mejia, R. (2019) *Jawetz, Melnick & Adelberg's Medical Microbiology*. 28th edn. New York: McGraw-Hill Education.
- Samboua, C.N. 2024, Review: Identification of the main bioactive compounds in leilem leaves (*Clerodendrum minahassae*) and their pharmacological potential, *Journal of Pharmaceutical and Sciences*, **7(4)**: 739–746.
- Sari, Y.E.S., Azizah, F., Tumbol, M.V.L., Prayekti, E., Nurbidayah, Wijayanti, D.R. 2025, *Bakteriologi I Teknologi Laboratorium Medis*, Media Pustaka Indo, Malang.
- Senawong, K., Katekaew, S., Juntahum, S. & Laloon, K. 2023. *Impact of Grinding and Sorting Particle Size on Phytochemical Yield in Dipterocarpus alatus Leaf Extract*. *International Journal of Biomaterials*.
- Shen, N., Wang, T., Gan, Q., Liu, S., Wang, L. & Jin, B. 2022. *Plant flavonoids: Classification, distribution, biosynthesis, and antioxidant activity*. *Food Chemistry*, 383.
- Silva, R.F., Carneiro, C.N., de Sousa, C.B.C., Gomez, F.J.V., Espino, M., Fernández, M.A. & Dias, F.S. 2022. *Sustainable extraction bioactive compounds procedures in medicinal plants based on the principles of green analytical chemistry: A review*. *Microchemical Journal*, 175.
- Situmorang, H.R.R., Waworuntu, O. dan Mintjelungan, C. 2016, Uji konsentrasi hambat minimum (KHM) ekstrak daun leilem (*Clerodendrum minahassae* L.) terhadap bakteri *Streptococcus mutans*, *Pharmakon Jurnal Ilmiah Farmasi*, **5(4)**: 69–75.
- Socfindo Conservation 2025, *Clerodendrum minahassae*, diakses pada 12 Februari 2026.
- Sogandi, S. dan Rabima, R. 2019, Identifikasi senyawa aktif ekstrak buah mengkudu (*Morinda citrifolia* L.) dan potensinya sebagai antioksidan, *Jurnal Kimia Sains dan Aplikasi*, **22(5)**: 206–212.
- Shrivastava, N. and Patel, T. 2007, *Clerodendrum and healthcare: An overview*, *Medicinal and Aromatic Plant Science and Biotechnology*, **1(1)**: 142–150.

- Sulistiawanti, N.L., Hairunnisa, H., Ningrum, N.W. dan Fitriyanti, S. 2025, Review: Perbedaan penggunaan pelarut terhadap nilai rendemen yang dihasilkan dengan berbagai metode ekstraksi dalam proses ekstraksi, *An-Najat*, **3(3)**.
- Summer, K., Browne, J., Hollanders, M. & Benkendorff, K. 2022. Out of control: The need for standardised solvent approaches and data reporting in antibiofilm assays incorporating dimethyl-sulfoxide (DMSO). *Biofilm*, **4**.
- Syahmani, S., Leny, L. dan Iriani, R. 2022, *Fitokimia dan Aplikasinya*, Lambung Mangkurat University Press, Banjarbaru.
- Thompson, C.N., Karkey, A., Dongol, S., Arjyal, A., Wolbers, M., Darton, T., Farrar, J.J., Thwaites, G.E., Dolecek, C., Basnyat, B. and Baker, S. 2017, Treatment response in enteric fever in an era of increasing antimicrobial resistance: An individual patient data analysis of 2092 participants enrolled into 4 randomized, controlled trials in Nepal, *Clinical Infectious Diseases*, **64(11)**: 1522–1531.
- Trease, G.E. and Evans, W.C. 2009, *Trease and Evans Pharmacognosy*, 16th edn., Saunders Elsevier, London.
- Utami, Y.P., Umar, A.H., Syahrini, R. dan Kadullah, I. 2017, Standardisasi simplisia dan ekstrak etanol daun leilem (*Clerodendrum minahassae* Teijsm. & Binn.), *Journal of Pharmaceutical and Medicinal Sciences*, **2(1)**: 32–39.
- Utami, Y.P., Imrawati, I. dan Rasyid, A.D. 2018, Isolasi dan karakterisasi ekstrak etanol daun leilem (*Clerodendrum minahassae* Teijsm. & Binn.) dengan metode spektrofotometri, *Pharmacy Medical Journal*, **1(2)**: 82–92.
- Wagner, H. and Bladt, S. 1996, *Plant Drug Analysis: A Thin Layer Chromatography Atlas*, 2nd edn., Springer-Verlag, Berlin.
- Wang, Y., Zhang, X., Liu, H. and Chen, J. 2023, Organoleptic evaluation and quality control of herbal extracts: Current status and future perspectives, *Journal of Ethnopharmacology*, **317**: 116780.
- Wardaniati, I. dan Gusmawarni, V. 2021, Uji aktivitas antibakteri ekstrak etanol propolis terhadap *Streptococcus mutans*, *Jurnal Farmasi Higea*, **13(2)**: 115–123.

- WHO 2019, *Essential Medicine List Application for Special Indication: Typhoid and Paratyphoid Fever*, World Health Organization, Geneva.
- Wijaya, H., Jubaidah, S. dan Rukayyah 2022, Perbandingan metode ekstraksi terhadap rendemen ekstrak batang turi (*Sesbania grandiflora* L.) dengan menggunakan metode maserasi dan sokhletasi, *Indonesian Journal of Pharmacy and Natural Product*, **5(1)**.
- Yadav, A., *et al.* 2024. *Critical analysis of green extraction techniques used for botanicals: Trends, priorities, and optimization strategies – A review*. TrAC Trends in Analytical Chemistry, 174.
- Yasin, N., Jabeen, A., Nisa, I., Tasleem, U., Khan, H., Momin, F., Shah, F., Rasheed, U., Zeb, U., Safi, A.-U.-R., Hussain, M., Qasim, M. and Rahman, H. 2018, A review: Typhoid fever, **2(3)**.
- Yogita, S.P., Hendrayana, M.A. dan Sukrama, I.D.M. 2018, Pola kepekaan bakteri *Salmonella typhi* terisolasi dari darah terhadap siprofloksasin dan seftriakson di RSUP Sanglah periode Maret 2015–Maret 2017, *E-Jurnal Medika*, **7(12)**: 1–6.