

BAB 5

KESIMPULAN DAN SARAN

5.1 Kesimpulan

Berdasarkan penelitian yang telah dilakukan maka dapat diambil kesimpulan sebagai berikut:

1. Metode kromatografi lapis tipis secara densitometri memenuhi persyaratan validasi yang ditunjukkan dengan hasil uji selektivitas didapatkan fase gerak yang digunakan yaitu n-heksana : etil asetat (8:2) dengan nilai R_f nya yaitu 0,33; uji linearitas yang didapatkan menunjukkan korelasi linear yang dilihat dari nilai r hitung yang lebih besar dari r tabel; uji akurasi didapatkan %*recovery* untuk infusa, fraksi etil asetat, dan fraksi air berturut-turut yaitu 100,70%, 100,16%, dan 99,80%; uji presisi dengan %KV untuk infus, fraksi etil asetat, dan fraksi air berturut-turut yaitu 1,29%, 1,28%, dan 1,13%; serta *LOD* dan *LOQ* yang didapatkan adalah 52,74 μ g/ml dan 175,81 μ g/ml.
2. Hasil penetapan kadar kumarin pada infusa dan fraksi air memberikan kadar yang lebih kecil dari limit deteksi sedangkan, pada fraksi etil asetat kadar kumarin yang didapatkan yaitu 1,95%.

5.2 Saran

Berdasarkan hasil penelitian diatas maka disarankan agar dapat melakukan penelitian lebih lanjut lagi untuk kumarin yang terkandung dalam kayu manis apakah dengan kadar yang kecil masih dapat memberikan efek samping yang negatif.

DAFTAR PUSTAKA

- Al-Dhubiab, B.E. 2012, Pharmaceutical applications and phytochemical profile of *Cinnamomum burmannii*, *Pharmacognosy reviews*, **6(12)**: 125-131.
- Arifin, B., Tetra, O. N., dan Maghfirah, S. 2020. Aktivitas Antibakteri Senyawa Metabolit Sekunder dari Fraksi Etil Asetat Daun Lengkung (*Dimocarpus longan* Lour.) dan Uji Aktivitas, *Jurnal Zarah*, **8(2)**: 69-75.
- Asra, R., Chandra, B., Zulharmita. 2018, Application of High Performance Thin Layer Chromatography-Densitometry and UV- Visible Spectrophotometry for the Simultaneous Determination of Thiamine in Green Beans, *International Journal of ChemTech Research*, **11(9)**: 191-196.
- Badan POM RI, 2010, Acuan Sediaan Herbal, Vol. 5, Edisi I, Direktorat Obat Asli Indonesia, Badan Pengawas Obat dan Makanan Republik Indonesia, Jakarta.
- Balijepalli, M. K., Buru, A. S., Sakirolla, R.A., and Pichika, M. R. 2017, *Cinnamomum* genus: A review on its biological activities, *Int J Pharm Pharm Sci*, **9(2)**: 1-11.
- Banu, R., and Nagarajan, N. 2014. TLC and HPTLC fingerprinting of leaf extracts of *Wedelia chinensis* (Osbeck) Merrill, *Journal of Pharmacognosy and Phytochemistry*, **2(6)**: 29-33.
- Bele, A. A., and Khale, A. 2011, An overview on thin layer chromatography, *International Journal of Pharmaceutical Sciences and Research*, **2(2)**: 256-267.
- Blahova, J., and Svobodova, Z. 2012, Assessment of coumarin levels in ground cinnamon available in the Czech retail market, *The Scientific World Journal*.
- Bubols, G., da Rocha Vianna, D., Medina-Remon, A., von Poser, G., Maria Lamuela-Raventos, R., Lucia Eifler-Lima, V., and Cristina Garcia, S. 2013, The antioxidant activity of coumarins and flavonoids. *Mini reviews in medicinal chemistry*, **13(3)**: 318-334.
- Coskun, O. 2016, Separation techniques: chromatography, *Northern clinics of Istanbul*, **3(2)**: 156.
- Departemen Kesehatan RI, 1977, *Materia Medika Indonesia* Jilid I, Jakarta : Departemen Kesehatan Republik Indonesia.

- Departemen Kesehatan RI, 2017, *Farmakope Herbal Indonesia*. Edisi II. Jakarta : Departemen Kesehatan Republik Indonesia.
- Dighe, N. S., Pattan, S. R., Dengale, S. S., Musmade, D. S., Shelar, M., Tambe, V., and Hole, M. B. 2010, Synthetic and pharmacological profiles of coumarins: A review, *Scholar Research Library*, **2(2)**: 65-71.
- Direktorat Jenderal Pengawasan Obat dan Makanan RI, 2000, *Parameter Standar Umum Ekstrak Tumbuhan Obat*, Jakarta: Departemen Kesehatan Republik Indonesia.
- Dvorackova, E., Snoblova, M., Chromcova, L., and Hrdlicka, P. 2015, Effects of extraction methods on the phenolic compounds contents and antioxidant capacities of cinnamon extracts, *Food science and biotechnology*, **24(4)**: 1201-1207.
- Ermer, J., and Miller, J.H. 2006, *Method Validation in Pharmaceutical Analysis*, Wiley-VCH, Weinheim.
- Ervina, M., Nawu, Y. E., and Esar, S. Y. 2016, Comparison of in vitro antioxidant activity of infusion, extract and fractions of Indonesian Cinnamon (*Cinnamomum burmannii*) bark, *International Food Research Journal*, **23(3)**: 13-46.
- Ervina, M., Lie, H. S., Diva, J., Tewfik, S., and Tewfik, I. 2019, Optimization of water extract of *Cinnamomum burmannii* bark to ascertain its in vitro antidiabetic and antioxidant activities. *Biocatalysis and Agricultural Biotechnology*, **19(10)**: 1-7.
- Eserian, J. K., and Lombardo, M. 2015, Method validation in pharmaceutical analysis: from theory to practical optimization, *Innovations in pharmacy*, **6(1)**: 1-3.
- Ewing, G.W. 1985. *Instrumental of Chemical Analysis Fifth edition*. Singapore: McGraw-Hill
- Gupta, P. 2015, Method validation of analytical procedures. *Pharma Tutor*, **3(1)**: 32-39.
- Harmita, H. 2004, Petunjuk pelaksanaan validasi metode dan Cara Perhitungannya. *Majalah Ilmu Kefarmasian*, **1(3)**: 117-135
- Harmono, H. D. 2020, Validasi Metode Analisis Logam Merkuri (Hg) Terlarutn pada Air Permukaan dengan Automatic Mercury Analyzer, *Indonesian Journal of Laboratory*, **2(3)**: 11-16.

- Herdiana, I., dan Aji, N. 2020, Fraksinasi Ekstrak Daun Sirih dan Ekstrak Gambir serta Uji Antibakteri *Streptococcus mutans*, *Jurnal Ilmiah Kesehatan*, **19(3)**: 100-106.
- Hermawan, D.S., Lukmayani, Y., dan Dasuki, U.A. 2016, Identifikasi Senyawa Flavonoid pada Ekstrak dan Fraksi yang Berasal dari Buah Berenuk (*Crescentia cujete* L.).
- Ibrahim, H. 2018, Introductory Chapter: Fractionation, In *Fractionation*, IntechOpen.
- Ismail, B., and Nielsen, S. 2010, Basic principles of chromatography, In *Food analysis*, Springer, Boston, MA.
- Isnawati, A.P., Retnaningsih, A., dan Nofita, N. 2018, Perbandingan Teknik Ekstraksi Maserasi Dengan Infusa Pada Pengujian Aktivitas Daya Hambat Daun Sirih Hijau (*Piper betle* L.) Terhadap *Escherichia coli*, *Jurnal Farmasi Malahayati*, **1(1)**: 19-24.
- Khasanah, L.U., Prasetyawan, P., Utami, R., Atmaka, W., Manuhara, G.J., and Sanjaya, A.P. 2017, Optimization and characterization of cinnamon leaves (*Cinnamomum burmannii*) oleoresin, In *IOP Conference Series: Materials Science and Engineering*, **193(1)**: 1-7
- Kumar, K.A., Renuka, N., Pavithra, G., and Kumar, G.V. 2015. Comprehensive review on coumarins: Molecules of potential chemical and pharmacological interest. *J. Chem. Pharm. Res*, **7(9)**: 67-81.
- Kupeli A.E., Genc, Y., Karpuz, B., Sobarzo Sanchez, E., and Capasso, R. 2020, Coumarins and coumarin related compounds in pharmacotherapy of cancer. *Cancers*, **12(7)**: 1-25
- Lake, B.G. 1999, Coumarin metabolism, toxicity and carcinogenicity: relevance for human risk assessment, *Food and Chemical Toxicology*, **37(44)**: 23-453.
- Larson, M.G. 2008. Statistical primer for cardiovascular research. analysis of variance. *Circulation*, **117**: 115-121.
- Liang, T., and Roy, R. 2014, Ultraviolet-visible spectrophotometry (UV-VIS) and SALIgAE® qualitative and semi-quantitative tools for the analysis of salivary amylase, *Journal of Forensic Research*, **5(6)**: 1.
- Lie, H.N. 2018, Optimasi Suhu, Konsentrasi, dan Lama Proses Infus Cinnamomi Cortex terhadap Daya Penangkap Radikal DPPH (1,1-

difenil-2-pikrilhidrazil), Skripsi, Fakultas Farmasi Universitas Katolik Widya Mandala Surabaya.

- Mulyati, A.H., dan Apriyani, D. 2017, Validasi Metode Analisis Kadar Ambroksol Hidroklorida dalam Sediaan Tablet Cystelis Secara Kromatografi Cair Kinerja Tinggi, *Ekologia*, **11(2)**: 36-45.
- Neves, B.M., Barros, F.M.C.D., Poser, G.L.V., and Teixeira, H.F. 2015, Quantification of coumarins in aqueous extract of *Pterocaulon balansae* (Asteraceae) and characterization of a new compound, *Molecules. Basel*, **20(10)**: 18083-18094.
- Oktavia, S.N., Wahyuningsih, E., dan Andasari, S.D. 2020, Skrining Fitokimia Dari Infusa Dan Ekstrak Etanol 70% Daun Cincau Hijau (*Cyclea barbata* Miers), *CERATA Jurnal Ilmu Farmasi*, **11(1)**: 1-6.
- Parisa, N., Islami, R.N., Amalia, E., Mariana, M., and Rasyid, R.S.P. 2019, Antibacterial Activity of Cinnamon Extract (*Cinnamomum burmannii*) against *Staphylococcus aureus* and *Escherichia coli* In Vitro, *Bioscientia Medicina: Journal of Biomedicine and Translational Research*, **3(2)**: 19-28.
- Pratiwi, L., Fudholi, A., Martien, R., dan Pramono, S. 2016, Ekstrak Etanol, Ekstrak Etil Asetat, Fraksi Etil Asetat, dan Fraksi nheksana Kulit Manggis (*Garcinia mangostana* L.) sebagai Sumber Zat Bioaktif Penangkal Radikal Bebas, *Journal of Pharmaceutical Science and Clinical Research*, **1(2)**: 71-82.
- Rao, P.V., and Gan, S.H. 2014, Cinnamon: a multifaceted medicinal plant, *Evidence-Based Complementary and Alternative Medicine*.
- Rahman, A., Lukmayani, Y., dan Sadiyah, E.R. 2019, Isolasi dan Identifikasi Senyawa Flavonoid dari Kulit Tangkai Daun Talas Hitam (*Xanthosoma Sagittifolium* (L.) Schot.) yang Berpotensi Sebagai Antioksidan **5(1)**: 66-74.
- Rasyadi, R., Ermi, N., dan Andayani, R. 2018, *Validasi Metode Analisis Mangiferin dalam Plasma In Vitro Secara Kromatografi Lapis Tipis-Densitometri* (Doctoral dissertation, Universitas Andalas).
- Ratnawati, N.A., Prasetya, A.T., dan Rahayu, E.F., 2019. Validasi Metode Pengujian Logam Berat Timbal (Pb) dengan Destruksi Basah Menggunakan FAAS dalam Sedimen Sungai Banjir Kanal Barat Semarang. *Indonesian Journal of Chemical Science*, **8(1)**: 60-68.

- Reich, E., and Schibli, A. 2007, *High performance thin-layer chromatography for the analysis of medicinal plants*, Thieme.
- Rohini, K.S.P.S., and Srikumar, P.S., 2014, Therapeutic role of coumarins and coumarin-related compounds, *J Thermodyn Catal*, **5(2)**: 1-3.
- Senduk, T.W., Montolalu, L.A.D.Y., dan Dotulong, V. 2020, Rendemen Ekstrak Air Rebusan Daun Tua Mangrove *Sonneratia alba* (The rendement of boiled water extract of mature leaves of mangrove *Sonneratia alba*), *Jurnal Perikanan Dan Kelautan Tropis*, **11(1)**: 9-15.
- Shah, R.S., Shah, R.R., Pawar, R.B., and Gayakar, P.P. 2015, UV-Visible spectroscopy-a review, *International Journal of Institutional Pharmacy and Life Sciences*, **5(5)**: 490-505.
- Singletary, K. 2019, Cinnamon: Update of potential health benefits, *Nutrition Today*, **54(1)**: 42-52.
- Solaiman, R., and Al-Zehouri, J. 2017, Determination of coumarin in methanol extract of cinnamon (*Cinnamomum cassia* Blume) using reversed-phase high performance liquid chromatography, *J. Pharmacogn. Phytochem*, **6(4)**: 726-729.
- Soetjipto, H., Martono, Y., dan Yuniarti, Z. 2018, Isolasi dan Analisis Genistein dari Tempe Busuk Menggunakan Metode Kromatografi Kolom, *Jurnal Bioteknologi dan Biosains Indonesia (JBBi)*, **5(1)**: 88-97.
- Sumarno, D., dan Kusumaningtyas, D.I. 2019. Penentuan Limit Deteksi Dan Limit Kuantitas Untuk Analisis Logam Timbal (Pb) dalam Air Tawar Menggunakan Alat Spektrofotometer Serapan Atom, *Buletin Teknik Litkayasa Sumber Daya dan Penangkapan*, **16(1)**: 7-11.
- Taufiq, M., Kiptiyah, K., dan Muti'ah, R. 2020, Pengembangan dan Validasi Prosedur Pengukuran Logam Timbal (Pb) dalam Makanan Pendamping Air Susu Ibu Menggunakan Spektroskopi Serapan Atom, *ALCHEMY Jurnal Penelitian Kimia*, **16(1)**: 25-37.
- Thada, R., Chockalingam, S., Dhandapani, R.K., and Panthamoorthy, R. 2013, Extraction and quantitation of coumarin from cinnamon and its effect on enzymatic browning in fresh apple juice: a bioinformatics approach to illuminate its antibrowning activity, *Journal of agricultural and food chemistry*, **61(22)**: 5385-5390.

- Tuzimski, T., and Sherma, J. 2006, Thin Layer Chromatography. *Encyclopedia of Analytical Chemistry: Applications, Theory and Instrumentation*, 1-26.
- 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, R., Khasanah, L.U., Manuhara, G.J., and Ayuningrum, Z.K. 2019, Effects of Cinnamon Bark Essential Oil (*Cinnamomum burmannii*) on Characteristics of Edible Film and Quality of Fresh Beef, *Pertanika Journal of Tropical Agricultural Science*, **42(4)**: 1173 - 1184
- USDA. 2015, *Classification of Cinnamomum burmannii* (Nees & Th. Nees) Nees ex Blume. Diakses pada 23 September 2021, <https://plants.usda.gov/home/plantProfile?symbol=CIBU2>
- USP 43. 2020, *The United States Pharmacopeial Convention*, Twinbrook Parkway, Rockville.
- Vangalapati, M., Satya, N.S., Prakash, D.S., and Avanigadda, S. 2012, A review on pharmacological activities and clinical effects of cinnamon species, *Research Journal of pharmaceutical, biological and chemical sciences*, **3(1)**: 653-663.
- Verushkin, A.G., Kulikov, A.Y., and Kutsanyan, A.A. 2021, A validated method for coumarin quantification in Meliloti herba and its ethanolic extracts using micellar thin-layer chromatography **5**: 13-18.
- Wang, Y.H., Avula, B., Nanayakkara, N.D., Zhao, J., and Khan, I.A. 2013, Cassia cinnamon as a source of coumarin in cinnamon-flavored food and food supplements in the United States, *Journal of agricultural and food chemistry*, **61(18)**: 4470-4476.
- Yadav, L.D.S. 2005, Ultraviolet (UV) and visible spectroscopy, In *Organic Spectroscopy*, Springer, Dordrecht, pp. 7-51.
- Yadav, M., Chatterji, S., Gupta, S.K., and Watal, G. 2014, Preliminary phytochemical screening of six medicinal plants used in traditional medicine, *Int J Pharm Pharm Sci*, **6(5)**: 539-42.

- Yang, S.M., Shim, G.Y., Kim, B.G., and Ahn, J.H. 2015, Biological synthesis of coumarins in *Escherichia coli*, *Microbial cell factories*, **14(1)**: 1-12.
- Yanty, Y.N., Sopianti, D.S., dan Veronica, C. 2019, Fraksinasi dan Skrining Fraksi Biji Kebiul (*Caesalpinia bonduc* (L) ROXB) dengan Metode KLT (Kromatografi Lapis Tipis), *Borneo Journal of Pharmascientech*, **3(1)**: 56-64.
- Yuda, P.E.S.K., Cahyaningsih, E., dan Winariyanthi, N. P.Y. 2017, Skrining fitokimia dan analisis kromatografi lapis tipis ekstrak tanaman patikan kebo (*Euphorbia hirta* L.), *Jurnal Ilmiah Medicamento*, **3(2)**: 61-70.
- Zhang, Q.W., Lin, L.G., and Ye, W.C. 2018, Techniques for extraction and isolation of natural products: A comprehensive review, *Chinese medicine*, **13(1)**: 1-26.