

BAB 5

KESIMPULAN DAN SARAN

5.1 Kesimpulan

Berdasarkan hasil penelitian yang sudah dilakukan maka dapat diambil kesimpulan bahwa:

1. Senyawa N’-(4-nitrobenziliden)isonikotinohidrazida dapat disintesis dengan menggunakan metode konvensional dengan pemanasan selama 1 jam dengan rendemen sebesar 71,60%.
2. Senyawa N’-(4-nitrobenziliden)isonikotinohidrazida dapat disintesis dengan menggunakan metode iradiasi gelombang mikro (480 Watt, 3 menit) dengan rendemen sebesar 77,77%.
3. Sintesis senyawa N’-(4-nitrobenziliden)isonikotinohidrazida dengan metode iradiasi gelombang mikro merupakan metode yang lebih efisien dibandingkan dengan metode konvensional.

5.2 Saran

1. Sebaiknya penelitian dilanjutkan dengan uji antimikobakteri sehingga dapat diketahui efek farmakologi dari senyawa hasil sintesis.

DAFTAR PUSTAKA

- Agrawal, P. 2013, Pharmacovigilance Structure-Based Drug Design, *Journal of Pharmacovigilance*, **1(4)**: 1–2.
- Baya, B., Achenbach, C. J., Kone, B., Toloba, Y., Dabitao, D. K., Diarra, B., Goita, D., Diabate, S., Maiga, M., Soumare, D., Ouattara, K., Kanoute, T., Berthe, G., Kamia, Y.M., Sarro, Y.S., Sanogo, M., Togo, A.C.G., Dembele, B.P.P., Coulibaly, N., Kone, A., Akanbi, M., Belson, M., Dao, S., Orsega, S., Siddiqui, S., Doumbia, S., Murphy, R.L., Diallo, S. 2019, Clinical risk factors associated with multidrug-resistant tuberculosis (MDR-TB) in Mali, *International Journal of Infectious Diseases*, **81**: 149–155.
- Belwal, S. 2013, Green Revolution in Chemistry by Microwave Assisted Synthesis: A Review, *Modern Chemistry*, **1(3)**: 22.
- Bisht, R., Katiyar, A., Singh, R., & Mittal, P. 2009, Antibiotic resistance - A global issue of concern, *Asian Journal of Pharmaceutical and Clinical Research*, **2(2)**: 34–39.
- Cai, L. 2014, Thin layer chromatography, *Current Protocols in Essential Laboratory Techniques*.
- Carey, F. A., 2000, *Organic Chemistry*, Edisi Keempat, McGraw-Hill Companies, Inc., London
- Charde, M. S., Shukla, A., Bukhariya, V., & Chakole, R. D. 2012, a Review on: a Significance of Microwave Assist Technique in Green Chemistry, *International Journal of Phytopharmacy*, **2(2)**: 1
- Clayden, J., Greeves, N. and Warren, S. 2012, *Organic Chemistry*, 2nd ed., Oxford University Press, New York.
- Dachriyanus, 2004. Analisis Struktur Senyawa Organik Secara Spektrofotometri, *Andalas University Press*, Padang
- Departemen Kesehatan RI, 2014, *Farmakope Indonesia* Edisi V, Departemen Kesehatan Republik Indonesia, Jakarta.
- Ferreira, M. D. L., Gonçalves, R. S. B., Cardoso, L. N. D. F., Kaiser, C. R., Candéa, A. L. P., Henriques, M. D. G. M. D. O., Lourenco, M.C.S.,

- Bezerra, F.A.F.M., De Souza, M. V. N. 2010, Synthesis and antitubercular activity of heteroaromatic isonicotinoyl and 7-chloro-4-quinolinyl hydrazone derivatives, *TheScientificWorld Journal*, **10**: 1347–1355.
- Franco, J. 2017, Purifying Compounds by Recrystallization, *Journal of Visualized Experiments*, 4–6.
- Gandjar, I.G. dan Rohman, A. 2012, *Analisis Obat Secara Spektroskopi dan Kromatografi*, Cetakan IX, Pustaka Pelajar, Yogyakarta.
- Grewal, A. S., Kumar, K., Redhu, S., Bhardwaj, S., 2013, Microwave Assisted Synthesis: A Green Chemistry Approach, *Int. Res J Pharm. App Sci.*, **3(5)**: 278-285
- Goude, R., & Parish, T. 2008, *The genetics of cell wall biosynthesis in Mycobacterium tuberculosis*, Future Microbiology, **3(3)**: 299–313.
- Gunawan, 2012. *Farmakologi dan Terapi*, Edisi 5, Fakultas Kedokteran Universitas Indonesia, Jakarta.
- Harmita, P.D. 2009, *Analisis Fisikokimia Potensiometri & Spektroskopi*. Penerbit Buku Kedokteran EGC, Jakarta.
- Heijden, Y. F. V. D., Karim, F., Mufamadi, G., Zako, L., Chinappa, T., Shepherd, B. E., Maruri, F., Moosa, M.Y.S., Sterling, T.R., Pym, A. S. 2017, Isoniazid-monoresistant tuberculosis is associated with poor treatment outcomes in Durban, South Africa, *International Journal of Tuberculosis and Lung Disease*, **21(6)**: 670–676.
- Jankovic, V. K., Furci, L., & Cirillo, D. M. 2012, Microbiology of mycobacterium tuberculosis and a new diagnostic test for TB, *European Respiratory Monograph*, **58**: 8–13.
- Junior, I. N., Lourenço, M. C. D. S., Henriques, G. M. O., Ferreira, B., Vasconcelos, T. R. A., Peralta, M. A., Oliveira, P.S.M., Wardell, S.M.S.V., Souza, M. V. N. D. 2005, Phenyl Methyldene] Isonicotino-Hydrazide Derivatives, *Letters in Drug Design and Discovery*, **2**: 563–566.
- Kappe, C. O., & Stadler, A. 2005, *Microwaves in Organic and Medicinal Chemistry*.

Kementerian Kesehatan RI, 2015, *Tuberkulosis Temukan Obati sampai Sembuhkan*, Kementerian Kesehatan Republik Indonesia, Jakarta.

Kementerian Kesehatan RI, 2018, *Dicari Para Pemimpin Untuk Dunia Bebas TBC*, Kementerian Kesehatan Republik Indonesia, Jakarta.

Krisnayanti, P. 2017, 'Pengaruh gugus hidroksi pada 2-hidroksibenzaldehida terhadap rendemen hasil sintesis N'-(2-hidroksibenziliden)isonicotinohidrazida dengan metode iradiasi gelombang mikro', *Skripsi*, Sarjana Farmasi, Universitas Katolik Widya Mandala, Surabaya.

Kumar, D., Khare, G., Beena, Kidwai, S., Tyagi, A. K., Singh, R., & Rawat, D. S. 2015, Novel isoniazid-amidoether derivatives: Synthesis, characterization and antimycobacterial activity evaluation, *Med Chem Comm*, **6(1)**: 131–137.

Kumar, H. S., Parumasisivam, T., Jumaat, F., Ibrahim, P., Asmawi, M. Z., & Sadikun, A. 2014, Synthesis and evaluation of isonicotinoyl hydrazone derivatives as antimycobacterial and anticancer agents, *Medicinal Chemistry Research*, **23(1)**: 269–279.

Kumar, S., Jyotirmayee, K., & Sarangi, M. 2013, Thin layer chromatography: A tool of biotechnology for isolation of bioactive compounds from medicinal plants, *International Journal of Pharmaceutical Sciences Review and Research*, **18(1)**: 126–132.

Lehman, J. W., 2004, *Microscale Operation Organic Chemistry*, Prentice Hall Upper Saddle River, New Jersey, 493, 643.

Loureiro, M. C. D. S., Ferreira, M. D. L., Souza, M. V. N., Peralta, M. A., Vasconcelos, T. R. A., Henriques, M. G. M. O. 2007, Synthesis and anti-mycobacterial activity of E-N'-(monosubstituted-benzylidene)isonicotinohydrazide derivatives, *European Journal of Medicinal Chemistry*, **43**: 1344-1347.

Malhotra, M., Sharma, R., Monga, V., Deep, A., Sahu, K., & Samad, A. 2011, Synthesis, Characterization of (E)-N'-(substituted-benzylidene)isonicotinohydrazide Derivatives as Potent Antitubercular Agents, *Letters in Drug Design & Discovery*, **8(6)**: 575–579.

- Martins, F., Santos, S., Ventura, C., Elvas-Leitão, R., Santos, L., Vitorino, S., Viveiros, M. 2014, Design, synthesis and biological evaluation of novel isoniazid derivatives with potent antitubercular activity, *European Journal of Medicinal Chemistry*, **81**: 119–138.
- McBryde, E.S., Meehan, M. T., Doan, T. N., Ragonnet, R., Marais, B. J., Guernier, V., Trauer, J. M. 2017, The risk of global epidemic replacement with drug resistant M.tuberculosis strains, *International Journal of Infectious Diseases*
- McMurry, J. 2016, *Organic Chemistry*, Ed 9th, Cengage Learning, Belmont.
- Mohrig, J. R., Alberg, D. G., Hofmeister, G. E., & Schatz, P. F. 2000, in *Organic Chemistry Supporting Inquiry-Driven Experiments*.
- Narang, R., Narasimhan, B., Sharma, S., Sriram, D., Yogeeshwari, P., Clerc, E.D., Pannecouque, C. and Balzarini, J. 2012, ‘Synthesis, antimycobacterial, antiviral, antimicrobial activities, and QSAR studies of nicotinic acid benzylidene hydrazide derivatives’, *Med Chem Res*, **21**: 1557-1576
- Ni'mah, L. 2017, ‘Pengaruh gugus hidroksi dan metoksi pada 4-hidroksi-3-metoksibenzaldehyda terhadap sintesis N’-(4-hidroksi-3-metoksibenziliden) isonicotinohidrazida dengan metode iradiasi gelombang mikro’. *Skripsi*, Sarjana Farmasi, Universitas Katolik Widya Mandala, Surabaya.
- O'Neil, M.J. (ed). 2006, *The Merck Index: An Encyclopedia of Chemicals, Drugs, and Biologicals*, 14th ed., Merck Research Laboratories, New Jersey.
- Ormerod, L. P. 2005, Multidrug-resistant tuberculosis (MDR-TB): Epidemiology, prevention and treatment, *British Medical Bulletin*, 17–24.
- Papadopoulou, M. V., Bloomer, W. D., & Rosenzweig, H. S. 2017, The antitubercular activity of various nitro(triazole/imidazole)-based compounds, *Bioorganic and Medicinal Chemistry*, **25(21)**: 6039–6048.
- Pavia, D.L., Lampman, G.M., Kriz, G.S. and Vyvyan, J.R. 2009, *Introduction to Spectroscopy*, 4th ed.

Pirrung, M., 2017. *Handbook of Synthetic Organic Chemistry*, 2nd Edition, Department of Chemistry, University of California, Riverside, CA.

Pubchem, 2019. Acetic Acid, diakses pada tanggal 20 Oktober 2019, https://pubchem.ncbi.nlm.nih.gov/compound/acetic_acid

Pubchem, 2019. Isoniazid, diakses pada tanggal 20 Oktober 2019, <https://pubchem.ncbi.nlm.nih.gov/compound/Isoniazid>

Pubchem, 2019. 4-nitrobenzaldehyde, diakses pada tanggal 20 Oktober 2019, <https://pubchem.ncbi.nlm.nih.gov/compound/4-nitrobenzaldehyde>

Ravichandran, S., dan Karthikeyan, E. 2011, Microwave Synthesis a Potential Tool for Green Chemistry, *International Journal of ChemTech Research*, **3(1)**: 466-470.

Reddy, C. S. K., Khan, K. K. A., & Nagaraja, C. 2016, A Review on the Determination of Melting Point Measurement System, *International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering*, **5(2)**: 975–979.

Sari, N. K. 2010, *Analisa Instrumentasi*, Yayasan Humaniora, Klaten, Surakarta

Satiadarma, K. 2004, *Azas Pengembangan Prosedur Analisis*, Edisi Pertama, Cetakan Pertama, Surabaya: Airlangga University Press. Halaman 378-388.

Sherma, J. and Fried, B. 2003, *Handbook of Thin Layer Chromatography*, 3rd edition, Marcel Dekker Inc., New York.

Silverstein, R. M., Webster, F. X., Kiemle, D. J. 2005, *Spectrometric Identification of Organic Compounds* 7th ed, John Wiley & Sons, Inc, USA.

Siswandono dan Soekardjo, B. 2015, *Kimia Medisinal* Edisi 1, Airlangga University Press, Surabaya, **10**.

Skoog, D.A., Holler, F.J., dan Crouch, S.R. 2007, *Principles of Instrumental Analysis*, Ed 6th

Solomons, G., & Fryhle, C. 2000, *Organic Chemistry*, 7th edition, pp. 734–735.

Tjay, T.H. dan Rahardja, K. 2015, *Obat – Obat Penting*, PT Elex Gramedia Komputindo Kelompok Kompas, Jakarta.

Vilchezze, C., & Jacobs JR., W. R. 2014, Resistance to Isoniazid and Ethionamide in Mycobacterium tuberculosis: Genes, Mutations, and Causalities, *Microbiology Spectrum*, **2(4)**.

Watson, D.G. 2015, *Pharmaceutical Analysis: Textbook for Pharmacy Students and Pharmaceutical Chemists*, Elsevier Health Sciences, China.

Yong, J., Mainsah, E., Ntum, S.-J., & Ndifon, P. 2016, Synthesis, Characterization and Antibacterial Studies of Some Isoniazid-derived Schiff Bases, *International Research Journal of Pure and Applied Chemistry*, **12(1)**: 1–8.