

## **BAB 5**

### **KESIMPULAN DAN SARAN**

#### **5.1 Kesimpulan**

Berdasarkan hasil penelitian yang dilakukan, dapat disimpulkan bahwa:

1. Katalis HCl-asam borat dapat digunakan untuk mensintesis senyawa 2,5-dibenzilidensiklopentanon melalui reaksi kondensasi Claisen- Schmidt. Pada kondisi optimum selama 50 menit, rendemen yang dihasilkan sebesar 0,43%.
2. Katalis HCl-asam borat dapat digunakan untuk mensintesis senyawa 2,5-bis(4-hidroksi-3-metoksibenziliden)siklopentanon melalui reaksi kondensasi Claisen-Schmidt. Pada kondisi optimum 60 menit, rendemen yang dihasilkan sebesar 0,98%
3. Pengaruh penambahan gugus 4-hidroksi-3-metoksi terhadap sintesis senyawa 2,5-bis(4-hidroksi-3-metoksibenziliden)siklopentanon memperlambat jalannya reaksi ditinjau dari lama waktu reaksi.

#### **5.2 Saran**

Perlu dilakukan uji aktivitas untuk mengetahui khasiat senyawa yang telah disintesis.

## DAFTAR PUSTAKA

- Adabella, E., Oei, C., Rantetasak, V., Budiati, T. and Soewandi, A., 2024, Microwave-assisted synthesis of bis-(hydroxybenzylidene)-cycloalkanones via acid catalyzed Claisen-Schmidt condensation, *Chemistry & Chemical Technology*, **18(3)**: 350–355.
- Aggarwal, B.B., Kumar, A., Aggarawal, M.S. and Shishodia, S., 2003, Curcumin derived from Turmeric (*Curcuma longa*): A Spice for All Seasons, *Phytochemical in cancer chemoprevention*, **8(28)**:1-9
- Akash, M.S.H. and Rehman, K., 2020, *Essentials of Pharmaceutical Analysis*, Springer, Singapore.
- Anand, P., Kunnumakkara, A. B., Newman, R. A. and Aggarwal, B. B., 2008, Bioavailability of Curcumin: Problems and Solutions, *Molecular Pharmacology*, **4(6)**, 807-818.
- Anand, P., Kunnumakkara, A.B., Newman, R.A. and Aggarwal, B.B., 2007, Bioavailability of Curcumin: Problems and Promises, *Molecular Pharmaceutics*, **4(6)**, 807-818
- Anisa, D.N., Anwar, C. dan Afriyani, H., 2020, Sintesis Senyawa Analog Kurkumin Berbahan Dasar Veratraldehida dengan Metode Ultrasound, *Analit: Analytical and Environmental Chemistry*, **5(1)**.
- Bruice, P.Y., 2003, *Organic Chemistry*, 4th Edition, Prentice Hall, New York.
- Budimarwanti, C. dan Handayani, S., 2010, 'Efektivitas Katalis Asam Basa Pada Sintesis 2-hidroksikalkon, Senyawa yang Berpotensi Sebagai Zat Warna', *Prosiding Seminar Nasional Kimia dan Pendidikan Kimia*, Yogyakarta.
- Chattopadhyay, I., Biswas, K., Bandyopadhyay, U. and Banerjee, R. K., 2004, Turmeric and Curcumin: Biological Actions and Medicinal Applications, *Current Science*, **87(1)**: 44-53
- Eryanti, Y., Nurulita, Y., Hendra, R., Yuharmen, Syahri, J. and Zamri, A., 2011, Synthesizing Derivatives From Cyclopentanone Analogue Curcumin and Their Toxic, Antioxidant, and Anti-Inflammatory Activities, *Makara Journal of Science*, **15(2)**: 117-123.

- Gandjar, I.G. dan Rohman, A., 2015, *Kimia Farmasi Analisis*, Pustaka Pelajar, Yogyakarta
- Gupta, S., Patchva, S. and Aggarwal, B., 2013, Therapeutic Roles of Curcumin: Lessons Learned from Clinical Trials, *The American Association of Pharmaceutical Scientists Journal*, **15(1)**: 195-218.
- Hajibeygi, M., 2011, Acid-Catalyzed Aldol Condensation of Vanillin Derivatives, *Journal of Organic Chemistry*, **76(12)**, 5234–5239.
- Handayani, S. and Arty, I.S., 2009, Synthesis and Activity Test of Some Compounds 1,5-diphenyl-1,4-pentadiene-3-one as Potensial Sun Screen Material, *Journal of Physical Science*, **19(2)**: 61-68.
- Hewlings, S. J. and Kalman, D. S., 2017, Curcumin: A Review of Its' Effects on Human Health. *Foods*, **6(10)**, 92.
- Kumar, R., Sharma, P. K. and Mishra, P. S., 2012, A Review on The Vanillin Derivatives Showing Various Biological Activities, *International Journal of PharmTech Research*, **4(1)**: 266-279.
- Lehman, J.W., 2004, *Microscale Operation Organic Chemistry*, Prentice Hall Upper, Sanddle River, pp., 493, 634.
- Liang, G., Shao, L., Wang, Y., Zhao, C., Chu, Y., Xiao, J., Zhao, Y., Li, X. and Yang, S., 2009, Exploration and synthesis of curcumin analogues with improved structural stability both in vitro and in vivo as cytotoxic agents, *Bioorganic & Medicinal Chemistry*, **17(6)**: 2623-2631.
- Lin, L., and Lee, K., 2006, Structure-activity relationships of curcumin and its analogs with different biological activities, *Studies in Natural Products Chemistry*, **33**: 785-812.
- Ma, Z., Wang, N., He, H. and Tang, X., 2019, Pharmaceutical strategies of improving oral systemic bioavailability of curcumin for clinical application, *Journal of Control Release*, **316**: 359–380.

- Mahalakshmi, S., Sruthi, V. S., Babu, N. G., R., Sivaraj, C. and Arumugam, P., 2019, Isolation and pharmacological activities of curcumin from *Curcuma longa* L., *International Journal for Research in Applied Sciences and Biotechnology*, **6(5)**: 7–17.
- Manohar, S., Khan, S. I., Kandi, S. K., Raj, K., Sun, G., Yang, X., Molina, A. D. C., Ni, N., Wang, B. and Rawat, D. S., 2013, Synthesis, antimalarial activity cytotoxic potential of new monocarbonyl analogues of curcumin. *Bioorganic and Medicinal Chemistry Letters*, **23(1)**, 112-116.
- Martha, R. D., Wahyuningsih, T. D. dan Anwar, C., 2020, Sintesis analog kurkumin 2,6-bis-(E)-4-hidroksi-3-metoksibenzilidin)-sikloheksa-1- on berbahan dasar vanilin dengan katalis HCl, STIKES Karya Putra Bangsa, Tulungagung.
- McMurry, J., 2016, *Organic Chemistry*, 9th Edition, Thomson Learning, Inc, Belmont.
- Meiyanto, E., Putri, D. D. P., Susidarti, R. A., Murwanti, R., Sardjiman, S., Fitriasari, A. and Kawaichi, M., 2014, Curcumin and its analogues (PGV-0 and PGV-1) enhance sensitivity of resistant MCF-7 cells to doxorubicin through inhibition of HER2 and NFkB activation. *Asian Pacific Journal of Cancer Prevention*, **15(1)**, 179-184.
- Nugroho, A. E., Yuniarti, N., Estyastono, E. P. dan Supardjan, H. L., 2006, Penetapan aktivitas antioksidan dehidro-zingeron melalui penangkapan radikal hidroksi dengan metode deoksiribosa. *Majalah Farmasi Indonesia*, **17(3)**: 116-122.
- Nurfina, A.N., Samhoedi, M., Timmerman, H., Jenie, U.A., Sugiyanto and Van der Goot, H. (eds). 1997, The Relationship between and Inhibition of Lipoxigenase Activity Of Curcumin Derivatives, Proceedings of the International Symposium on Curcumin Pharmacochemistry (YSCP), Factuali of Gajah Mada University, Aditya Media, Yogyakarta, p. 152-161.
- O'Neil, M., Heckelman, P., Koch, C., Roman, K. and Kenny, C., 2006, *The Merck Index*, Ed 14th, Merck and Co, Inc., New York.

- Priyadarsini, K.I., 2014, The chemistry of curcumin: From extraction to therapeutic agent. *Molecules*, **19**, 20091–20112.
- Pudjono dan Supardjan, 2004, Sintesis Hasil Kondensasi Turunan Benzaldehida dan Siklopentanon dengan Katalis Basa, QUE Project of the Pharmacy Education Program Fakultas Farmasi UGM, Yogyakarta.
- Pudjono, S. dan Irawati, T., 2006, Sintesis 2,5-dibenzilidinsiklopentanon dari benzaldehid dan siklopentanon dengan variasi pelarut. *Majalah Farmasi Indonesia*, **17(1)**: 45-49
- Rahmawati, N., Fitriana, A. S. dan Sholikha, M. S., 2023, Sintesis analog kurkumin (2E,6E)-2-(4-hidroksi-3-metoksi-5 ((pirolidin)metil)benziliden)-6-(4-metoksibenziliden)sikloheksan--on. *Sainstech Farma*, **16(2)**, 84–93.
- Richa, Y., 2009, ‘Uji Aktivitas Penangkap Radikal dari Ekstrak Petroleum Eter, Etil Asetat, dan Etanol Rhizoma Binahong (*Anredera cordifolia* (Tenore) Steen) dengan Metode DPPH (2,2-difenil-1-pikrihidrazil)’, *Skripsi*, Fakultas Farmasi UMS, Surakarta.
- Sahne, F., Mohammadi, M., Najafpour, G. D. and Moghadamnia, A. A., 2021, Extraction of curcumin from turmeric using ultrasound- assisted natural deep eutectic solvent: A green methodology. *Journal of Molecular Liquids*, **322**, 114823.
- Santosa, I., 2008, ‘Kinetika Reaksi Sintesis 2,5-Bis-(4-Hidroksi-3-Metoksibenzilidin) Siklopentanon dari Vanilin dan Siklopentanon secara Batch pada Tahap Pengadukan’. *Prosiding Seminar Nasional Rekayasa Kimia dan Proses 2008*.
- Sardjiman, 2000, ‘Synthesis of Some New Series of Curcumin Analogues, Antioxydative, Antiinflammatory, Antibacterial Activities and Quantitative-Structure Activity Relationship’, *Tesis*, Gadjah Mada University, Yogyakarta.
- Silalahi J., 2002, Senyawa Polifenol sebagai Komponen Aktif yang Berkhasiat dalam Teh, *Majalah Kedokteran Indonesia*, **52(10)**:361
- Smith, J. R. and Jones, A. B., 2022, The Role of Substituents in Modifying the Activity of Natural Products, *Natural Products Journal*, **12(4)**, 123-134.
- Sreejayan and Rao, M., 1994, Curcuminoids as Potent Inhibitors of Lipid

Peroxidation, *Journal of Pharmacy and Pharmacology*, **46**:1013-1016.

Sreen Material', Proceeding of the First International Seminar on Science and Technology, Yogyakarta, Indonesia.

Sundaryono, A., 2011, Sintesis senyawa analog kur,kumin simetri (1E, 3E, 8E,10E)-1, 11-difenil-undeka-1,3,8,10 tetraena-5,7-dion, *Jurnal Gradien*, **8(1)**: 734-738.

Urošević, M., Nikolić, L., Gajić, I., Nikolić, V., Dinić, A. and Miljković, V., 2022, Curcumin: Biological Activities and Modern Pharmaceutical Forms, *Antibiotics*, **11(135)**.

Wang,H., et al., 2015, Boric Acid as Mild and Efficient Catalyst for Organic Transformations, *ACS Catalysis*, **5(5)**, 2903-2911.

Worsfold, P., Townshend, A., Poole, C. F. and Miró, M., 2019, *Encyclopedia of analytical science*, 2nd Ed, Elsevier., London.