

BAB V

KESIMPULAN DAN SARAN

5.1. Kesimpulan

- 1) Ekstrak etanol daun bintaro (*Cerberra odollam* Gaertn.) memiliki aktivitas antibakteri terhadap *Staphylococcus aureus* dengan adanya DHP (Daerah Hambat Pertumbuhan), KHM sebesar 1,324% dan KBM sebesar 1,892%.
- 2) Ekstrak etanol daun bintaro (*Cerberra odollam* Gaertn.) memiliki aktivitas penghambatan biofilm *Staphylococcus aureus* dengan penghambatan pembentukan biofilm 100% terdapat pada konsentrasi 1,875%.
- 3) Jenis golongan senyawa yang terdapat pada ekstrak etanol daun bintaro (*Cerberra odollam* Gaertn.) adalah flavonoid, saponin, tanin dan sterol.

5.2. Saran

- 1) Dilakukan pemisahan terhadap senyawa flavonoid, saponin, tanin dan sterol dari ekstrak etanol daun bintaro (*Cerberra odollam* Gaertn.) untuk dilakukan penelitian lebih lanjut terhadap khasiat antibakterinya sehingga dapat dikembangkan menjadi bahan baku obat terhadap infeksi yang disebabkan oleh *Staphylococcus aureus*.
- 2) Perlu dilakukan penelitian lebih lanjut untuk mengetahui golongan senyawa yang aktif sebagai sebagai antibakteri dan antibiofilm pada ekstrak etanol daun bintaro (*Cerberra odollam* Gaertn.).

DAFTAR PUSTAKA

- Ahmed, F., Amin, R., Shahid, IZ., & Sobhani. 2008. *Antibacterial, cytotoxic and neuropharmacological activities of Cerbera odollam seeds, Oriental Pharmacy and Experimental Medicine*.
- Alasil, Saad Musbah., Omar, Rahmat., Ismail, Salmah., Yusof, Mohd Yasim., Dhabaan, Ghulam N., and Abdulla, Mahmood amen. 2013. Evidenc of bacterial biofilms among infected and hypertrophied tonsil in correlation with microbiology, histopathology, and clinical symptoms of tonsilar diseases. International journal of Otolaryngology. MAHSA university, Malaysia. Vol. 2013.
- Archer, N.K., M.J. Mazaitis, J.W. Costerton, J.G. Leid, M.E. Powers, M.E Shirliff. 2011. *Staphylococcus Aureus Biofilms Properties, Regulation and Roles in Human Disease*. Landes Bioscience. Virulence.
- Assani, S. 1994. Ultrastruktur, Morfologi, dan Pewarnaan Kuman, dalam Buku Ajar Mikrobiologi Kedokteran, Binarupa Aksara, Jakarta.
- Bailey, W. R. and E. G. Scott, 1974, Diagnostic Microbiology, 4th ed., The C.V.Mosby Company, Saint Louis
- Benson, H.J. 1998. Microbilology Aplications Laboratory Manual in General Microbiology 7th. Mc Graw Hill. London.
- Bjarnsholt *et al.* 2011. Biofilm Infections, *Springer-Verlag*. New York. Hal : 251-255
- Brooks, G.F., Butel, J.S. and Morse, S.A. 2005. Jawetz, Melnick, & Adelberg's Microbiologi Kedokteran. Diterjemahkan dari Bahasa Inggris oleh bagian Mikrobiologi Fakultas Kedokteran Universitas Airlangga. Jakarta: Salemba Medika.
- Brooks, G.F., Carroll, K.C., Butel, J.S., dan Morse, S.A. 2007. Jawetz, Melnick, & Adelberg's Medical Microbiology. 24th ed. United States of America: The McGraw-Hill Companies, Inc

- Cassandra L. Quave, Lisa R.W. Plano, Traci Pantuso, Bradley C. Bennett. 2008. *Effects of extracts from Italian medicinal plants on planktonic growth biofilm*. Journal of Ethnopharmacology 118 (2008) 418–428
- Chambers, H.F. 2006. Beta-Laktam Antibiotics and Other Inhibitors of Cell Wall Synthesis. In : Katzung, B.G., et al. Basic and Clinical Pharmacology, 10th ed. McGraw Hills Companies, Inc., New York.
- Chamdit, S., & Siripermpool, P., 2012, Antimicorbial Effect of Clove and Lemongrass Oils against Planktonic Cells and Biofilms of Staphylococcus aureus, Mahidol University J. Pharm. Sci., 39 (2), 28-36
- Chang, L.C., Gills, J.J., Bhat, K.P.L., Luyengi,L., Farnsworth, N.R., Pezzuto, J.M., & Kinghorn, A.D. 2000. *Activity-Guided Isolation of Constituents of Cerbera manghas with Antiproliferative and Antiestrogenic Activities*, Bioorganic & Medicinal Chemistry Letters.
- Chen, P., Abercrombie, J., Seth, A., Mustoe, T., & Leung, K., 2013, Activity of Imipenem against *Klebsiella pneumoniae* Biofilms In Vitro and In Vivo, *Antimicrobial Agents Chemotherapy*, 58, 1208-1213.
- Consterton, J.W. 1999. *Bacterial Biofilms : A Common Cause of Persistent Infection*. American Association od Advancement Science, Washington DC
- Cortés et al. 2011. *Biofilm Formation, Control and Novel Strategies for Eradication*. Department of Restorative Dentistry. Brazil. Formatex. Hal 896-905
- Deacon J.W. 1997. Modern microbiology. 3rd ed. London: Blackwell Science Ltd. p. 29-46, 66-69, 104-108, 254- 291.
- Departemen Kesehatan RI. 1995. Farmakope Indonesia Jillid IV. Jakarta: Departemen Kesehatan Republik Indonesia

- Departemen Kesehatan RI. 2008. Farmakope Herbal Indonesia. Jakarta: Departemen Kesehatan Republik Indonesia.
- Ditjen POM. 2000. Parameter Standar Umum Ekstrak Tumbuhan Obat. Cetakan Pertama. Jakarta: Departemen Kesehatan RI.
- Ditjen POM. 2015. Farmakope Indonesia. Edisi IV. Jakarta: Departemen Kesehatan R.I.
- [Drenkard E](#), [Ausubel F.M](#). 2002. Pseudomonas biofilm formation and antibiotic resistance are linked to phenotypic variation. *Nature* 416(6882):740-3
- Farnsworth, N.R. (1966). Biological and Phytochemical Screening of Plants. *Journal of Pharmaceutical Sciences*. Volume 55. No.3. Chicago: Reheis Chemical Company. Pages 263-264
- Ganiswara S.G., Setiabudy, Suyatna F.D., dkk. 1995. Farmakologi dan Terapi edisi 4. Jakarta: Fakultas Kedokteran Universitas Indonesia,: 571-583.
- Ganiswara, 1995. Farmakologi dan Terapan. Edisi IV. Bagian Farmakologi. Fakultas Kedokteran. Universitas Indonesia. Jakarta.
- Griffin, H.D. 1981. *Fungal Physiology*. New York : John Wiley and Son, Inc.
- Hamburger, M.O., Cordell G.A., 1987. Bioautographic assay for antibacterial compound. *J. Nat. Prod.* 19, 50-53.
- Hashim R., Boon J.G.,Sulaiman O., Kawamura F., Lee C.Y. 2009. Evaluation of the decay resistance properties of *Cerbera odollam* Extracts and Their Influence on Properties of Particleboard. *International Biodeterioration & Biodegradation* 63, 1013-1017.
- Hermawan,A., Hana, W. dan Wiwiek, T. 2007. Pengaruh Ekstrak Daun Sirih (Piper betle L) Terhadap Pertumbuhan Staphylococcus aureus dan Escherichia coli dengan Metode Diffusi Disk. Surabaya : Unair.

- Hoiby, N., Bjarnsholta, T., Givskovb, M., Molinc, S., Ciofub, O. 2010. *Antibiotic resistance of bacterial biofilms*. Ijantimicag.
- Hoiby, N., T. Bjarnsholt, M. Givskov, S. Molin, O. Ciofu. 2010. *Antibiotic resistance of bacterial biofilms*. Int J Antimicrob Agents. (Abstr.); 35(4):322-32.
<http://www.bacteriainphotos.com/staph.html>
<http://www.sapphirebioscience.com/page.jsp?id=56>
<https://naturespoisons.com/2015/03/18/cerberin-the-heartbreaker-of-the-suicide-tree-cerbera-odollam/>. Diakses pada tanggal 20 April 2016 pukul 18.00.
- Hugo, W. B., Russell A. D., 1987, Evaluation of non antibiotic antibacterial agents, in: Pharmaceutical Microbiology, W. B. Hugo and A. D. Russell (Eds.), 4th ed., Blackwell Scientific Publications, Oxford, 267.
- Jawetz, E., *et al*, 1995. *Mikrobiologi Kedokteran* Edisi 20. Jakarta : EGC.
- Jawetz, E., Melnick, J. L., Adelberg, E. A., 2001, *Mikrobiologi Kedokteran*, Edisi XXII, diterjemahkan oleh Bagian Mikrobiologi Fakultas Kedokteran Universitas Airlangga, 205-209, Penerbit Salemba Medika, Jakarta
- Jawetz, Melnick, Adelberg. 2008. *Mikrobiologi Kedokteran*. (H. Hartanto, C. Rachman, A. Dimanti, A. Diani). Jakarta : EGC.p.199 – 200 : 233.
- Katzung, B. G. 2007. *Basic & Clinical Pharmacology*, 10th ed. United States : Lange Medical Publications.
- Khanh. 2001. *Cerbera L*, PROSEA (Plant Resources of South-East Asia) Foundation, Bogor,. <http://www.proseanet.org>. (Diakses tanggal 03 Maret 2012)
- Kuddus. M. R., Rumi, F., & Masud, M.M. 2011. *Phytochemical Screening and Antioxidant Activity Studies of Cerbera odollam Gaertn*. International Journal of Pharma and Bio Sciences

- Kudva I.T., Jelacic S., Tarr P.I., Youderian P., Hovde C. J. 1999. *Biocontrol of Escherichia coli O157 with O157-specific bacteriophages*. Applied and Environmental Microbiology 65: 3767–3773.
- Kusmayati, Agustini, N.W.R. 2007. Uji Aktivitas Senyawa Antibakteri dari Mikroalga (*Porphyridium cruentum*), J Biod. 8(1) : 48 – 53.
- Laphookhieo S., Cheenpracha S., Karalai C., Chantrapromma S., Rat-A-Pa Y., Ponglimanont C., Chantrapromma K. Cytotoxic Cardenolide glycoside from the seeds of *Cerbera odollam*. *Phytochem*, 65:507-510, 2004.
- Lee, J-H., J.H. Park, H.S. Cho, S.W. Joo, M.H. Cho, J. Lee. 2013. *Antibiofilm Activities of Quercetin and Tannic Acid Against Staphylococcus aureus*. *Biofouling: The Journal of 7 Bioadhesion and Biofilm Research*. Vol 29, Issue 5.
- Lewis, K., 2010, Persister Cells, *Annu. Rev. Microbiol.*, 64, 357-372 cit. Archer, N.K., Mazaitis, M.J., Costerton, J.W., Leid, J.G., Powers, M.E., Shirtliff, M.E., 2011, *Staphylococcus aureus* Biofilms: Properties, Regulation and Roles in Human Disease, *Virulence*, 2(5), 445-459
- Madigan. Michael T *et al. Biology of Microorganism*. 10th ed. New York; Southern Illinois University Carbondale, 2003.
- Manuel Simoes, Lucia C. Simoes dan Maria J. Vieira. 2010. *A review of current and emergent biofilm control strategies*. 43: 573-583.
- Mardiastuti, H.W., *et al.* 2007. Emerging Resistance Pathogen: Situasi Terkini di Eropa, Amerika Serikat, Timur Tengah dan Indonesia. *Majalah Kedokteran Indonesia*, vol: 57.
- Maric, S and Vranes, J. 2007. Characteristics and significance of microbial biofilm formation. Department of Biology: Croatia.
- Melki, Wike Ayu EP, Kurniati. 2011. Uji Antibakteri Ekstrak *Gracilaria* sp (Rumput Laut) Terhadap Bakteri *Escherichia coli* dan *Staphylococcus aureus*. Universitas Sriwijaya, Indralaya-Indonesia

- N'Guessa N, J.D., Coulibaly, A., Ramanaou, A.A., Okou, O.C., Djaman, A.J. and Guede-Guina, F. 2007. Antibacterial activity of *Thonningia sanguine* against some multidrug resistant strain of *Salmonella enteric*, *African Health Science*, 7(3):155-158.
- Pace, J. L., Rupp, M. E. and Finch, R. G. 2006. *Biofilms, Infection, and Antimicrobial Therapy*. Taylor and Francis Group.LLC : Boca Raton.
- Paraje M.G. 2011. *Antimicrobial resistance in biofilm. Science against microbial pathogens : communicating current research and technological advances*. A Mendez-Vilaz (Ed.).
- Pelczar, Michael, J., E.C.S Chan. 1988. *Dasar – Dasar Mikrobiologi*, Jakarta : UI Press.
- Pertiwi, Nursitasari. 2010. *Uji Aktivitas Antibakteri dan Mekanisme Hambat Ekstrak Air Campuran Daun Piper Bettle L Terhadap Bakteri Uji*. Jurusan Farmasi. Fakultas Kedokteran dan Ilmu Kesehatan. UIN Syarif Hidayatullah. Jakarta [Skripsi].
- Prakash B., Veeregowda B.M., Krishnappa G.. 2003. *Biofilms: A Survival Strategy of Bacteri*. Current Sci.
- Rahalison *et al.*, 1991. A Bioautographic Agar Overlay Method for Detection of Antifungal Compounds from Higher Plant, *Phytochemical Analysis*, 2, 199- 203.
- Rahman, M.D.A., Paul, P., & Rahman, A.A. 2011. *Antinociceptive, Antibacterial & Diuretic Activities of Cerbera odollam Gaertn Roots*, *Research Journal of Pharmaceutical, Biological and Chemical Sciences*, 2 (3), 16-23
- Ranganathan Vasudevan.2014.Biofilms: Microbial Cities of Scientific Significance. *Journal of Microbiology & Experimentation*. School of Chemical and Biotechnology, SASTRA University, Thanjavur.
- Saad M.A *et al.* 2014. *Antibiofilm Activity, Compound Characterization and Acute Toxicity of Extract from a Novel Bacterial Species of*

- Paenibacillus*. International Journal of Microbiology. Volume 2014. Article ID 649420. 11 pages.
- Salleh. 1997. Ethno botany, Ethno Pharmacognasy and Documentation of Malaysia Medicinal and Aromatic Plants, Malaysia, UKM.
- Simoës M., Simoës L.C., Vieira M.J. 2010. *A review of current and emergent biofilm control strategies*. LWT-Food Science and Technology 43: 573-583.
- Siswandono dan Soekardjo, B., 2008. Kimia Medisinal. edisi 2. Surabaya : Airlangga University Press.
- Sulistyo, 1971, Farmakologi dan Terapi, Yogyakarta, EKG
- Syarifah, M.M.S., Nurhanah, M.Y., Haffiz, J.M., Ilham, A.M., Getha, K., Asiah, O., Norhayati, I., Sehira, H.L., & Suryani, S.A., 2011, Potential Anticancer Coumpound From Cerbera Odollam, Journal of Tropical Fores Science, 23 (1), 89-96.
- Tarmadi, D., Prianto, A.H. Guswenrivo, I., Kartika, T., & Yusuf, S., 2007, Pengaruh Ekstrak Bintaro (Carbera odollam Gaertn) dan Kecubung (Brugmansia candida Pers) terhadap Rayap Tanah Coptotermes sp, J. Tropical Wood Science and Technology, J. Tropical Wood Science and Technology, 5 (1), 38-42.
- Tjay, T . dan Rahardja, K. 2007. Obat-obat Penting (Khasiat, Penggunaan, dan Efek-efek Sampingnya), Jakarta: PT. Elex Media Komputindo.
- Tobing R.R, Teruna H.Y., Yuharmen. 2012. Isolasi Metabolit sekunder dan Uji toksisitas Ekstrak Metanol Daun Tanaman *Cerbera odollam* Gaertn (Apocynaceae). Fakultas Matematika dan Ilmu Pengetahuan Alam Kampus Binawidya Pekanbaru, 28293, Indonesia.
- Tortora G.J., Funke B.R., Case C.L. 2001. Microbiology, an Introduction. 7th edition. USA: Addison Wesley Longman Inc.
- Trisnawati, I.N. 2010. Pengaruh perlakuan sanitiser air panas pada peralatan penyajian terhadap penurunan angka total bakteri dan coliform di

bangsal geriatri RSUP Dr. Kariadi Semarang. Skripsi. Semarang: UNDIP.

Utami S.2010. Aktivitas Insektida Bintaro (*Cerbera odollam* Gaertn.) Terhadap Hama *Eurema* sp. pada skala laboratorium. Penelitian Hutan Tanaman 7(4):211-220.

Van Steenis, C. G. G. J.. 2006. Flora. Cetakan Keduabelas. Jakarta : Pradnya Paramita.

Wahjono,H.2007. Peran Mikrobiologi Klinik Pada Penanganan Penyakit Infeksi. Diakses dari eprints.undip.ac.id/320/1/Hendro_Wahjono.pdf pada tanggal 26 Maret 2016 pukul 09:55.

Wulandari M.A. 2014. Potensi Antibakteri dan Bioautografi Ekstrak Etanol Daun Bintaro (*Cerbera odollam* Gaertn.) terhadap *Salmonella typhi* dan *Staphylococcus aureus*. Fakultas Farmasi. Universitas Muhammadiyah Surakarta.

Zetra, Y dan Parasetya, P. (2007). Isolasi Senyawa α -amirin dari Tumbuhan *Beilschmiedia roxburghiana* (Medang) dan Uji Bioaktivitasnya. Akta Kimindo, 3: 27-30