

1.7 References

1. Alan R. Katritzky, Christopher A. Ramsden, John A. Joule, and Viktor V. Zhdankin. *Handbook of heterocyclic chemistry*. Elsevier, (2010).
2. M. Y. Langroudi, "Review of studies focused on heterocyclic compounds containing a heteroatom and aromaticity evaluation methods." *Indian J Sci Res* **7** (2014): 724-31.
3. Katritzky, Alan R. *Advances in heterocyclic chemistry*. Vol. **70**. Academic press, (1997).
4. A. Weissberger, (Ed.), "The Chemistry of Heterocyclic Compounds", Wiley Interscience, New York **1-29**, 1950-1975.
5. John H. Fletcher, Otis C. Dermer, and Robert B. Fox, eds. Nomenclature of organic compounds: principles and practice. *American Chemical Society*, (1974).
6. A. Weissberger, (Ed.), "The Chemistry of Heterocyclic Compounds", Wiley Interscience, New York **1-29**, (2020) 1950-1975
7. Nagaraj, A. and C. S. Reddy, "Synthesis and biological study of novel bis-chalcones, bis-thiazine and bis-pyrimidine," *Journal of the Iranian chemical society*, **5(2)** (2008) 262- 267.
8. Ju, Y. and R. S. Varma, "Aqueous N-heterocyclization of primary amines and hydrazines with dihalides: microwave-assisted syntheses of N-azacycloalkanes, isin-

- dole, pyrazole, pyrazolidine and phthalazine derivatives," *The Journal of organic chemistry*, **71(1)** (2006) 135-141.
9. Yadav, P. S., D. Devprakash and G. P. Senthilkumar, "Benzothiazole: Different methods of synthesis and diverse biological activities," *International Journal of Pharmaceutical Sciences and Drug*, **3** (2011) 1-7.
10. Li, D., Y. Huang and J. Su, "Dyeing behaviours of amino heterocyclic compounds as blue oxidative hair dye precursors applied to keratin fibres," *International Journal of cosmetic science*, **33(2)** (2011) 183-189.
11. Martins, M. A. P, W. Cunico, C. M. P. Pereira, A. P. Sinhoin, A. F. C. Flores, H. G. Bonacorso and N. Zanatta, "4-Alkoxy-1,1,1-trichloro-3-alken-2-ones: preparation and applications in heterocyclic synthesis," *Current Organic Synthesis*, **1(4)** (2004) 391-403.
12. J. Fournier, *Actualité Chimique* "Births of chemical crop protection." (2006): 43-53.
13. W.Q. Fan and A. R. Katritzky, *In Comprehensive Heterocyclic Chemistry II. Elsevier Science, Oxford* (**4**) 1996, 1-126.
14. H. Dehne, In *Methoden der Organischen Chemie (Houben-Weyl)*, E. Schaumann and Ed. Stuttgart, Thieme (**8**), (1994), 305-405.
15. T. Eicher and S. Hauptmann the Chemistry of Heterocycles: Structure, Reactions, Syntheses and Applications. *Wiley& sons* (**2**) (2003), 371-370
16. Alcazar, Jesus, and Daniel Oehlrich. "Recent applications of microwave irradiation"

- tion to medicinal chemistry." *Future medicinal chemistry* **2(2)** (2010): 169-176.
17. Bird, C. W., & Katritzky, A. R. (Eds.). *Comprehensive heterocyclic chemistry: the structure, reactions, synthesis and uses of heterocyclic compounds*; **2(8)** (1984).4.
18. Paul Anastas, and Nicolas Eghbali. "Green chemistry: principles and practice." *Chemical Society Reviews* **39**, (2010): 301-312.
19. Ahluwalia, V. K., and Mazaahir Kidwai. *New trends in green chemistry*. Springer Science & Business Media, **2012**.
20. Einstein, A., B. Podolsky, and N. Rosen, "Can quantum-mechanical description of physical reality be considered complete?"; *Phys. Rev.* (**47**) 1935, 777-780
21. J.M.D. Fortunak, Trop. J. An Efficient, Green Chemical Synthesis of the Malaria Drug, Piperaquine *Pharm. Res.* **7(1)**, (2008), 865-866.
22. M.E. Kerr, Neurophysiology of human touch and eye gaze in therapeutic relationships and healing, *Int. J. Sci. Tech.* **1(2)** (2007) 95-97.
23. Li, Chao-Jun, and Liang Chen. "Organic chemistry in water." *Chemical Society Reviews* **35**, **1** (2006): 68-82.
24. Gleye, C., G. Lewin, A. Laurens, J.-C. Jullian, P. Loiseau, C. Bories and R. Hocquemiller, "Acaricidal activity of tonka bean extracts synthesis and structure-activity relationships of bioactive derivatives," *Journal of natural products*, **66(5)** (2003) 690-692.

25. Vekariya, R. H. and H. D. Patel, "Recent advances in the synthesis of coumarin derivatives via Knoevenagel condensation: A review," *Synthetic Communications*, **44(19)** (2014), 2756- 2788.
26. G. Brahmachari, "Room temperature one-pot green synthesis of coumarin-3-carboxylic acids in water: a practical method for the large-scale synthesis," *ACS Sustainable Chemistry & Engineering*, **3(9)** (2015) 2350-2358.
27. Murray, R. D. H., "Naturally occurring plant coumarins," In *fortschritte der Chemie organischer naturstoffe/progress in the Chemistry of Organic Natural products*," (1991) 83-316
28. Stefanachi, A., F. Leonetti, L. Pisani, M. Catto and A. Carotti, "Coumarin: A natural, privileged and versatile scaffold for bioactive compounds," *Molecules*, **23(2)** (2018) 250.
29. Bonsignore, L., F. Cottiglia, A. M. Maccioni, D. Secci and S. M. Lavagna, "Synthesis of coumarin-3-O-acylisoureas by dicyclohexylcarbodiimide," *Journal of heterocyclic chemistry*, **32(2)** (1995) 573-577.
30. Yavari, I., R. Hekmat-Shoar and A. Zonouzi, "A new and efficient route to 4-carboxymethyl coumarins mediated by vinyltriphenylphosphonium salt," *Tetrahedron Letters*, **39(16)** (1998) 2391-2392.

31. Augustine, J. K., A. Bombrun, B. Ramappa and C. Boodappa, "An efficient one-potsynthesis of coumarins mediated by propylphosphonic anhydride (T3P) via the Perkin condensation," *Tetrahedron Letters*, **53**(33) (2012) 4422-4425.
32. Kaye, P. T., M. A. Musa and X. W. Nocanda, "Efficient and chemoselective access to 3-(chloromethyl) coumarins via direct cyclisation of unprotected Baylis-Hillman adducts," *Synthesis*, **(04)** (2003) 0531-0534.
33. Pechmann, H. V., "New Formation of Coumarins. Synthesis of Daphnetin. I," *Reports of the German Chemical Society*, **17**(1) (1884) 929-936.
34. Valizadeh, H. and A. Shockravi, "An efficient procedure for the synthesis of coumarin derivatives using TiCl₄ as catalyst under solvent-free condition," *Tetrahedron Letters*, **46** (20) (2005) 3501-3503.
35. Ranu, B. C. and R. Jana, "Ionic Liquid as Catalyst and Reaction Medium—A Simple, Efficient and Green Procedure for Knoevenagel Condensation of Aliphatic and Aromatic Carbonyl Compounds Using a Task-Specific Basic Ionic Liquid," *European Journal of organic chemistry*, **(16)** (2006) 3767-3770.
36. Gopalakrishnan, S., K. R. Viswanathan, S. V. Priya, J. H. Mabel, M. Palanichamy and V. Murugesan, "Lewis's acid metal ion-exchanged MAPO-5 molecular sieves for solvent free synthesis of coumarin derivative," *Catalysis Communications*, **10**(1) (2008) 23-28.

37. Verdía, P., F. Santamarta and E. Tojo, "Knoevenagel reaction in [MMIm][MSO₄]: *Synthesis of coumarins*," *Molecules*, **16(6)** (2011) 4379-4388.
38. Tasqeeruddin, S., A. S. A.-Arifi and P. K. Dubey, "An Efficient Solid-Phase Green Synthesis of Chromen-2-one Derivatives," *Asian Journal of Chemistry*, **25(12)** (2013).
39. Srikrishna, D., S. Tasqeeruddin and P. K. Dubey, "Synthesis of 3-substituted Coumarins: An Efficient Green Approach Using L-proline as Catalyst in Triethanolamine Medium," *Letters in Organic Chemistry*, **11(8)** (2014) 556-563.
40. Bonsignore, L.; Cottiglia, F.; Lavagna, S. M.; Loy, G.; Secci, D. Synthesis of coumarin-3-O-acylisoureas by different carbodiimides Heterocycles **1999**, 50, 469– 478
41. Fiorito, S., V. A. Taddeo, S. Genovese and F. Epifano, "A green chemical synthesis of coumarin-3-carboxylic and cinnamic acids using crop-derived products and waste waters as solvents," *Tetrahedron Letters*, **57(43)** (2016) 4795-4798.
42. Khan, D., S. Mukhtar, M. A. Alsharif, M. I. Alahmdi and N. Ahmed, "PhI(OAc)₂ mediated an efficient Knoevenagel reaction and their synthetic application for coumarin derivatives," *Tetrahedron Letters*, **58(32)** (2017) 3183-3187.
43. Ghomi, J. S. and Z. Akbarzadeh, "Ultrasonic accelerated Knoevenagel condensation by magnetically recoverable MgFe₂O₄ nanocatalyst: A rapid and green synthesis of coumarins under solvent-free conditions," *Ultrasonics sonochemistry*, **40** (2018) 78-83.

44. Dinparast, L., S. Hemmati, G. Zengin, A. A. Alizadeh, M. B. Bahadori, H. S. Kafil and S. Dastmalchi, "Rapid, Efficient, and Green Synthesis of Coumarin Derivatives via Knoevenagel Condensation and Investigating Their Biological Effects," *ChemistrySelect*, **4(31)** (2019) 9211-9215.
45. Bagdi, A. K., S. Santra, K. Monir and A. Hajra, "Synthesis of imidazo [1,2-a] pyridines: a decade update," *Chemical Communications*, **51(9)** (2015) 1555-1575.
46. Douhal, A., F. A.-Guerra and A. U. Acuña, "Probing Nanocavities with Proton-Transfer Fluorescence," *Angewandte Chemie International*, **36(13-14)** (1997) 1514-1516.
47. Leopoldo, M., E. Lacivita, E. Passafiume, M. Contino, N. A. Colabufo, F. Berardi and R. Perrone, "4-[ω-[4-Arylpiperazin-1-yl] alkoxy] phenyl) imidazo[1,2-a] pyridine derivatives: fluorescent high-affinity dopamine D3 receptor ligands as potential probes for receptor visualization," *Journal of Medicinal Chemistry*, **50(20)** (2007) 5043-5047.
48. Roopan, S. M., S. M. Patil and J. Palaniraja, "Recent synthetic scenario on imidazo[1,2-a] pyridines chemical intermediate," *Research on Chemical Intermediates*, **42(4)** (2016) 2749- 2790.
49. Schwerkoske, J., T. Masquelin, T. Perun and C. Hulme, "New multi-component reaction accessing 3-aminoimidazo[1,2-a] pyridines," *Tetrahedron Letters*, **46(48)** (2005) 8355-8357.

50. Chernyak, N. and V. Gevorgyan, "General and efficient copper-catalyzed three-component coupling reaction towards imidazoheterocycles: one-pot synthesis of alpidem and zolpidem," *Angewandte Chemie International Edition*, **49(15)** (2010) 2743-2746.
51. Adib, M., E. Sheikhi and N. Rezaei, "One-pot synthesis of imidazo[1,2-a] pyridines from benzyl halides or benzyl tosylates, 2-aminopyridines and isocyanides," *Tetrahedron Letters*, **52(25)** (2011) 3191-3194.
52. Khan, A. T., R. S. Basha and M. Lal, "Bromodimethylsulfonium bromide (BDMS) catalyzed synthesis of imidazo[1,2-a] pyridine derivatives and their fluorescence properties," *Tetrahedron Letters*, **53(17)** (2012) 2211-2217
53. Denora, Nunzio, Valentino Laquintana, Maria Giuseppina Pisu, Riccardo Dore, Luca Murru, Andrea Latrofa, Giuseppe Trapani, and Enrico Sanna. "2-Phenyl-imidazo [1, 2-a] pyridine compounds containing hydrophilic groups as potent and selective ligands for peripheral benzodiazepine receptors: synthesis, binding affinity and electrophysiological studies." *Journal of medicinal chemistry* **51, 21** (2008): 6876-6888.
54. Liu, P., L.-S. Fang, X. Lei and G.-Q. Lin, "Synthesis of imidazo[1,2-a] pyridines via three-component reaction of 2-aminopyridines, aldehydes and alkynes," *Tetrahedron Letters*, **51 (35)** (2010) 4605-4608.
55. Guntreddi, T., B. K. Allam and K. N. Singh, "Simple and efficient one-pot synthesis of imidazo[1,2-a] pyridines catalyzed by magnetic nano-Fe₃O₄-KHSO₄· SiO₂," *Synlett*, **23 (18)** (2012) 2635-2638.

56. Yan, H., Y. Wang, C. Pan, H. Zhang, S. Yang, X. Ren, J. Li and G. Huang, "Iron (III)- Catalyzed Denitration Reaction: One-Pot Three-Component Synthesis of Imidazo[1,2-a] pyridine Derivatives," *European Journal of Organic Chemistry*, **2014**(13) (2014) 2754- 2763.
57. Yan, H., S. Yang, X. Gao, K. Zhou, C. Ma, R. Yan and G. Huang, "Iron (II)-catalyzed denitration reaction: synthesis of 3-methyl-2-arylimidazo[1,2-a] pyridine derivatives from aminopyridines and 2-methylnitroolefins," *Synlett*, **23**(20) (2012) 2961-2964.
58. Santra, S., S. Mitra, A. K. Bagdi, A. Majee and A. Hajra, "Iron (III)-catalyzed three-component domino strategy for the synthesis of imidazo[1,2-a] pyridines," *TetrahedronLetters*, **55**(37) (2014) 5151-5155.
59. B. W. Cue, J. Zhang, Green process chemistry in the pharmaceutical industry *Green Chem. Lett. Rev.* **2**, (2009), 193–211.
60. S. R. Varma, Greener” chemical syntheses using mechanochemical mixing or microwave and ultrasound irradiation *Green Chem. Lett. Rev.* **1**, (2007), 37–45.
61. L.-X. Liu, Recent Uses of Iron Catalysts in Organic Reactions, *Curr. Org. Chem.* **14**, (2010), 1099.
62. C. Bolm, J. Legros, J.-L. Le Paih, L. Zani, Iron-Catalyzed Reactions in Organic Synthesis *Chem. Rev.* **104** (2004), 6217.
63. Shi, M. and X.G. Liu, “Asymmetric Morita-Baylis-Hillman reaction of arylaldehydes with 2-cyclohexen-1-one catalyzed by chiral bis (thio) urea and DABCO,” *Organic*

- letters*, **10(6)** (2008) 1043-1046. Shi, M. and X.G. Liu, "Asymmetric Morita-Baylis-Hillman reaction of arylaldehydes with 2-cyclohexen-1-one catalyzed by chiral bis (thio) urea and DABCO," *Organic letters*, **10(6)** (2008) 1043-1046.
64. Shi, M. and X.G. Liu, "Asymmetric Morita-Baylis-Hillman reaction of arylaldehydes with 2-cyclohexen-1-one catalyzed by chiral bis (thio) urea and DABCO," *Organic letters*, **10(6)** (2008) 1043-1046.
65. Shi, M. and X.G. Liu, "Asymmetric Morita-Baylis-Hillman reaction of arylaldehydes with 2-cyclohexen-1-one catalyzed by chiral bis (thio) urea and DABCO," *Organic letters*, **10(6)** (2008) 1043-1046.
66. Das, Debasis, Papiya Sikdar, and Moumita Bairagi. "Recent developments of 2-aminothiazoles in medicinal chemistry." *European Journal of Medicinal Chemistry* 109 (2016): 89-98.
67. Mahesh T. Chhabria, Shivani Patel, Palmi Modi, and Pathik S Brahmksatriya. "Thiazole: A review on chemistry, synthesis and therapeutic importance of its derivatives." *Current topics in medicinal chemistry* 16, no. 26 (2016): 2841-2862.
68. Sunil Kumar, and Ranjana Aggarwal. "Thiazole: a privileged motif in marine natural products." *Mini-Reviews in Organic Chemistry* **16, 1** (2019): 26-34.
69. Koneni V. Sashidhara, K. Bhaskara Rao, Pragati Kushwaha, Ram K. Modukuri, Pratiksha Singh, Isha Soni, P. K. Shukla, Sidharth Chopra, and Mukesh Pasupuleti. "Novel chalcone-thiazole hybrids as potent inhibitors of drug resistant *Staphylococcus aureus*." *ACS medicinal chemistry letters* 6, no. 7 (2015): 809-813.

70. Jin, Z.; *Nat. Prod. Rep.*, Muscarine, imidazole, oxazole, and thiazole alkaloids **20**, (2003), 584-605.
71. Răzvan C. Cioc, Eelco Ruijter, and Romano VA Orru. "Multicomponent reactions: advanced tools for sustainable organic synthesis." *Green Chemistry* 16, no. 6 (2014): 2958-2975.
72. Xin, Xin, Yan Wang, Santosh Kumar, Xu Liu, Yingjie Lin, and Dewen Dong. "Efficient one-pot synthesis of substituted pyridines through multicomponent reaction." *Organic & Biomolecular Chemistry* 8, no. 13 (2010): 3078-3082.
73. Ghasemzadeh, M. A.; Mirhosseini-Eshkevari, B.; Tavakoli. M.; Zamani, F.; Metal-organic frameworks: advanced tools for multicomponent reactions *Green Chem.*, **2020**,
74. Candeias, N. R.; Branco, L. C.; Gois, P. M. P.; Afonso C. A. M.; and Trindade, A. F.; The modern face of synthetic heterocyclic chemistry *Chem. Rev.* **109**, (2009), 2703-2802.
75. Aloysio Fellet, "Fentiazac in rheumatoid arthritis: a multicentre study." *Current Medical Research and Opinion* **6-2** (1979): 64-70.
76. Bryan L. Love, Robert Barrons, Angie Veverka, and K. Matthew Snider. "Urate-lowering therapy for gout: focus on febuxostat." *Pharmacotherapy: The Journal of Human Pharmacology and Drug Therapy* **30**, **6** (2010): 594-608.
77. Xu-Yuan Liu, Run-Ling Wang, Wei-Ren Xu, Li-Da Tang, Shu-Qing Wang, and Kuo-Chen Chou. "Docking and molecular dynamics simulations of peroxisome

- proliferator activated receptors interacting with pan agonist sodelglitazar." *Protein and peptide letters* **18,10** (2011): 1021-1027.
78. Ali, Sukinah H., and Abdelwahed R. Sayed. "Review of the synthesis and biological activity of thiazoles." *Synthetic Communications* **51, 5** (2021): 670-700.
79. Shabaan, Sara N., et al. "Ultrasound-assisted green synthesis and antimicrobial assessment of 1, 3-thiazoles and 1, 3, 4-thiadiazole." *Green Chemistry Letters and Reviews* **14.4** (2021) 679-688. Mulvaney, J. E., and C. S. Marvel. "Synthesis Of polymers containing recurring thiazole rings." *The Journal of Organic Chemistry* **26.1** (1961) 95-97.
80. Mulvaney, J. E., and C. S. Marvel. "Synthesis Of polymers containing recurring thiazole rings." *The Journal of Organic Chemistry* **26.1** (1961) 95-97.
81. Watt, George W. "Reactions in the thiazole series. II. The reaction of 2-chlorobenzothiazole with thiourea in aqueous media." *The Journal of Organic Chemistry* **4.4** (1939) 436-441.
82. Manjit, Singh, Vijay B. Yadav, Mohd Danish Ansari, Manisha Malviya, and I. R. Siddiqui. "Green and Efficient Iron-Catalysed Synthesis of Polyfunctionalized Coupling." *ChemistrySelect* **5-23** (2020): 7026-7030.
83. Liu, Xu-Yuan, Run-Ling Wang, Wei-Ren Xu, Li-Da Tang, Shu-Qing Wang, and Kuo-Chen Chou. "Docking and molecular dynamics simulations of peroxisome proliferator activated receptors interacting with pan agonist sodelglitazar." *Protein and peptide letters* **18-10** (2011): 1021-1027.

84. Zheng, Hui, Yi-Jia Mei, Kui Du, Xian-Ting Cao, and Peng-Fei Zhang. "One-pot chemoenzymatic multicomponent synthesis of thiazole derivatives." *Molecules* **18**, **11** (2013): 13425-13433.
85. Banerjee, Riddhiman, Danish Ali, Nurabul Mondal, and Lokman H. Choudhury. "HFIP-Mediated Multicomponent Reactions: Synthesis of Pyrazole-Linked Thiazole Derivatives." *The Journal of Organic Chemistry* (2024).
86. Asim Jana, Prabhas Bhaumick, Anoop Kumar Panday, Richa Mishra, and Lokman H. Choudhury. "I₂/DMSO mediated multicomponent reaction for the synthesis of 2-arylbenzo [d] imidazo [2, 1-b] thiazole derivatives." *Organic & Biomolecular Chemistry* 17, no. 21 (2019): 5316-5330.

2.9 References

1. Uekama, Kaneto; Hirayama, Fumitoshi; Irie, Tetsumi. "Cyclodextrin Drug Carrier Systems". *Chemical Reviews*. **98** (5): (1998) 2045–2076.
2. Becket, Gordon; Schep, Leo J.; Tan, Mun Yee. "Improvement of the in vitro dissolution of praziquantel by complexation with α -, β - and γ -cyclodextrins". *International Journal of Pharmaceutics*. **179** (1): (1999) 65–71.
3. Bahrami, K., M.M. Khodaei and A. Nejati, "Synthesis of 1, 2-disubstituted benzimidazoles, 2-substituted benzimidazoles and 2-substituted benzothiazoles in SDS micelles," *Green Chemistry*, **12**(7) (2010) 1237-1241.
4. Basile, Adriana, Sergio Sorbo, Vivienne Spadaro, Maurizio Bruno, Antonella Maggio, Nicoletta Faraone, and Sergio Rosselli. "Antimicrobial and antioxidant activities of coumarins from the roots of *Ferulago campestris* (Apiaceae)." *Molecules* **14**, 3 (2009): 939-952.
5. Sashidhara, Koneni V., Abdhesh Kumar, Manavi Chatterjee, K. Bhaskara Rao, Seema Singh, Anil Kumar Verma, and Gautam Palit. "Discovery and synthesis of novel 3-phenylcoumarin derivatives as antidepressant agents." *Bioorganic & medicinal chemistry letters* **21**, 7 (2011): 1937-1941.
6. Keri, Rangappa S., B. S. Sasidhar, Bhari Mallanna Nagaraja, and M. Amelia Santos. "Recent progress in the drug development of coumarin derivatives as potent

- antituberculosis agents." *European journal of medicinal chemistry* **100** (2015): 257-269.
7. Smyth, T., V. N. Ramachandran, and W. F. Smyth. "A study of the antimicrobial activity of selected naturally occurring and synthetic coumarins." *International journal of antimicrobial agents* **33**, **5** (2009): 421-426.
 8. Zhang, Rong-Rong, Jia Liu, Yu Zhang, Meng-Qing Hou, Ming-Zhi Zhang, Fenger Zhou, and Wei-Hua Zhang. "Microwave-assisted synthesis and antifungal activity of novel coumarin derivatives: Pyrano [3, 2-c] chromene-2, 5-diones." *European journal of medicinal chemistry* **116** (2016): 76-83.
 9. Zohdy M., Nofal, M. I. El-Zahar, and S. S. Abd El-Karim. "Novel coumarin derivatives with expected biological activity." *Molecules* **5**,**2** (2000) 99-113.
 10. Tanuraghaj, Hamideh Mohamadi, and Mahnaz Farahi. "A novel sodium carbonate-catalyzed regioselective synthesis of pyrano [2, 3-h] coumarins using a three-component reaction." *Tetrahedron Letters* **60**,**7** (2019): 557-559.
 11. A. Shakeri, N. Ward, Y. Panahi, A. Sahebkar A Narrative Review. *CurrVasc Pharmacol.*, **17**, (2019), 262-269.
 12. Molnar, M., B. Šarkanj, M. Cacic, L. Gille, and I. Strelec. "Antioxidant properties and growth-inhibitory activity of coumarin Schiff bases against common foodborne fungi." *Der Pharma Chem* **6**, (2014): 313-320.

13. Siddiqui, Zeba N. "Sulfamic acid catalysed synthesis of pyranocoumarins in aqueous media." *Tetrahedron Letters* **55**, 1 (2014): 163-168.
14. Souza, Simone M. de, Franco Delle Monache, and Artur Smânia Jr. "Antibacterial activity of coumarins." *Zeitschrift fuer Naturforschung* **9-10** (2005): 693-700.
15. Baldoumi, Vassiliki, D. R. Gautam, K. E. Litinas, and D. N. Nicolaides. "Convenient synthesis of linear pyrano [3, 2-g] and angular pyrano [3, 2-f] coumarins from 4 [(1, 1-dimethyl-2-propynyl) oxy] phenol." *Tetrahedron* **62,34** (2006): 8016-8020.
16. S Zambare, Abhay, Firoz A Kalam Khan, Sureshchandra P Zambare, Shantanu D Shinde, and Jaiprakash N Sangshetti. "Recent advances in the synthesis of coumarin derivatives via Pechmann condensation." *Current Organic Chemistry* **20**, 7 (2016): 798-828.
17. áP Bandgar, B. "Solvent-free one-pot rapid synthesis of 3-carboxycoumarins. using focused microwaves." *Green Chemistry* **1**, (5) (1999): 243-245.
18. Zhang, Ming, and Ai-Qin Zhang. "Catalyzed Preparation of Ylide nemalono nitriles and 3-Cyanocoumarin in Water." *Synthetic communications* **34(24)** (2004): 4531-4535.

19. Volmajer, Julija, Renata Toplak, Ivan Leban, and Alenka Majcen Le Marechal. "Synthesis of new iminocoumarins and their transformations into N-chloro and hydrazono compounds." *Tetrahedron* **61(29)** (2005): 7012-7021.
20. Karade, Nandkishor N., Sumit V. Gampawar, Sandeep V. Shinde, and Wamanrao N. Jadhav. "L-proline catalyzed solvent-free knoevenagel condensation for the synthesis of 3-substituted coumarins." *Chinese Journal of Chemistry* **25 (11)** (2007): 1686-1689.
21. Heravi, M. M., N. Poormohammad, Y. S. Beheshtiha, B. Baghernejad and R. Malakooti, " *Bulletin of the Chemical Society of Ethiopia*, **24(2)** (2010) 273-276.
22. Pasricha, Sharda, and Pragya Gahlot. "Synthetic Strategies and Biological Potential of Coumarin-Chalcone Hybrids: A New Dimension to Drug Design." *Current Organic Chemistry* **24, 4** (2020): 402-438.
23. Suresh Kumar, "A solvent free approach for Knoevenagel condensation: facile synthesis of 3-cyano and 3-carbethoxycoumarins." *Green Processing and Synthesis* **3 (3)** (2014): 223-227.
24. Ghomi, Javad Safaei, and Zeinab Akbarzadeh. "Ultrasonic accelerated Knoevenagel condensation by magnetically recoverable MgFe₂O₄ nano catalyst: A rapid and green synthesis of coumarins under solvent-free conditions." *Ultrasonics sonochemistry* **40** (2018): 78-83.

25. Sabetpoor, Setareh, and Farhad Hatamjafari. "Synthesis of coumarin derivatives using glutamic acid under solvent-free conditions." *Orient. J. Chem* 30 (2) (2014): 863-865.
26. Rajesh Kumar Sharma, and Diksha Katiyar. "Recent advances in transition-metal-catalyzed synthesis of coumarins." *Synthesis* **48**, (15) (2016): 2303-2322.
27. Landge, S.M. and B. Török, "Synthesis of condensed benzo [N, N]-heterocycles by microwave-assisted solid acid catalysis," *Catalysis letters*, **122(3-4)** (2008) 338-343.
28. Tanuraghaj, H.M. and Farahi, M. advances in transition-metal-catalyzed synthesis of coumarins. *Tetrahedron Lett.*, **2019**, **60**,557-559.
29. Balbuena, Patricia, David Lesur, M. José González Álvarez, Francisco Mendicuti, Carmen Ortiz Mellet, and José M. García Fernández. "One-pot regioselective synthesis of 2 I,3 I-O-(o-xylylene)-capped cyclomaltooligosaccharides: tailoring the topology and supramolecular properties of cyclodextrins." *Chemical communications* **31** (2007): 3270-3272.
30. Manjit Singh, Vijay B. Yadav, Mohd Danish Ansari, Manisha Malviya, and I. R. Siddiqui. "Efficient one-pot synthesis of substituted diphenyl 1, 3-thiazole through multicomponent reaction by using green and efficient Iron-catalyst via Cross-Dehydrogenative Coupling (CDC)." *Molecular Diversity* (2022): 1-6.

31. M. Singh, V. B. Yadav, Mohd D. Ansari, M. Malviya, and I. R. Siddiqui. *Chemistry Sel.*, **23** (2020): 7026-7030.
32. Akhilesh Kumar, Pragati Rai, Vijay B. Yadav, and I. R. Siddiqui. "Oligosaccharide Assisted Approach: An Efficient and Facile Access to Isochromeno [4, 3-b] Indoles Derivatives in the Presence of Beta Cyclodextrin." *Catalysis Letters* **149** (2019): 190-195.
33. V. B. Yadav, P. Rai, H. agir, A. Kumar, and I. R. Siddiqui *New Journal of Chemistry.*, **42** (2018): 628-633.
34. Xu, Zhi, Qingtai Chen, Yan Zhang, and Changli Liang. "Coumarin-based derivatives with potential anti-HIV activity." *Fitoterapia* **150** (2021): 104863.
35. Petruľová-Poracká, Veronika, Miroslav Repčák, Mária Vilková, and Ján Imrich. "Coumarins of *Matricaria chamomilla* L.: Aglycones and glycosides." *Food chemistry* **141** (10) (2013): 54-59.
36. Han, Shuang, Fei-Fei Zhang, Hai-Yan Qian, Li-Li Chen, Jian-Bin Pu, Xin Xie, and Jian-Zhong Chen. "Design, syntheses, structure–activity relationships and docking studies of coumarin derivatives as novel selective ligands for the CB2 receptor." *European Journal of Medicinal Chemistry* **93** (2015): 16-32.

37. Paul, Kamaldeep, Shweta Bindal, and Vijay Luxami. "Synthesis of new conjugated coumarin–benzimidazole hybrids and their anticancer activity." *Bioorganic & medicinal chemistry letters* **23, 12** (2013): 3667-3672.
38. Rempel, Viktor, Nicole Volz, Sonja Hinz, Tadeusz Karcz, Irene Meliciani, Martin Nieger, Wolfgang Wenzel, Stefan Bräse, and Christa E. Müller. "7-Alkyl-3-benzylcoumarins: a versatile scaffold for the development of potent and selective cannabinoid receptor agonists and antagonists." *Journal of Medicinal Chemistry* **55 (18)** (2012): 7967-7977.**38(a)** Siddharth R. Kamat, Ananda H. Mane, Audumbar D. Patil, Trushant R. Lohar, and Rajashri S. Salunkhe. "Synthesis of xanthene and coumarin derivatives in water by using β -Cyclodextrin." *Research on Chemical Intermediates* **47** (2021): 911-924.
39. Breslow, Ronald. "A Fifty-Year Perspective on Chemistry in Water." *Organic Reactions in Water: Principles, Strategies and Applications* (2007): 1-28.
40. Tayade, Yogesh A., and Dipak S. Dalal. " β -Cyclodextrin as a supramolecular catalyst for the synthesis of 1H-pyrazolo [1, 2-b] phthalazine-5, 10-dione derivatives in water." *Catalysis Letters* **147** (2017): 1411-1421.
41. Subhankar Paul, Sharmistha Das, Bijeta Mitra, Gyan Chandra Pariyar, and Pranab Ghosh. " β -Cyclodextrin: a green supramolecular catalyst assisted eco-friendly one-

pot three-component synthesis of biologically active substituted pyrrolidine-2-one." *RSC advances* **13** (8) (2023): 5457-5466.

42. Chang Cai Bai, Bing Ren Tian, Tian Zhao, Qing Huang, and Zhi Zhong Wang. "Cyclodextrin-catalyzed organic synthesis: Reactions, mechanisms, and applications." *Molecules* **22**, (9) (2017): 1475.
43. Zujin Yang, Xia Zhang, Xingdong Yao, Yanxiong Fang, Hongyan Chen, and Hongbing Ji. " β -cyclodextrin grafted on lignin as inverse phase transfer catalyst for the oxidation of benzyl alcohol in H₂O." *Tetrahedron* **72**, (14) (2016): 1773-1781.
44. Chen, H.; Ji, H. Effect of substitution degree of 2-hydroxypropyl- β -cyclodextrin on the alkaline hydrolysis of cinnamaldehyde to benzaldehyde. *Supramol. Chem.* (26), **2014**,796–803.
45. Kakroudi, M.A.; Kazemi, F.; Kaboudin, B. β -cyclodextrin–TiO₂: Green nest for reduction of nitroaromatic compounds. *RSC Adv.* (4), **2014**,52762–52769.
46. Akhilesh, Kumar, Pragati Rai, Vijay B. Yadav, and I. R. Siddiqui. "Oligosaccharide Assisted Approach: An Efficient and Facile Access to Isochromeno [4, 3-b] Indoles Derivatives in the Presence of Beta Cyclodextrin." *Catalysis Letters* **149** (2019): 190-195.

47. Sabetpoor, Setareh, and Farhad Hatamjafari. "Synthesis of coumarin derivatives using glutamic acid under solvent-free conditions." *Orient. J. Chem* **30** (20) (2014): 863-865.
48. Boroujeni, Kaveh Parvanak, and Parvin Ghasemi. "Synthesis and application of a novel strong and stable supported ionic liquid catalyst with both Lewis and Brønsted acid sites." *Catalysis Communications* **37** (2013): 50-54.
49. Li, Wei, Yu Wang, Zhizhong Wang, Liyi Dai, and Yuanyuan Wang. "Novel SO₃H-functionalized ionic liquids based on benzimidazolium cation: efficient and recyclable catalysts for one-pot synthesis of biscoumarin derivatives." *Catalysis Letters* **141** (2011): 1651-1658.
50. Lončarić, Melita, Dajana Gašo-Sokač, Stela Jokić, and Maja Molnar. "Recent advances in the synthesis of coumarin derivatives from different starting materials." *Biomolecules* **10**, 1 (2020): 151.
51. Masoud Zeydi, Mohammadi, Seyed Jafar Kalantarian, and Zahra Kazeminejad. "Overview on developed synthesis procedures of coumarin heterocycles." *Journal of the Iranian Chemical Society* **17**,12 (2020): 3031-3094.
52. Maja Molnar, Melita Lončarić, and Marija Kovač. "Green chemistry approaches to the synthesis of coumarin derivatives." *Current organic chemistry* **24**, 1 (2020): 4-43.

53. Kanwal, A., M. Ahmad, S. Aslam, S.A.R. Naqvi and M.J. Saif, "Recent Advances in Antiviral Benzimidazole Derivatives: A Mini Review," *Pharmaceutical Chemistry Journal*, **53(3)** (2019) 179-187.
54. Mohamadpour, Farzaneh. "Supramolecular β -Cyclodextrin as a Reusable Catalyst for Xanthene Synthesis in Aqueous Medium." *Organic Preparations and Procedures International* **55, 4** (2023): 317-325.
55. Swati Chauhan, Pratibha Verma, Jeyakumar Kandasamy, and Vandana Srivastava. "A Practical Synthesis of 3-Functionalized Coumarins from o-Cresols and Active Methylene Compounds under Metal and Catalyst-Free Conditions Using tert-Butyl Hydrogen Peroxide." *ChemistrySelect* **5,29** (2020): 9030-9033
56. Azimi, Seyyede Cobra, and Esmayeel Abbaspour-Gilandeh. "A green and eco-friendly method for the synthesis of xanthene derivatives using cellulose sulfuric acid under solvent-free conditions." *Iranian chemical communication* **4,3**, 236-358, **12** (2016): 245-255.

3.8 References

1. Chai, She-Jie, Yi-Feng Lai, Jiang-Cheng Xu, Hui Zheng, Qing Zhu, and Peng-Fei Zhang. "One-pot synthesis of spirooxindole derivatives catalyzed by lipase in the presence of water." *Advanced Synthesis & Catalysis* **353**, 2-3 (2011) 371-375.
2. Wenjia Qian, Xiaorui Wang, Yu Kang, Peichen Pan, Tingjun Hou, and Chang-Yu Hsieh. "A general model for predicting enzyme functions based on enzymatic reactions." *Journal of Cheminformatics* **16**, (1) (2024) 38.
3. Mudassar Hussain, Imad Khan, Bangzhi Jiang, Lei Zheng, Yuechao Pan, Jijie Hu, Azqa Ashraf et al. "Lipases: Sources, immobilization techniques, and applications." *International Journal of Environment, Agriculture and Biotechnology* **8**, (6) (2023).
4. Li, Kun, Ting He, Chao Li, Xing-Wen Feng, Na Wang, and Xiao-Qi Yu. "Lipase-catalysed direct Mannich reaction in water: utilization of biocatalytic promiscuity for C–C bond formation in a “one-pot” synthesis." *Green Chemistry* **11**- 6 (2009): 777-779.
5. Hui, Zheng, Juan Liu, Yi Jia Mei, Qiao Yue Shi, and Peng Fei Zhang. "A novel enzymatic synthesis of quinoline derivatives." *Catalysis letters* **142** (2012): 573-577.

6. Ashok Kumar, Kartik Dhar, Shamsheer Singh Kanwar, and Pankaj Kumar Arora. "Lipase catalysis in organic solvents: advantages and applications." *Biological procedures online* 18 (2016): 1-11.
7. Kokkinou, Marina, Leonidas G. Theodorou, and Emmanuel M. Papamichael. "Aspects on the catalysis of lipase from porcine pancreas (type VI-s) in aqueous media: development of ion-pairs." *Brazilian Archives of Biology and Technology* 55 (2012): 231-236.
8. Francesco, Secundo, and Giacomo Carrea. "Lipase activity and conformation in neat organic solvents." *Journal of Molecular Catalysis B: Enzymatic* 19 (2002): 93-102.
9. Amit, Kumar, Abdullah Khan, Shashwat Malhotra, Ravi Mosurkal, Ashish Dhawan, Mukesh K. Pandey, Brajendra K. Singh et al. "Synthesis of macromolecular systems via lipase catalyzed biocatalytic reactions: applications and future perspectives." *Chemical Society Reviews* 45, 24 (2016): 6855-6887.
10. Cristiane D. Anobom, Anderson S. Pinheiro, Rafael A. De-Andrade, Erika CG Agueiras, Guilherme C. Andrade, Marcelo V. Moura, Rodrigo V. Almeida, and Denise M. Freire. "From structure to catalysis: recent developments in the biotechnological applications of lipases." *BioMed Research International* (1) (2014): 684506.

11. Yan Yang, Jianxu Zhang, Di Wu, Zhen Xing, Yulin Zhou, Wei Shi, and Quanshun Li. "Chemoenzymatic synthesis of polymeric materials using lipases as catalysts: A review." *Biotechnology advances* **32, 3** (2014): 642-651.
12. Karl-Erich, Jaeger, and Thorsten Eggert. "Lipases for biotechnology." *Current opinion in biotechnology* **13- 4** (2002): 390-397.
13. Chao Li, Xing-Wen Feng, Na Wang, Yu-Jie Zhou, and Xiao-Qi Yu. "Biocatalytic promiscuity: the first lipase-catalysed asymmetric aldol reaction." *Green Chemistry* **10- 6** (2008): 616-618
14. Zhi Wang, Chun-Yu Wang, Hao-Ran Wang, Hong Zhang, Ya-Lun Su, Teng-Fei Ji, and Lei Wang. "Lipase-catalyzed Knoevenagel condensation between α , β -unsaturated aldehydes and active methylene compounds." *Chinese Chemical Letters* **25- 5** (2014): 802-804.
15. Weina Li, Rong Li, Xiaochun Yu, Xuebing Xu, Zheng Guo, Tianwei Tan, and Sergey N. Fedosov. "Lipase-catalyzed Knoevenagel condensation in water–ethanol solvent system. Does the enzyme possess the substrate promiscuity." *Biochemical Engineering Journal* **101** (2015): 99-107.
16. Kun Li, Ting He, Chao Li, Xing-Wen Feng, Na Wang, and Xiao-Qi Yu. "Lipase-catalysed direct Mannich reaction in water: utilization of biocatalytic promiscuity for C–C bond formation in a “one-pot” synthesis." *Green Chemistry* **11- 6** (2009): 777-779.

17. Zhang-Gao Le, Li-Tao Guo, Guo-Fang Jiang, Xiao-Bin Yang, and Hui-Qiang Liu. "Henry reaction catalyzed by Lipase A from *Aspergillus niger*." *Green Chemistry Letters and Reviews* **6-4** (2013): 277-281.
18. Tian, Xuemei, Suoqin Zhang, and Liangyu Zheng. "First Novozym 435 lipase-catalyzed Morita–Baylis–Hillman reaction in the presence of amides." *Enzyme and Microbial Technology* **84** (2016): 32-40.
19. Jian-Feng Cai, Zhi Guan, and Yan-Hong He. "The lipase-catalyzed asymmetric C–C Michael addition." *Journal of Molecular Catalysis B: Enzymatic* **68**, 3-4 (2011): 240-244.
20. Dong-Hang Yin, Wei Liu, Zhi-Xiang Wang, Xin Huang, Jing Zhang, and De-Chun Huang. "Enzyme-catalyzed direct three-component aza-Diels–Alder reaction using lipase from *Candida* sp. 99–125." *Chinese Chemical Letters* **28-1** (2017): 153-158.20
21. Orazio A Attanasi, Luca Bianchi, Linda A. Campisi, Lucia De Crescentini, Gianfranco Favi, and Fabio Mantellini. "A novel solvent-free approach to imidazole containing nitrogen-bridgehead heterocycles." *Organic letters* **15-14** (2013): 3646-3649.
22. Christopher Hulme, and Yeon-Sun Lee. "Emerging approaches for the syntheses of bicyclic imidazo [1, 2-x]-heterocycles." *Molecular Diversity* **12** (2008): 1-15.

23. Avik Kumar Bagdi, Sougata Santra, Kamarul Monir, and Alakananda Hajra. "Synthesis of imidazo [1, 2-a] pyridines: a decade update." *Chemical Communications* **51-9** (2015): 1555-1575.
24. Cecile Enguehard -Gueiffier, and Alain Gueiffier. "Recent Progress in the Pharmacology of Imidazo [1, 2-a] pyridines." *Mini Reviews in Medicinal Chemistry* **7**, no. 9 (2007): 888-899.
25. Richa Goel, Vijay Luxami, and Kamaldeep Paul. "Recent advances in development of imidazo [1, 2-a] pyrazines: synthesis, reactivity and their biological applications." *Organic & Biomolecular Chemistry* **13-12** (2015): 3525-3555.
26. Richa Goel, Vijay Luxami, and Kamaldeep Paul. "Synthetic approaches and functionalization of imidazo [1, 2-a] pyrimidines: an overview of the decade." *RSC advances* **5 -99** (2015): 81608-81637.
27. D. J Sanger, and B. Zivkovic. "Discriminative stimulus effects of alpidem, a new imidazopyridine anxiolytic." *Psychopharmacology* **113** (1994): 395-403.
28. R. J Boerner, and H. J. Moller. "Saripidem-a new treatment for panic disorders." *Psychopharmacotherapies* **4** (2024): 145-148.
29. D Belohlavek, and P. Malferttheiner. "The effect of zolimidine, imidazopyridine-derivate, on the duodenal ulcer healing." *Scandinavian Journal of Gastroenterology. Supplement* **54** (2020): 44-44.

30. Rosenberg, Russell P. "Sleep maintenance insomnia: strengths and weaknesses of current pharmacologic therapies." *Annals of Clinical Psychiatry* **18- 1** (2006): 49-56.
31. Katsufumi Mizushige, Takashi Ueda, Kazushi Yukiiri, and Hitoshi Suzuki. "Olprinone: a phosphodiesterase III inhibitor with positive inotropic and vasodilator effects." *Cardiovascular drug reviews* **20- 3** (2002): 163-174.
32. Boggs, Sharon, Vassil I. Elitzin, Kristjan Gudmundsson, Michael T. Martin, and Matthew J. Sharp. "Kilogram-scale synthesis of the CXCR4 antagonist GSK812397." *Organic Process Research & Development* **13-4** (2009): 781-785.
33. Laura Gerard, Kevin W. Garey, and Herbert L. DuPont. "Rifaximin: a nonabsorbable rifamycin antibiotic for use in nonsystemic gastrointestinal infections." *Expert review of anti-infective therapy* **3- 2** (2005): 201-211.
34. Jenkinson, Stephen, Michael Thomson, David McCoy, Mark Edelstein, Susan Danehower, Wendell Lawrence, Pat Wheelan, Andrew Spaltenstein, and Kristjan Gudmundsson. "Blockade of X4-tropic HIV-1 cellular entry by GSK812397, a potent noncompetitive CXCR4 receptor antagonist." *Antimicrobial agents and chemotherapy* **54- 2** (2010): 817-824.
35. Joel Barrish, Percy Carter, Peter Cheng, and Robert Zahler, eds. *Accounts in drug discovery: case studies in medicinal chemistry*. Royal Society of Chemistry, 2010.
36. Ramírez-Trinidad, Angel, Karol Carrillo-Jaimes, José A. Rivera-Chávez, and Eduardo Hernandez-Vazquez. "Synthesis and cytotoxic/antimicrobial screening of

- 2-alkenylimidazo [1, 2-a] pyrimidines." *Medicinal Chemistry Research* 32, (1) (2023): 144-157.
- 37.** Nitesh Kumar Nandwana, Rajnish Prakash Singh, Om PS Patel, Shiv Dhiman, Hitesh Kumar Saini, Prabhat N. Jha, and Anil Kumar. "Design and synthesis of imidazo/benzimidazo [1, 2-c] quinazoline derivatives and evaluation of their antimicrobial activity." *ACS omega* 3, 11 (2018) 16338-16346.
- 38.** Sonia Laneri, Antonia Secchia, Marina Gallitelli, Francesca Arena, Elena Luraschi, Enrico Abignente, Walter Filippelli, and Francesco Rossi. "Research on heterocyclic compounds Part XXXIX. 2-Methylimidazo [1, 2-a] pyrimidine-3-carboxylic derivatives: Synthesis and anti-inflammatory activity." *European journal of medicinal chemistry* 33- 3 (1998): 163-170.
- 39.** Abe, Y., H. Kayakiri, S. Satoh, T. Inoue, Y. Sawada, K. Imai and N. Inamura, "A novel class of orally active non-peptide bradykinin B2 receptor antagonists 1. Construction of the basic framework, " *Journal of medicinal chemistry*, 41(4) (1998) 564-578.
- 40.** Ando, K. and K. Yamada, "Highly E-selective solvent-free Horner–Wadsworth–Emmons reaction catalyzed by DBU," *Green Chemistry*, 13(5) (2011) 1143-1146.
- 41.** Bose, A. K., S. Pednekar, S. N. Ganguly, G. Chakraborty and M. S. Manhas, "A simplified green chemistry approach to the Biginelli reaction using Grindstone Chemistry," *Tetrahedron letters*, 45(45) (2004) 8351-8353.

42. Cao, H., H. Zhan, Y. Lin, X. Lin, Z. Du and H. Jiang, "Direct arylation of imidazo[1,2-a] pyridine at C-3 with aryl iodides, bromides, and triflates via copper (I)-catalyzed C–H bond functionalization," *Organic letters*, 14(7) (2012) 1688-1691.
43. Dangel, B. D., K. Godula, S. W. Youn, B. Sezen and D. Sames, "C– C Bond Formation via C–H Bond Activation: Synthesis of the Core of Teleocidin B4," *Journal of the American Chemical Society*, 124(40) (2002) 11856-11857.
44. Xu Meng, Chaoying Yu, Gexin Chen, and Peiqing Zhao. "Heterogeneous biomimetic aerobic synthesis of 3-iodoimidazo [1, 2-a] pyridines via CuO x/OMS-2-catalyzed tandem cyclization/iodination and their late-stage functionalization." *Catalysis Science & Technology* **5- 1** (2015): 372-379.
45. Dong-Jian Zhu, Jiu-Xi Chen, Miao-Chang Liu, Jin-Chang Ding, and Hua-Yue Wu. "Catalyst- and solvent-free synthesis of imidazo [1, 2-a] pyridines." *Journal of the Brazilian Chemical Society* **20** (2009): 482-487.
46. Chuan He, Jing Hao, Huan Xu, Yiping Mo, Huiying Liu, Juanjuan Han, and Aiwen Lei. "Heteroaromatic imidazo [1, 2-a] pyridines synthesis from C–H/N–H oxidative cross-coupling/cyclization." *Chemical Communications* **48-90** (2012): 11073-11075.
47. Anton J Stasyuk, Marzena Banasiewicz, Michał K. Cyrański, and Daniel T. Gryko. "Imidazo [1, 2-a] pyridines susceptible to excited state intramolecular proton

- transfer: One-pot synthesis via an Ortoleva–King reaction." *The Journal of organic chemistry* **77-13** (2012): 5552-5558.
- 48.** Thiruvengadam Palani, Kyungho Park, Manian Rajesh Kumar, Hyun Ming Jung, and Sunwoo Lee. "Copper-Catalyzed Decarboxylative Three-Component Reactions for the Synthesis of Imidazo [1, 2-a] pyridines." *European Journal of Organic Chemistry* **26** (2012): 5038-5047.
- 49.** Masquelin, Thierry, Hai Bui, Bob Brickley, Gregory Stephenson, John Schwerkoske, and Christopher Hulme. "Sequential Ugi/Strecker reactions via microwave assisted organic synthesis: novel 3-center-4-component and 3-center-5-component multi-component reactions." *Tetrahedron letters* **47-17** (2006): 2989-2991.
- 50.** Abu T Khan, R. Sidick Basha, and Mohan Lal. "Bromodimethylsulfonium bromide (BDMS) catalyzed synthesis of imidazo [1, 2-a] pyridine derivatives and their fluorescence properties." *Tetrahedron Letters* **53- 17** (2012): 2211-2217.
- 51.** Chernyak, Natalia, and Vladimir Gevorgyan. "General and efficient copper-catalyzed three-component coupling reaction towards imidazoheterocycles: one-pot synthesis of alpidem and zolpidem." *Angewandte Chemie* **122 15** (2010): 2803-2806.
- 52.** Michael A. Lyon, and Timothy S. Kercher. "Glyoxylic acid and MP-glyoxylate: efficient formaldehyde equivalents in the 3-C-C of 2-aminoazines, aldehydes, and isonitriles." *Organic letters* **6- 26** (2004): 4989-4992.

- 53. (a)** Vanya. Kurteva, "Recent progress in metal-free direct synthesis of imidazo [1, 2-a] pyridines." *ACS omega* **6 (51)** (2021): 35173-35185. **53(b)** Kwong, Huey Chong, C. S. Chidan Kumar, Siau Hui Mah, Yew Leng Mah, Tze Shyang Chia, Ching Kheng Quah, Gin Keat Lim, and Siddegowda Chandraju. "Crystal Correlation of Heterocyclic Imidazo [1, 2-a] pyridine Analogues and their Anticholinesterase potential evaluation." *Scientific reports* **9, (1)** (2019): 926. **53(c)** Liu, Yanpeng, Lixue Lu, Haipin Zhou, Feijie Xu, Cong Ma, Zhangjian Huang, Jinyi Xu, and Shengtao Xu. "Chemodivergent synthesis of N-(pyridin-2-yl) amides and 3-bromoimidazo [1, 2-a] pyridines from α -bromoketones and 2-aminopyridines." *RSC advances* **9 (59)** (2019): 34671-34676. **53 (d)** Godugu, Kumar, and Chinna Gangi Reddy Nallagonda. "Solvent and catalyst-free synthesis of imidazo [1, 2-a] pyridines by grindstone chemistry." *Journal of Heterocyclic Chemistry* **58, (1)** (2021): 250-259.
- 54.** Dalal, Kiran S., Swapnil A. Padvi, Yogesh B. Wagh, Dipak S. Dalal, and Bhushan L. Chaudhari. "Lipase from porcine pancreas: an efficient biocatalyst for the synthesis of ortho-aminocarbonitriles." *Chemistry Select* **3,37** (2018):10378-10382.
- 55.** Zheng, Hui, Qiaoyue Shi, Kui Du, Xianting Cao, and Pengfei Zhang. "Chemoenzymatic selective formation of C–N bonds in a benzimidazole heterocycle." *RSC Advances* **3, 47** (2013): 24959-24963.

- 56.** Marín-Suárez, Marta, David Méndez-Mateos, Antonio Guadix, and Emilia M. Guadix. "Reuse of immobilized lipases in the transesterification of waste fish oil for the production of biodiesel." *Renewable Energy* **140** (2019): 1-8.
- 57.** Pam Sawatzky, Gary Liu, Jo-Anne R. Dillon, Vanessa Allen, Brigitte Lefebvre, Linda Hoang, Greg Tyrrell, Paul Van Caesele, Paul Levett, and Irene Martin. "Quality assurance for antimicrobial susceptibility testing of *Neisseria gonorrhoeae* in Canada, 2003 to 2012." *Journal of clinical microbiology* **53-11** (2015): 3646-3649.
- 58.** Jacobus Nicolaas. Eloff, "Avoiding pitfalls in determining antimicrobial activity of plant extracts and publishing the results." *BMC complementary and alternative medicine* **19- 1** (2019): 1-8.
- 59.** Gregory T. Carroll, and David L. Kirschman. "A peripherally located air recirculation device containing an activated carbon filter reduces VOC levels in a simulated operating room." *ACS omega* **7-50** (2022): 46640-46645.
- 60.** Beata Kowalska-Krochmal, and Ruth Dudek-Wicher. "The minimum inhibitory concentration antibiotics: Methods, interpretation, clinical relevance." *Pathogens* **10, 2** (2021): 165.

4.7 References

1. Paul T., Anastas, and John C. Warner. *Green chemistry: theory and practice*. Oxford university press, (2000).
2. Selvaraj Mohana Roopan, and Fazlur Rahman Nawaz Khan. "ZnO nanoparticles in the synthesis of AB ring core of camptothecin." *Chemical Papers* **64** (2010): 812-817.
3. Jinliang Song, and Buxing Han. "Green chemistry: a tool for the sustainable development of the chemical industry." *National Science Review* **2- 3** (2015): 255-256.
4. Capello, Christian, Ulrich Fischer, and Konrad Hungerbühler. "What is a green solvent? A comprehensive framework for the environmental assessment of solvents." *Green Chemistry*, **9** (2007): 927-934.
5. Guo, Rui-Yun, Zhi-Min An, Li-Ping Mo, Rui-Zhi Wang, Hong-Xia Liu, Shu-Xia Wang, and Zhan-Hui Zhang. "Meglumine: a novel and efficient catalyst for one-pot, three-component combinatorial synthesis of functionalized 2-amino-4 H-pyrans." *ACS Combinatorial Science* **15, 11** (2013): 557-563
6. Cue, Berkeley W., and Ji Zhang. "Green process chemistry in the pharmaceutical industry." *Green Chemistry Letters and Reviews* **2- 4** (2009): 193-211.
7. Rajender S. Varma." *Green Chemistry Letters and Reviews* **1** (2007): 37-45. (a) Wang, Bi-Qin, Shi-Kai Xiang, Zuo-Peng Sun, Bing-Tao Guan, Ping Hu, Ke-Qing Zhao, and Zhang-Jie Shi. "Benzylation of arenes through FeCl₃-catalyzed Friedel–

- Crafts reaction via C–O activation of benzyl ether." *Tetrahedron Letters* 49, 27 (2008): 4310-4312. (b) Jana, Umasish, Sukhendu Maiti, and Srijit Biswas. "An FeCl₃-catalyzed highly C₃-selective Friedel–Crafts alkylation of indoles with alcohols." *Tetrahedron Letters* 48, 40 (2007): 7160-7163. (c) Hong-Ru Wu, Hong-Yan Huang, Chuan-Li Ren, Li Liu, Dong Wang, and Chao-Jun Li. "Fe III-catalyzed cross-dehydrogenative arylation (CDA) between oxindoles and arenes under an air atmosphere." *Chemistry—A European Journal* 21, 47 (2015): 16744-16748.
8. Zhi-Yu Tan, Ke-Xin Wu, Lu-Shan Huang, Run-Shi Wu, Zheng-Yu Du, and Da-Zhen Xu. "Iron-catalyzed cross-dehydrogenative coupling of indolin-2-ones with active methylene for direct carbon–carbon double bond formation." *Green Chemistry* 22- 2 (2020): 332-335
 9. Yan, Bai, Yibo Dou, Lin-Hua Xie, William Rutledge, Jian-Rong Li, and Hong-Cai Zhou. "Zr-based metal–organic frameworks: design, synthesis, structure, and applications." *Chemical Society Reviews* 45, 8 (2016): 2327-2367.
 10. T Punniyamurthy, Subbarayan Velusamy, and Javed Iqbal. "Recent advances in transition metal catalyzed oxidation of organic substrates with molecular oxygen." *Chemical Reviews* 105, 6 (2005): 2329-2364.
 11. Alison E. Wendlandt, Alison M. Suess, and Shannon S. Stahl. "Copper-Catalyzed Aerobic Oxidative C-H Functionalization: Trends and Mechanistic Insights." *Angewandte Chemie International Edition* 50- 47 (2011): 11062-11087.

12. Yang, Yu, Yuan Liu, Aoxia Liu, Hexin Xie, Hao Li, and Wei Wang. "Ligand-free Cu-catalyzed [3+ 2] cyclization for the synthesis of pyrrolo [1, 2-a] quinolines with ambient air as a terminal oxidant." *Organic & Biomolecular Chemistry* **14-31** (2016): 7455-7458.
13. Liang-Xian. Liu, "Recent uses of iron catalysts in organic reactions." *Curr. Org. Chem* **14** (2010): 1099-1126.
14. Sebastián O. Simonetti, Enrique L. Langhi, Andrea BJ Bracca, and Teodoro S. Kaufman. "Angular tricyclic benzofurans and related natural products of fungal origin. Isolation, biological activity and synthesis." *Natural Product Reports* **30- 7** (2013): 941-969.
15. Tao Liu, Somarajan J. Nair, André Lescarbeau, Jitendra Belani, Stéphane Peluso, James Conley, Bonnie Tillotson et al. "Synthetic silvestrol analogues as potent and selective protein synthesis inhibitors." *Journal of medicinal chemistry* **55-20** (2012): 8859-8878.
16. Hyun Bae Bang, Su Young Han, Da Hye Choi, Deok Mo Yang, Jung Woon Hwang, Hyun Suck Lee, and Jong-Gab Jun. "Facile total synthesis of benzo [b] furan natural product XH-14." *Synthetic Communications* **39- 3** (2009): 506-515.
17. Mohd Danish Ansari, Hozeyfa Sagir, Vijay B. Yadav, Neetu Yadav, and I. R. Siddiqui. "Synthesis of Benzo [b] furan Derivatives via S8-Nano particles/ β -cyclodextrin: An Environmentally Friendly Approach." *ChemistrySelect* **3-19** (2018): 5326-5329.

18. Hatem A. Abdel-Aziz, Amal AI Mekawey, and Kamal M. Dawood. "Convenient synthesis and antimicrobial evaluation of some novel 2-substituted-3-methylbenzofuran derivatives." *European journal of medicinal chemistry* **44-9** (2009): 3637-3644.
19. Miyako Masubuchi, Ken-ichi Kawasaki, Hirosato Ebiike, Yoshihiko Ikeda, Shinji Tsujii, Satoshi Sogabe, Toshihiko Fujii et al. "Design and synthesis of novel benzofurans as a new class of antifungal agents targeting fungal N-myristoyltransferase. Part 1." *Bioorganic & medicinal chemistry letters* **11- 14** (2001): 1833-1837.
20. Miyako Masubuchi, Hirosato Ebiike, Ken-ichi Kawasaki, Satoshi Sogabe, Kenji Morikami, Yasuhiko Shiratori, Shinji Tsujii et al. "Synthesis and biological activities of benzofuran antifungal agents targeting fungal N-myristoyltransferase." *Bioorganic & medicinal chemistry* **11- 20** (2003): 4463-4478.
21. Minghua Sun, Chen Zhao, Gregory A. Gfesser, Christine Thiffault, Thomas R. Miller, Kennan Marsh, Jill Wetter et al. "Synthesis and SAR of 5-amino-and 5-(aminomethyl) benzofuran histamine H3 receptor antagonists with improved potency." *Journal of medicinal chemistry* **48- 20** (2005): 6482-6490.
22. Masayuki Inoue, Matthew W. Carson, Alison J. Frontier, and Samuel J. Danishefsky. "Total synthesis and determination of the absolute configuration of frondosin B." *Journal of the American Chemical Society* **123, 9** (2001): 1878-1889.

23. Hua Lu, and Geng-Tao Liu. "Anti-oxidant activity of dibenzo cyclooctene lignans isolated from Schisandraceae." *Planta Medica* **58**, **04** (1992): 311-313.
24. George A. Kraus, and Ikyon Kim. "Synthetic approach to malibatol A." *Organic Letters* **5**, **8** (2003): 1191-1192.
25. Eduardo Navarro, Simeona J. Alonso, Juan Trujillo, Elena Jorge, and Cirilo Pérez. "General behavior, toxicity, and cytotoxic activity of elenoside, a lignan from *Justicia hyssopifolia*." *Journal of natural products* **64**, **1** (2001): 134-135.
26. A. A. Deana, G. E. Stokker, E. M. Schultz, R. L. Smith, E. J. Cragoe Jr, H. F. Russo, and L. S. Watson. "2-(Aminomethyl) phenols, a new class of saluretic agents. 5. Fused-ring analogs." *Journal of Medicinal Chemistry* **26**, **4** (1983): 580-585.
27. Ernest Wenkert, and Brian L. Buckwalter. "Cabor-13 nuclear magnetic resonance spectroscopy of naturally occurring substances. X. Pimaradienes." *Journal of the American Chemical Society* **94**, **12** (1972): 4367-4369.
28. Mohammad Hossein Mosslemin, Mohammad Anary-Abbasinejad, Abbas Fazli Nia, Samaneh Bakhtiari, and Hossein Anaraki-Ardakani. "Synthesis of furan annulated heterocycles via a one-pot three-component reaction." *Journal of Chemical Research* (**10**) (2009): 599-601.
29. Asta, Chimène, Dietmar Schmidt, Jürgen Conrad, Wolfgang Frey, and Uwe Beifuss. "Combination of enzyme-and Lewis's acid-catalyzed reactions: a new method for the synthesis of 6, 7-dihydrobenzofuran-4 (5 H)-ones starting from 2,

- 5-dimethylfuran and 1,3-cyclohexanediones." *Organic & Biomolecular Chemistry* **11**,34 (2013): 5692-5701.
30. Yinsong Wu, Xinwei He, Mengqing Xie, Ruxue Li, Yi Ning, Jiahui Duan, Enshen Zhang, and Yongjia Shang. "Rh (III)-Catalyzed Cascade Nucleophilic Addition/Annulation of 2-Diazo-1, 3-diketones with 1, 3-Dicarbonyl Compounds To Access 6, 7-Dihydrobenzofuran-4 (5 H)-ones." *The Journal of Organic Chemistry* **86**, 11 (2021): 7370-7380. (b) Jiang, B.; Hao, W. J.; Zhang, J. P.; Tu, S. J.; Shi, F. New domino reaction for the selective synthesis of tetracyclic cinnolino[5,4,3-cde]cinnolines. *Org. Biomol. Chem.* **7**, (2009), 1171–1175.
31. (a) Vasilevsky, S. F.; Tretyakov, E. V.; Verkrujisse, H. D. A convenient synthesis of 4-chloro- and 4-bromocinnolines from oaminophenylacetylenes. *Synth. Commun.* **24**, (1994), 1733–1736. (b) Kanner, C. B.; Pandit, U. K. Functionalized enamines. PartXXXI. Base-catalyzed transformations of iminium phenylhydrazones: A new convenient synthesis of imidazo[1,2a] azacycloalkanes. *Tetrahedron* **37**, (1981), 3519–3523.
32. (a) Al-Awadi, N. A.; Elnagdi, M. H.; Ibrahim, Y. A.; Kaul, K.; Kumar, A. Efficient synthesis of 3-aryl cinnolines from aryl methyl ketones. *Tetrahedron* **57** (2001), 1609–1614. (b) Gomaa, M.-A. M. An efficient and facile synthesis of substituted cinnoline and benzo[h]-cinnoline derivatives. *Tetrahedron Lett.* **44**, (2003), 3493–3496.

33. Alford, E. J.; Schofield, K. Peptides III. Selective degradation from the carboxyl end. The use of carbodiimides. *J. Chem. Soc.* **5** (1952), 2081–2088.
34. Chen, D.; Yang, C.; Xie, Y.; Ding, J. Novel process to 4,4-dialkyl-1,4-dihydro-6-methoxy-3-phenylcinnolines via Grignard reaction. *Heterocycles* **77**, (2009), 273–277.
35. Prasanta, G.; Sandhya, R. G.; Namita, D.; Pranjit, B. Aluminium chloride catalyzed synthesis of 4-benzyl cinnolines from arylhydrazones. *Synth. Commun.* **4,2** (2013), 234-246
36. Michael L. Pegis, Daniel J. Martin, Catherine F. Wise, Anna C. Brezny, Samantha I. Johnson, Lewis E. Johnson, Neeraj Kumar, Simone Raugei, and James M. Mayer. "Mechanism of catalytic O₂ reduction by iron tetraphenylporphyrin." *Journal of the American Chemical Society* **141, 20** (2019): 8315-8326.
37. Wu, Hong-Ru, Liang Cheng, De-Long Kong, Hong-Yan Huang, Chun-Ling Gu, Li Liu, Dong Wang, and Chao-Jun Li *Organic letters* **18, (6)** (2016): 1382-1385.
38. Wu, Hong-Ru, Hong-Yan Huang, Chuan-Li Ren, Li Liu, Dong Wang, and Chao-Jun Li. "FeIII-catalyzed cross-dehydrogenative arylation (CDA) between oxindoles and arenes under an air atmosphere." *Chemistry—A European Journal* **21,47** (2015): 16744-16748.

5.7 References

1. Berkeley W. Cue, and Ji Zhang. "Green process chemistry in the pharmaceutical industry." *Green Chemistry Letters and Reviews* **2,4** (2009): 193-211.
2. Jinliang, Song, and Buxing Han. "Green chemistry: a tool for the sustainable development of the chemical industry." *National Science Review* **2, 3** (2015): 255-256.
3. Rui-Yun Guo, Zhi-Min An, Li-Ping Mo, Rui-Zhi Wang, Hong-Xia Liu, Shu-Xia Wang, and Zhan-Hui Zhang. "Meglumine: a novel and efficient catalyst for one-pot, three-component combinatorial synthesis of functionalized 2-amino-4 H-pyrans." *ACS Combinatorial Science* **15, 11** (2013): 557-563.
4. Rajender S. Varma, "“Greener” chemical syntheses using mechanochemical mixing or microwave and ultrasound irradiation." *Green Chemistry Letters and Reviews* **1, 1** (2007): 37-45.
5. Rotstein, Benjamin H., Serge Zaretsky, Vishal Rai, and Andrei K. Yudin. "Small heterocycles in multicomponent reactions." *Chemical reviews* **114, 16** (2014): 8323-8359.
6. Shū Kobayashi, , and Kei Manabe. "Development of novel Lewis’s acid catalysts for selective organic reactions in aqueous media." *Accounts of chemical research* **35,4** (2002): 209-217.
7. Itaru Nakamura, and Yoshinori Yamamoto. "Transition-metal-catalyzed reactions in heterocyclic synthesis." *Chemical reviews* **104,5** (2004): 2127-2198.

8. Ingmar Bauer, and Hans-Joachim Knölker. "Iron catalysis in organic synthesis." *Chemical reviews* **115**, **9** (2015): 3170-3387.
9. Manjit Singh, Vijay B. Yadav, Mohd Danish Ansari, Manisha Malviya, and I. R. Siddiqui. "Green and Efficient Iron-Catalysed Synthesis of Polyfunctionalized Benzofuran-4 (5H) -one Derivatives via Cross-Dehydrogenative Coupling." *Chemistry Select* **5**, **23** (2020): 7026-7030.
10. Sulochana S. Mudaliar, Anuj P. Patel, Janki J. Patel, and Kishor H. Chikhalia. "Iron-catalyzed cross-dehydrogenative CN coupling of thiohydantoins with various amines." *Tetrahedron Letters* **59**, **8** (2018): 734-738.
11. Ingmar Bauer, and Hans-Joachim Knölker. "Iron catalysis in organic synthesis." *Chemical reviews* **115**, **9** (2015): 3170-3387.
12. Liang-Xian Liu, "Recent uses of iron catalysts in organic reactions." *Curr. Org. Chem* **14** (2010): 1099-1126.
13. Bolm, Carsten, Julien Legros, Jacques Le Paih, and Lorenzo Zani. "Iron-catalyzed reactions in organic synthesis." *Chemical reviews* **104**, **12** (2004): 6217-6254.
14. Tan, Zhi-Yu, Ke-Xin Wu, Lu-Shan Huang, Run-Shi Wu, Zheng-Yu Du, and Da-Zhen Xu. "Iron-catalyzed cross-dehydrogenative coupling of indolin-2-ones with active methylenes for direct carbon-carbon double bond formation." *Green Chemistry* **22**, **2** (2020): 332-335.

15. Alison E Wendlandt, Alison M. Suess, and Shannon S. Stahl. "Copper-Catalyzed Aerobic Oxidative C-H Functionalizations: Trends and Mechanistic Insights." *Angewandte Chemie International Edition* **50**, **47** (2011): 11062-11087.
16. T.Punniyamurthy, Subbarayan Velusamy, and Javed Iqbal. "Recent advances in transition metal catalyzed oxidation of organic substrates with molecular oxygen." *Chemical Reviews* **105**, **6** (2005): 2329-2364.
17. Zhuangzhi Shi, Chun Zhang, Conghui Tang, and Ning Jiao. "Recent advances in transition-metal catalyzed reactions using molecular oxygen as the oxidant." *Chemical Society Reviews* **41**, **8** (2012): 3381-3430.
18. Răzvan C. Cioc, Eelco Ruijter, and Romano VA Orru. "Multicomponent reactions: advanced tools for sustainable organic synthesis." *Green Chemistry* **16**, **6** (2014): 2958-2975.
19. X, Xin, Yan Wang, Santosh Kumar, Xu Liu, Yingjie Lin, and Dewen Dong. "Efficient one-pot synthesis of substituted pyridines through multicomponent reaction." *Organic & Biomolecular Chemistry* **8**, **13** (2010): 3078-3082.
20. Mohammad Ali Ghasemzadeh, Boshra Mirhosseini-Eshkevari, Mona Tavakoli, and Farzad Zamani. "Metal–organic frameworks: advanced tools for multicomponent reactions." *Green Chemistry* **22**, **21** (2020): 7265-7300.
21. Chiara Cabrele, and Oliver Reiser. "The modern face of synthetic heterocyclic chemistry." *The Journal of Organic Chemistry* **81**, **21** (2016): 10109-10125.

22. MP Gois, Candeias, Nuno R., Luis C. Branco, Pedro Carlos AM Afonso, and Alexandre F. Trindade. "More sustainable approaches for the synthesis of N-based heterocycles." *Chemical reviews* **109**, 6 (2009): 2703-2802.
23. Debasis Das, Papiya Sikdar, and Moumita Bairagi. "Recent developments of 2-aminothiazoles in medicinal chemistry." *European Journal of Medicinal Chemistry* **109** (2016): 89-98.
24. Mahesh T Chhabria, Shivani Patel, Palmi Modi, and Pathik S Brahmksatriya. "Thiazole: A review on chemistry, synthesis and therapeutic importance of its derivatives." *Current topics in medicinal chemistry* **16**, 26 (2016): 2841-2862.
25. Sunil Kumar, and Ranjana Aggarwal. "Thiazole: a privileged motif in marine natural products." *Mini-Reviews in Organic Chemistry* **16**, 1 (2019): 26-34.
26. Koneni Shashidhar, V., K. Bhaskara Rao, Pragati Kushwaha, Ram K. Modukuri, Pratiksha Singh, Isha Soni, P. K. Shukla, Sidharth Chopra, and Mukesh Pasupuleti. "Novel chalcone–thiazole hybrids as potent inhibitors of drug resistant *Staphylococcus aureus*." *ACS medicinal chemistry letters* **6**, 7 (2015): 809-813.
27. Zhong Jin. "Muscarine, imidazole, oxazole, and thiazole alkaloids." *Natural product reports* **20**, 6 (2003): 584-605.
28. Fellet, Aloysio. "Fentiazac in rheumatoid arthritis: a multicentre study." *Current Medical Research and Opinion* **6**, 2 (1979): 64-70.

29. Bryan L. Love, Robert Barrons, Angie Veverka, and K. Matthew Snider. "Urate-lowering therapy for gout: focus on febuxostat." *Pharmacotherapy: The Journal of Human Pharmacology and Drug Therapy* **30, 6** (2010): 594-608.
30. Xun Gao, Ying-ming Pan, Min Lin, Li Chen, and Zhuang-ping Zhan. "Facile one-pot synthesis of three different substituted thiazoles from propargylic alcohols." *Organic & Biomolecular Chemistry* **8,14** (2010): 3259-3266.
31. Shinde, Mahesh H., and Umesh A. Kshirsagar. "One pot synthesis of substituted imidazopyridines and thiazoles from styrenes in water assisted by NBS." *Green chemistry* **18, 6** (2016): 1455-1458.
32. Tomoya Miura, Yuuta Funakoshi, Yoshikazu Fujimoto, Junki Nakahashi, and Masahiro Murakami. "Facile synthesis of 2, 5-disubstituted thiazoles from terminal alkynes, sulfonyl azides, and thionoesters." *Organic letters* **17,10** (2015): 2454-2457.
33. Mingzhong Wu, Yong Jiang, Zhenyu An, Zhenjie Qi, and Rulong Yan. "Iron-Catalyzed Synthesis of Substituted Thiazoles from Enamines and Elemental Sulfur through C– S Bond Formation." *Advanced Synthesis & Catalysis* **360,21** (2018): 4236-4240.
34. Wang, Xiaoyang, Xu Qiu, Jialiang Wei, Jianzhong Liu, Song Song, Wen Wang, and Ning Jiao. "Cu-catalyzed aerobic oxidative sulfuration/annulation approach to thiazoles via multiple Csp³–H bond cleavage." *Organic letters* **20, 9** (2018): 2632-2636.

35. J. Jiang, H. Huang and G.-J. Deng Multicomponent synthesis of diphenyl-1, 3-thiazole-barbituric acid hybrids and their fluorescence property studies *Org. Biomol. Chem.*, **8** (2010), 3259 —3266
36. Mohit Saroha, and Jitender M. Khurana. "Acetic acid mediated regioselective synthesis of 2, 4, 5-trisubstituted thiazoles by a domino multicomponent reaction." *New Journal of Chemistry* **43**, **22** (2019): 8644-8650.
37. Alizadeh-Bami, Farzaneh, Hossein Mehrabi, and Reza Ranjbar-Karimi. "One-pot three-component reaction of arylglyoxals with acetylthiourea and Meldrum's acid or barbituric acid for synthesis of new 2-acetamido-4-arylthiazol-5-yl derivatives." *Journal of Sulfur Chemistry* **40**,**5** (2019): 469-478.
38. L. L. Zamigajlo, A. O. Vinnyk, O. V. Turov, and N. M. Kolos. "A new approach to 2, 4, 5 trisubstituted thiazoles from β dicarbonylic compounds, arylglyoxals and thioamides." *Ukrainica Bioorganica Acta* **1** (2013): 37-43.
39. Seham A. Ibrahim, and Hala F. Rizk. "Synthesis and biological evaluation of thiazole derivatives." In *Azoles-Synthesis, Properties, Applications and Perspectives*. London, UK: Intech Open, 2020.
40. Duc DX, Chung NT. Recent Development in the Synthesis of Thiazoles. *Curr Org Synth.* 2022 Aug 6;19(6):702-730.
41. Tan, Zhi-Yu, Ke-Xin Wu, Lu-Shan Huang, Run-Shi Wu, Zheng-Yu Du, and Da-Zhen Xu. "Iron-catalyzed cross-dehydrogenative coupling of indolin-2-ones with active

- methylenes for direct carbon–carbon double bond formation." *Green Chemistry* 22, 2 (2020): 332-335.
42. (a) Hong-Ru Wu, Liang Cheng, De-Long Kong, Hong-Yan Huang, Chun-Ling Gu, Li Liu, Dong Wang, and Chao-Jun Li *Organic letters* 18, 6 (2016): 1382-1385. (b) Hong-Ru, Wu Hong-Yan Huang, Chuan-Li Ren, Li Liu, Dong Wang, and Chao-Jun Li. " *Chemistry–A European Journal* 21, 47 (2015): 16744-16748.; (c) X. Guo, S. Pan, J. Liu and Z. Li, *J. Org. Chem.*, 74(2009), 8848.
43. Pegis, Michael L., Daniel J. Martin, Catherine F. Wise, Anna C. Brezny, Samantha I. Johnson, Lewis E. Johnson, Neeraj Kumar, Simone Raugei, and James M. Mayer. "Mechanism of catalytic O₂ reduction by iron tetraphenylporphyrin." *Journal of the American Chemical Society* 141, no. 20 (2019): 8315-8326.

List of Research Publications

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1. **Manjit Singh**, Vijay B. Yadav, Mohd Danish Ansari, Manisha Malviya, and I. R. Siddiqui. "Green and Efficient Iron-Catalysed Synthesis of Polyfunctionalized Benzofuran-4 (5H) -one Derivatives via Cross-Dehydrogenative Coupling." *Chemistry Select* **5**, **23** (2020): 7026-7030.): **I.F. 2.307**
2. **Manjit Singh**, Vijay B. Yadav, Mohd Danish Ansari, Manisha Malviya, and I. R. Siddiqui. "Efficient one-pot synthesis of substituted diphenyl 1, 3-thiazole through multicomponent reaction by using green and efficient Iron-catalyst via Cross-Dehydrogenative Coupling (CDC)." *Molecular Diversity* (2022): 1-6. **I.F. 3.307**
3. **Manjit Singh**, Manisha Malviya, Vijay B. Yadav, Aishwarya Nikhil, and Munesh Gupta. "Synthesis of imidazole-fused nitrogen-bridgehead heterocycles catalysed by lipase and their antifungal and antimicrobial bioactivity." *RSC advances* **14**, **8** (2024): 5037-5044. **I.F. 3.907**
4. Ansari, Mohd Danish, Hozeyfa Sagir, Vijay B. Yadav, Neetu Yadav, Ankit Verma, Sonam Shakya, **Manjit Singh**, and I. R. Siddiqui. "Magnetically recoverable Fe₃O₄ nanocatalyst for the synthesis of biodynamically significant 1H-pyrazolo [1, 2-b] phthalazine-5, 10-diones derivatives and its DFT study." *Molecular Diversity* **27**, **4** (2023): 1853-1866.
5. **Manjit, Singh**, and Manisha Malviya" Oligosaccharide assisted approach: A green route for the synthesis of 3-Functionalized Coumarins derivatives in the presence of beta-cyclodextrin." Communicated (2024)
6. **Manjit Singh** and Manisha Malviya " Green and benign strategy for the metal-free synthesis of 2,3-dihydro-1,5- Benzothiazepines by liquid-assisted grinding. "in *Australian Journal of Chemistry* **77** (2024) CH24006.