

## **BAB 5**

### **KESIMPULAN DAN SARAN**

#### **5.1 Kesimpulan**

Dari penelitian yang sudah dilakukan dapat disimpulkan bahwa:

1. Daya dan lama iradiasi yang optimum dalam mensintesis asam sinamat adalah 480 W selama 10 menit dengan hasil rendemen sebanyak  $(69,74 \pm 2,06)$  %.
2. Sintesis asam 4-metoksisinamat dengan iradiasi 480 W selama 10 menit menghasilkan rendemen sebanyak  $(82,31 \pm 1,29)$  %.
3. Adanya gugus metoksi pada bahan 4-metoksibenzaldehid dapat meningkatkan rendemen sintesis asam 4-metoksisinamat.

#### **5.2 Saran**

Dapat dilakukan uji farmakologis dari senyawa asam 4-metoksisinamat yang sudah disintesis untuk mengetahui aktivitas neuroprotektifnya lebih lanjut dalam penanganan penyakit Parkinson.

## DAFTAR PUSTAKA

- Adisakwattana, S., Moonsan, P. dan Yibchok-anun, S. 2008, Insulin Releasing Properties of a Series of Cinnamic Acid Derivatives *in Vitro* and *in Vivo*, *Journal of Agricultural and Food Chemistry*, **56(17)**: 7838-7844.
- Adisakwattana, S., Roengsamran, S., Hsu, W. H. dan Yibchok-anun, S. 2005, Mechanism of Antihyperglycemic Effect of *p*-methoxycinnamic Acid in Normal and Streptozotocin-Induced Diabetic Rats, *Life Sciences*, **78(4)**: 406-412.
- Andersen, A. 2006, Final Report on the Safety Assessment of Benzaldehyde, *International Journal of Toxicology*, **25(Suppl. 1)**: 11-27.
- Atole, D. M. dan Rajput, H. H. 2018, Ultraviolet Spectroscopy and its Pharmaceutical Applications- A Brief Review, *Asian Journal of Pharmaceutical and Clinical Research*, **11(2)**: 59-66.
- Bassyouni, F. A., Abu-Bakr, S. M. dan Rehim, M. A. 2012, Evolution of Microwave Irradiation and its Application in Green Chemistry and Biosciences, *Research on Chemical Intermediates*, **38**: 283-322.
- Bele, A. A. dan Khale, A. 2011, An Overview on Thin Layer Chromatography, *International Journal of Pharmaceutical Sciences and Research*, **2(2)**: 256-267.
- Calvino, V., Picallo, M., López-Peinado, A. J. Martín-Aranda, R. M. dan Durán-Valle, C. J. 2006, Ultrasound Accelerated Claisen-Schmidt Condensation: A Green Route to Chalcones, *Applied Surface Science*, **252(17)**: 6071-6074.
- Carey, F. A. 2000, *Organic Chemistry, Fourth Edition*, Mc-Graw Hill Higher Education, New York.
- Gupta, M. dan Wakhloo, B. P. 2007, Tetrabutylammoniumbromide Mediated Knoevenagel Condensation in Water: Synthesis of Cinnamic Acids, *Arkivoc*, **15**: 94-98.
- Hatsuda, M., Kuroda, T. dan Seki, M. 2003, An Improved Synthesis of (E)-Cinnamic Acid Derivatives via the Claisen-Schmidt Condensation, *Synthetic Communications, An International Journal for Rapid Communication of Synthetic Organic Chemistry*, **33(3)**: 427-434.

- Indriyanti, E. dan Prahasiwi, M. S. 2020, Synthesis of Cinnamic Acid Based on Perkin Reaction Using Sonochemical Method and its Potential as Photoprotective Agent, *Jurnal Kimia dan Pendidikan Kimia*, **5(1)**: 54-61.
- Julianus, J. dan Luckyvano, E. 2014, Sintesis Asam Sinamat dari Benzaldehida dan Asam Malonat dengan Katalis Dietilamina, *Jurnal Farmasi Sains dan Komunitas*, **11(1)**: 1-6.
- Kar, S., Rai, P., Chelli, S. M., Akhir, A., Shivalingegowda, N., Chopra, S., Krishnappagowda, L. N., Belliraj, S. K. dan Golakoti, N. R. 2021, Exploring the Unexpected Formation of Spirobibenzopyrans and Benzopyrylium Salts and Effect of Lewis Acids on the Claisen-Schmidt Reaction, *Journal of Molecular Structure*, **1240(2021)**: 130598.
- Kharissova, O. V., Kharisov, B. I., González, C. M. O., Méndez, Y. P. dan López, I. 2019, Greener Synthesis of Chemical Compounds and Materials, *Royal Society Open Science*, **6(11)**: 1-41.
- Kumar, N. dan Parle, A. 2019, Cinnamic acid derivatives: An ERA, *The Pharma Innovation Journal*, **8(5)**: 580-595.
- Lee, E. J., Kim, S. R., Kim, J. dan Kim, Y. C. 2002, Hepatoprotective Phenylpropanoids from *Scrophularia buergeriana* Roots against CCl<sub>4</sub>-Induced Toxicity: Action Mechanism and Structure-Activity Relationship, *Planta Medica*, **68(5)**: 407-411.
- McMurry, J. 2012, *Organic Chemistry, Eighth Edition*, Brooks/Cole, Belmont.
- Medvedeva, M., Barinova, K., Melkinova, A., Semenyuk, P., Kolmogorov, V., Gorelkin, P., Erofeev, A. dan Muronetz, V. 2020, Naturally Occurring Cinnamic Acid Derivatives Prevent Amyloid Transformation of Alpha-synuclein, *Biochimie*, **170**: 128-139.
- Mendoza, N. dan Silva, E. M. E. 2018, ‘Introduction to Phytochemicals: Secondary Metabolites from Plants with Active Principles for Pharmacological Importance’, in Asao T. dan Asaduzzaman, M. *Phytochemicals – Source of Antioxidants and Role in Disease Prevention*, IntechOpen, London, pp 25-47.
- Nain, S., Singh, R. dan Ravichandran, S. 2019, Importance of Microwave Heating in Organic Synthesis, *Advanced Journal of Chemistry-Section A*, **2(2)**: 94-104.

National Centre for Biotechnology Information, 2021, PubChem Compound Summary for CID 699414, 4-Methoxycinnamic acid. Diakses pada 1 September 2021, <https://pubchem.ncbi.nlm.nih.gov/compound/4-Methoxycinnamic-acid#section=Deposit> or-Provided-PubMed-Citations.

O'Neil, M. J., Smith, A., Heckelman, P. E., Obenchain, J. R., Gallipeau, J. R. dan D'Arecca, M. A. 2001, *The Merck Index: an Encyclopedia of Chemical, Drugs, and Biological*, Merck & Co., Inc., New Jersey.

Pawar, P. M., Jarag, K. J. dan Shankarling, G. B. 2011, Environmentally Benign and Energy Efficient Methodology for Condensation: an Interesting Facet to the Classical Perkin Reaction, *Green Chemistry*, **13**: 2130-2134.

Pavia, D. L., Lampman, G. M., Kriz, G. S. dan Vyvyan, J. R. 2009, *Introduction to Spectroscopy, Fourth Edition*, Brooks/Cole, Belmont.

Płowuszyńska, A. dan Gliszczynska, A. 2021, Recent Development in Therapeutic and Nutraceutical Application of *p*-Methoxycinnamic Acid from Plant Origin, *Molecules*, **2021(26)**: 3827.

Rohman, A. 2012, Application of Fourier Transform Infrared Spectroscopy for Quality Control of Pharmaceutical Products: A Review, *Indonesian Journal of Pharmacy*, **23(1)**: 1-8.

Rudyanto, M. dan Hartanti, L. 2008, Sintesis Beberapa Turunan Asam Sinamat: Pengaruh Gugus yang Terikat pada Cincin Aromatik Terhadap Kereaktifan Benzaldehida, *Indonesian Journal of Chemistry*, **8(2)**: 226-230.

Rupainwar, R., Pandey, Smriti dan Ruchi, 2019, The Importance and Application of Knoevenagel Reaction (Brief Review), *Oriental Journal of Chemistry*, **35(1)**: 423-429.

Ruwizhi, N. dan Aderibigbe, B. A. 2020, Cinnamic Acid Derivatives and Their Biological Efficacy, *International Journal of Molecular Sciences*, **21(16)**: 5172.

Kumar, H. M. S., Subbareddy, B. V., Anjaneyulu, S. dan Yadav, J. S. 1998, Non Solvent Reaction: Ammonium Acetate Catalyzed Highly Convenient Preparation of Trans-Cinnamic Acids, *Synthetic Communications: An International Journal for Rapid Communication of Synthetic Organic Chemistry*, **28(20)**: 3811-3815.

- Singh, R. 2014, Heating Mechanism of Microwave, *International Journal for Exchange of Knowledge*, **1(1)**: 43-46.
- Shriner, R. L., Fuson, R. C., Curtin, D. Y. dan Morrill, T. C. 1980, *The Systemic Identification of Organic Compounds, a laboratory manual, 6th. ed.*, John Wiley & Sons, Inc., New Jersey.
- Zhang, Q. W., Lin, L. G. dan Ye, W. C. 2018, Techniques for Extraction and Isolation of Natural Products: a Comprehensive Review, *Chinese Medicine*, **13**: 20.
- Zia, K., Siddiqui, T., Ali, S., Farooq, I., Zafar, M. S. dan Khurshid, Z. 2019, Nuclear Magnetic Resonance Spectroscopy for Medical and Dental Applications: A Comprehensive Review, *European Journal of Density*, **13(1)**: 124-128.