

## BAB V

### KESIMPULAN DAN SARAN

#### 5.1. Kesimpulan

Dari hasil penelitian yang diperoleh dapat disimpulkan bahwa :

1. Ekstrak etanol *Andrographidis* Herba memiliki aktivitas antibakteri terhadap *Pseudomonas aeruginosa* dengan kadar hambat minimum sebesar 2000 ppm.
2. Ekstrak etanol *Echinacea* Herba memiliki aktivitas antibakteri terhadap *Pseudomonas aeruginosa* dengan kadar hambat minimum sebesar 2000 ppm.
3. Jenis golongan senyawa ekstrak etanol *Andrographidis* Herba yang diduga memiliki aktivitas antibakteri terhadap *Pseudomonas aeruginosa* adalah alkaloid dan triterpenoid.
4. Jenis golongan senyawa ekstrak etanol *Echinacea* Herba yang diduga memiliki aktivitas antibakteri terhadap *Pseudomonas aeruginosa* adalah alkaloid dan flavonoid.

#### 5.2. Saran

Untuk kedepanya dapat dilakukan pemisahan terhadap senyawa alkaloid dan triterpenoid pada *Andrographis paniculata* dan senyawa alkaloid dan flavonoid pada *Echinacea purpurea* untuk dilakukan penelitian lebih lanjut terhadap khasiat antibakterinya sehingga dapat dikembangkan menjadi bahan baku obat terhadap infeksi yang disebabkan oleh *Pseudomonas aeruginosa*.

## DAFTAR PUSTAKA

- Albritton, R.L., Coen, D.M. and Golan, D.E. 2008. 'Principles of Combination Chemotherapy', in Golan D.E., Tashjian A.H., Armstrong E.J. and Armstrong, A.W (Eds), *Principles of Pharmacology. The Pathophysiologic Basis of Drug Therapy*, 2<sup>nd</sup> ed. Lippincott, Williams & Wilkins, pp 720-721.
- Ameh, S.J., Obodozie, O.O., Inyang, U.S., Abubakar M.S. and Garba, M. 2010. Quality Control Tests on *Andrographis paniculata* Nees (Family: Acanthaceae) – an Indian 'Wonder' Plant Grown in Nigeria, *Tropical Journal of Pharmaceutical Research*, **9**(4): 387-394.
- Anju, D., Jugnu, G., Kavita, S., Arun, S., and Sandeep, D. 2012. A Review on Medical Prospectives of *Andrographis paniculata* Ness, *Journal of Pharmaceutical and Scientific Innovation*, **1**(1):1-4.
- Arifin, H., Anggraini, N., Handayani, D., dan Rasyid, R. 2006. Standarisasi Ekstrak Etanol Daun *Eugenia cumini* Merr, *Jurnal Sains Teknologi Farmasi*, **11**(2): 88-93.
- Aronstein, K. A. dan Hayes, G. W. 2004. Antimicrobial Activity of Allicin Against Honey Bee Pathogens, *International Bee Research Association*, **42**(2): 57-59
- Backer, C.A. and Brink, R.C. 1965. Flora of Java. N.V.P. Noordhoff, Groningen, The Netherlands.
- Badan POM RI. 2011. Acuan Sediaan Herba Volume 6. Jakarta: Departemen Kesehatan Republik Indonesia.
- Badan Penelitian dan Pengembangan Kesehatan. 2013. Riset Kesehatan Dasar 2013. Jakarta: Departemen Kesehatan Republik Indonesia.
- Basch, H. and Gadebusch, H.H. 1968. *In Vitro* Antimicrobial Activity of Dimethyl Sulfoxide, *Applied Microbiology*, **16**:1953-1954.
- Basri, F. D., Tan, L. S., Shafiei, Z. And Zin, N. M., 2012, In Vitro Antibacterial Activity of Galls of *Quercus infectoria* Olivier against Oral Pathogens, *Evidence-Based Complementary and Alternative Medicine*, 1-7.
- Berridge, M.V., Herst, P.M., and Tan, A.S., 2005, Tetrazolium Dyes as Tools in Cell Biology: New Insights into Their Cellular Reduction, *Biotechnology Annual Review*, **11**: 127-152.

- 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.
- Chambers, H.F. 2006. Beta-Laktam Antibiotics and Other Inhibitors of Cell Wall Synthesis. In : Katzung, B.G., *et al. Basic and Clinical Pharmacology*, 10<sup>th</sup> ed. McGraw Hills Companies, Inc., New York.
- Choma, I. M., and Grzelak E. M. 2010. Bioautography Detection in Thin-Layer Chromatography, *Journal of Chromatography*, **12**: 1- 8.
- Ciulei, J. 1984. Metodology for Analysis of Vegetables Drugs. Bucharest: Faculty of Pharmacy Bucharest.
- Cowan, M.M. 1999. Plant Products as Antimicrobial Agents, *Clinical Microbiology Reviews*, 12(4):564-82.
- Cushnie, T. P. T. and Lamb, A. J. 2005. Antimicrobial Activity of Flavonoids, *International Journal of Antimicrobial Agents*, **26**(5): 343-356.
- Dahlan, Z. 2007. 'Pneumonia', dalam Sudoyo A. W., Setiyohadi., Alwi I., Simadibrata M., Setiati S. (eds), *Buku Ajar Departemen Ilmu Penyakit Dalam, Jilid II Edisi IV*, Jakarta : Pusat Penerbitan Departemen Ilmu Penyakit Dalam FKUI, pp 964-965
- Dalimunthe, A. 2009. Interaksi Sambiloto (*Andrographis paniculata*). Medan: Departemen Farmakologi Fakultas Farmasi Universitas Sumatera Utara.
- Denyer, S.P., Hodges, N.A. and Gorman, S.P (eds). 2004. Hugo and Russell's Pharmaceutical Microbiology 7<sup>th</sup> ed. Chichester: Blackwell Publishing.
- Departemen Kesehatan RI. 1979. *Materia Medika Indonesia Jilid III*. Jakarta: Departemen Kesehatan Republik Indonesia.
- Departemen Kesehatan RI. 1989. *Materia Medika Indonesia Jilid V*. Jakarta Departemen Kesehatan Republik Indonesia.
- Departemen Kesehatan RI. 1995. *Farmakope Indonesia Jilid IV*. Jakarta: Departemen Kesehatan Republik Indonesia
- Departemen Kesehatan RI. 2000. *Parameter Standar Umum Ekstrak Tumbuhan Obat edisi I*, Direktorat Jenderal Pengawasan Obat dan Makanan, Direktorat Pengawasan Obat Tradisional, Jakarta.

- Departemen Kesehatan RI. 2008. Farmakope Herbal Indonesia. Jakarta: Departemen Kesehatan Republik Indonesia.
- Dharmadasa, R.M., Samarasinghe, K., Adhihetty, P. and Hettiarachchi, P.L. 2013. Comparative Pharmacognostic Evaluation of *Munronia Pinnata* (Wall.) Theob. (Meliaceae) and it's Substitute *Andrographis paniculata* (Burm.f.) Wall. Ex Nees (Acanthaceae), *World Journal of Agricultural Research*, **1**(5): 77-81.
- Direktorat Jenderal Pengendalian Penyakit dan Penyehatan Lingkungan. 2011. Jakarta: Departemen Kesehatan Republik Indonesia.
- Ditjen POM RI. 2000. Parameter Standar Umum Tumbuhan Obat. Jakarta: Departemen Kesehatan Republik Indonesia.
- Doctor, T.R. and Manuel, J.F. 2014. Phytochemical Screening of Selected Chemical Indigenous Medicinal Plants of Tublay, Benguet Province, Cordillera Administrative Region, Philliphines, *International Journal of Scientific and Research Publications*, **4**(4):1-12.
- Ganiswara S.G., Setiabudy, Suyatna F.D., dkk. 1995. Farmakologi dan Terapi edisi 4. Jakarta: Fakultas Kedokteran Universitas Indonesia,: 571-583.
- Gellatly, S.L. and Hancock, R.E.W. 2013. *Pseudomonas aeruginosa*: New Insights Into Pathogenesis and Host Pefense, *Pathogens and Disease*, **67**:159-173.
- Ghimire, M., Bhattacharya, S.K. and Narain, J.P. 2012. Pneumonia in South-East Asia Region: Public health perspective, *Indian Medicine Journal Research*, **135**:459-468.
- Hugo, W.B. and Russel, A.D. 1987. *Pharmaceutical Microbiology* 4<sup>th</sup> ed. London: Blackwell Scientific Publication.
- Hogg. 2005. *Essential Microbiology*. The University of Glamorgan, Jhon Wiley & Sons Ltd.
- Jasmine, R., Selvakumar, B. N., and Daisy, P. 2011. Investigating The Mechanism of Action of Terpenoids and the Effect of Interfering Substances on an Indian Medicinal Plant Extract Demonstrating Antibacterial, *International Journal of Pharmaceutical Studies and Research*, **2**(2): 19-24.
- Jeremy, P.T. 2007. *At Glance Sistem Respirasi*. Edisi Kedua. Jakarta: Erlangga Medical Series.

- Kang, C.I., Kim, S.H., Kim, H.B., Park, S.W., Choe, Y.J., Oh, M.D., Kim, E.C., and Choe, K.W. 2003. *Pseudomonas aeruginosa* Bacteremia: Risk Factors for Mortality and Influence of Delayed Receipt of Effective Antimicrobial Therapy on Clinical Outcome, *Clinical Infectious Diseases*, **37**:745–751.
- Katzung, B. G. 2007. Basic & Clinical Pharmacology, 10<sup>th</sup> ed. United States : Lange Medical Publications.
- Kieninger, A.N. and Lipsett, P.A. 2009. Hospital-Acquired Pneumonia: Pathophysiology, Diagnosis, and Treatment, *Surgical Clinic of North America*, **89**(2):439-461.
- Kumar, A., Dora, J. and Tripathi, R. 2012. A Review on King of Bitter (kalmegh), *International Journal of Research in Pharmacy and Chemistry*, **2**(1):118.
- Kumar, K.M. and Ramaiah, S. 2011, Pharmacological Importance Of *Echinaceae Purpurea*, *International Journal of Pharma and Bio Sciences*, **2**(4) : 305-316.
- Kusumaningtyas, Astuti dan Darmono. 2008. Sensitivitas Metode Bioautografi Kontak dan Agar Overlay dalam Penentuan Senyawa Antikapang, *Jurnal Ilmu Kefarmasian Indonesia*, **6**(2):75-79.
- Lister, P.D., Wolter, D.J., and Hanson, N.D. 2009. Antibacterial-Resistant *Pseudomonas aeruginosa*: Clinical Impact and Complex Regulation of Chromosomally Encoded Resistance Mechanisms, *Clinical Microbiology Reviews*, **22**(4):582-610.
- Lorian, V., 1991, Antibiotics in Laboratory Medicine 3<sup>rd</sup> ed. Baltimore: The Williams and Wilkins Company.
- Lullmann, H., Mohr, H., Hein, L., Ziegler, A. and Bieger, D. 2000. *Color Atlas of Pharmacology*. Second Edition. Thieme, New York.
- Mani, C.S. and Murray, D.L. 2012. ‘Acute Pneumonia and Its Complications’, in Long, S.S., Pickering, L.K. and Prober, C.G. (Eds), *Principles and Practice of Pediatric Infectious Diseases*, 4<sup>th</sup> ed., Elsevier Saunders, Edinburgh, p.235.
- Misnadiarly. 2008. Penyakit Infeksi Saluran Napas Pneumonia pada Anak, Orang Dewasa, Usia Lanjut, Pneumonia Atipik & Pneumonia Atypik Mycobacterium. Jakarta: Pustaka Obor Populer.

- Muller, S., Ebnother, M., and Itin, P. 2014. Green Nail Syndrome (*Pseudomonas aeruginosa* Nail Infection): Two Cases Successfully Treated with Topical Nadifloxacin, an Acne Medication, *Case Report in Dermatology*, **6**:180-184.
- Musher, D.M. and Thorner, A.R. 2014. Community-Acquired Pneumonia, *The New England Journal of Medicine*, **371**:1619-1628.
- National Center fo Biotechnology Information. 2015. “*Echinacea pupurea*”, Diakses pada tanggal 23 Februari 2015, <http://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=53751>
- National Center for Biotechnology Information. 2015. “*Pseudomonas aeruginosa*”, Diakses pada tanggal 23 Februari 2015, <http://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?mode=Info&id=287&lvl=3&lin=f&keep=1&srchmode=1&unlock>
- N'GuessaN, 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.
- Perhimpunan Dokter Paru Indonesia. 2003. *Pneumonia Komuniti. Pedoman Diagnosis & Penatalaksanaan di Indonesia*. Jakarta: Perhimpunan Dokter Paru Indonesia.
- Price, S.A. and Wilson, L.M. 1992. *Patofisiologi: Konsep Klinis Proses-Proses Penyakit*. Diterjemahkan dari Bahasa Inggris oleh Dr. Peter Anugerah. Jakarta: EGC.
- Rahardjo, M. 2005. Peluang Pembudidayaan Tanaman *Echincacea* (*Echinacea pupurea*) di Indonesia, *Perspektif*, **4**(1):1-10.
- Ratnani, R.D., Hartati, I., Kurniasari, L. 2012. Potensi Produksi Andrographolide Dari Sambilotto (*Andrographis paniculata* Ness) Melalui Proses Ekstraksi Hidrotropi. *Momentum*, **8**(1):6-10.
- Reynold, J.E.F. 1996. Martindale, *The Extra Pharmacopoeia* 31<sup>st</sup> ed. London: The Royal Pharmaceutical Society Press.
- Rudan, I., Pinto, C.B., Biloglav, Z., Mulholland, K. and Campbell, H. 2008. Epidemiology and etiology of childhood pneumonia, *Bulletin of the World Health Organization*, **86**:408-416.

- Sahare, P., Moon, A. And Shinde, G.B. 2014. In Vitro Phytochemical Analysis for Combating Urinary Tract Infection with *Andrographis paniculata*. *Journal of Pharmaceutical, Chemical and Biological Sciences*, **2**(2): 93-103.
- Sawitti, M.S., Mahatmi, H. dan Besung, I.N.K. 2013. Daya Hambat Perasan Daun Sambiloto Terhadap Pertumbuhan Bakteri Escherichia coli, *Indonesia Medicus Veterinus*, **2**(2):142-150.
- Sharma, M., Vohra, S., Arnason, J.T. and Hudson, J.B. 2008. Echinacea Extract Contain Significant and Selective Activities Against Human Pathogenic Bacteria, **46**(1-2):111-116.
- Sharma, R., Jhanji, V., Satpathy, G., Sharma, N., Khokhar, S., and Agarwal, T. 2013. Coinfection with *Acanthamoeba* and *Pseudomonas* in Contact Lens-Associated Keratitis, *Optometry and Vision Science*, **90**(2):53-55.
- Siswandono dan Soekardjo, B., 2008. Kimia Medisinal. edisi 2. Surabaya : Airlangga University Press.
- Skoog, D.B and Donald, M.W. 1980. Principles of Instrumental Analysis, 3<sup>rd</sup> edition. London: Stanford University.
- Stahl, E. 1985, Analisis Obat Secara Kromatografi dan Mikroskopi, Diterjemahkan dari Bahasa Inggris oleh Kosasih Padmawinata dan Iwang Sudiro, ITB, Bandung.
- Stanisavljević, I., Stojičević, S., Veličković, D., Veljković, V., and Lazić M. 2009. Antioxidant and antimicrobial activities of echinacea (*Echinacea purpurea* L.) Extracts Oobtained by Classical and Ultrasound Extraction, *Chinese Journal of Chemical Engineering*, **17**(3):478-483.
- Sundari, I. 2010, 'Identifikasi senyawa dalam ekstrak etanol biji buah merah (Pandanus conoideus Lamk.)', *Skripsi*, Sarjana Sains Kimia, Universitas Sebelas Maret, Surakarta.
- Subramanian, P., Rao, P.P., Baig, H., Gupta, H.C., Reddy, P.R. and Nayak, C. 2010. Pharmacognostic Study of Echinacea pupurea (L) Moench, *Indian Journal of Research in Homoeopathy*, **4**(3):17-21.
- Tandon, C., Mathur, P. and Sen, M. 2015. *Andrographis paniculata* Nees (Kalmegh): A Review on Its Antibacterial Activities and Phytocompounds, *European Journal of Medicinal Plants*, **8**(1): 1-10.
- Tjay, T. dan Rahardja, K. 2007. Obat-obat Penting (Khasiat, Penggunaan, dan Efek-efek Sampingnya), Jakarta: PT. Elex Media Komputindo.

- Todar, K. 2008-2012. Todar's Online Textbook of Bacteriology. "Opportunistic Infections Caused by *Pseudomonas aeruginosa*". Diakses pada tanggal 23 Februari 2015, <http://textbookofbacteriology.net/pseudomonas.html>
- Tyas, M.W., Suprapti, B., Hardiono dan Widodo, A.D.W. 2013. Analysis of Antibiotic Use in VAP (Ventilator-Association Pneumonia) Patients, *Folia Medica Indonesiana*, **49**(3): 168-172.
- Wagner, H. and Bladt, S. 1996. Plant Drug Analysis: A Thin Layer Chromatography Atlas 2<sup>nd</sup> edition. Munchen: Springer Science.
- Weiss, R.F. and Fintelmann, V. 2000. Herbal Medicine. New York: Thieme Stugart.
- Werner, R. 2005. A Massage Therapist's Guide to Pathology 3<sup>rd</sup> edition. Philadelphia: Lippincott William & Wilkins.
- Wikantyasning, E.D.R., Nurwaini, S., Wilisa, O.Y. dan Mohandani, I.P. 2009. Formulasi Tablet Effervescent Ekstrak Herba Sambiloto (*Andrographis paniculata* (Burn f.) Ness.) dan Daun Dewandaru (Linn.): Uji Sifat Fisik dan Respon Rasa. *Pharmacon*, **10**(1):1-6.
- Zolgharneun, J., Niazi, A.S. and Zamani, K. 2010. Determination of Chicoric Acid as a Biomarker in *Echinacea purpurea* Cultivated in Iran Using High Performance Liquid Chromatography, *Chinese Medicine*, **1**:23-27.