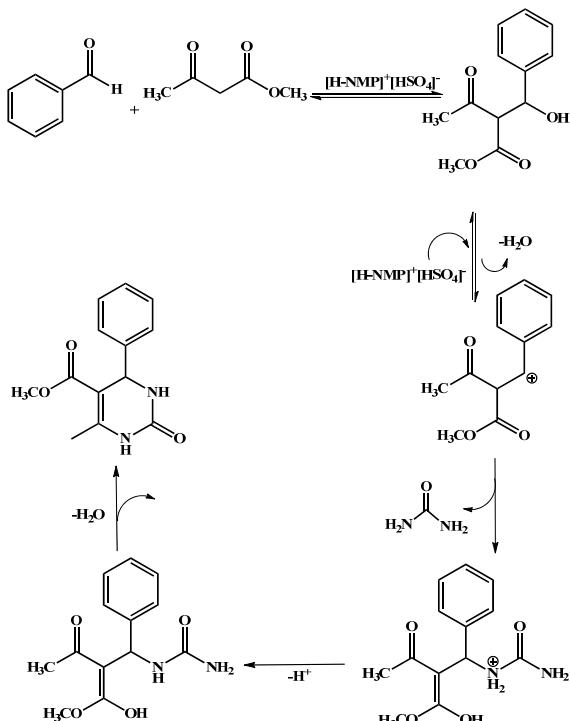


Table 4. (Continued).

7				5	94
8				12	92
9				9	90
10				8	94
11				11	93
12				7	95
13				10	93
14				8	90

^aIsolated yields.



Scheme 1. The proposed Knoevenagel reaction mechanisms for synthesis of dihydropyrimidinones.

References

- [1] G.C. Rovnyak, K. Atwal, A. Hedberg, S. Kimball, S. Moreland, J.Z. Gougoutas, B.C. O'Reilly, M.F. Malley, *J. Med. Chem.* 35 (1992) 3254-3263.
- [2] H. Cho, M. Ueda, K. Shima, A. Mizuno, Hayashimatsu, M. Ohnaka, Y. Takeuchi, Y. Hamaguchi, M.K. Aisaka, T. Hidaka, M. Kawai, M. Takeda, T. Ishihara, K. Funahashi, F. Satoh, M. Morita, T. Noguchi, *J. Med. Chem.* 32 (1989) 2396-2402.
- [3] T.U. Mayer, T.M. Kapoor, S.J. Haggarty, R.W. King, S.L. Schreiber, *Chem. Biol.* 7 (2000) 275-286.
- [4] K.S. Atwal, B.N. Swanson, S.E. Unger, D.M. Floyd, S. Moreland, A. Hedberg, B.C. O'Reilly, *J. Med. Chem.* 34 (1991) 806-811.
- [5] G.J. Grover, S. Dzwonczyk, D.M. McMullen, D.E. Normandin, C.S. Parham, P.G. Slep, S. Moreland, *J. Cardiovasc. Pharmacol.* 26 (1995) 289-294.
- [6] T. Matsuda, I. Hirao, *Nippon Kagaku Zasshi* 86 (1965) 1195-1199.
- [7] E.W. Hurst, R. Hull, *J. Med. Pharm. Chem.* 3 (1961) 215-229.
- [8] C.O. Kappe, A. Stadler, *Org. React.* 63 (2004) 1-116.
- [9] L.Z. Gong, X.H. Chen, X.Y. Xu, *Chem. Eur. J.* 13 (2007) 8920-8926.
- [10] P. Biginelli, *Gazz. Chim. Ital.*, 23 (1893) 360-416. K. Folkers, H.J. Harwood, T.B. Johnson, *J. Am. Chem. Soc.* 54 (1932) 3751-3758.
- [11] L. Moradi, G.R. Najafi, H. Saeidiroshan, *Iran. J. Catal.* 5 (2015) 357-364.
- [12] S. Sayyahi, M. Behvandi, *Iran. J. Catal.* 5 (2015) 119-122.
- [13] S. R. Jetti, D. Verma, S. Jain, *Iran. J. Catal.* 3 (2013) 203-209.
- [14] I. Garcia-Saez, S. DeBonis, R. Lopez, F. Trucco, B. Rousseau, P. Thuery, F. Kozielski, *J. Biol. Chem.* 282 (2007) 9740-9747.
- [15] C.O. Kappe, *Eur. J. Med. Chem.* 35 (2000) 1043-1052.
- [16] X.Y. Han, F. Xu, Y.Q. Luo, Q. Shen, *Eur. J. Org. Chem.* (2005) 1500-1503.
- [17] J.C. Legeay, J.J. VandenEynde, J.P. Bazureau, *Tetrahedron*, 61 (2005) 12386-12397.
- [18] B.L. Nilsson, L.E. Overman, *J. Org. Chem.* 71 (2006) 7706-7714.
- [19] I. Cepanec, M.F.L.M. Litvic, I. Grungold, *Tetrahedron*, 63 (2007) 11822-11827.
- [20] J. P. Wan, Y.J. Pan, *Chem. Commun.* 19 (2009) 2768-2770.
- [21] T. Welton, *Chem. Rev.* 99 (1999) 2071-2084.
- [22] H. Naeimi, Z.S. Nazifi, *J. Ind. Eng. Chem.* 20 (2013) 1043-1049.
- [23] H. Naeimi, Z.S. Nazifi, *J. Chin. Chem. Soc.* 60 (2013) 1113-1117.
- [24] N. Isambert, M.D.M.S. Duque, J.C. Plaquevent, Y.G. Nisson, J. Rodriguez, T. Constantieux, *Chem. Soc. Rev.* 40 (2011) 1347-1357.
- [25] X. Tong, Y. Li, *ChemSusChem* 3 (2010) 350-355

Table 5. The synthesis of 4c using different catalysts.

Entry	Catalyst	Time (min)	Yield (%)	Ref.
1	Cu@PMO-IL, 60 °C, solvent-free	120	80	[32]
2	TSILs, 100 °C, solvent-free	10	88	[33]
3	[Cbmim] Cl, Reflux, MeCN	90	69	[34]
4	ZnO, 80 °C, BMI·BF4	12 h	67	[35]
5	MWCNTs-OSO3H, 120 °C, solvent-free	20	94	[11]
6	Al-MCM-41, 80 °C, solvent-free	15	84	[12]
7	H6GeW10V2O40.22H2O, 80 °C, solvent-free	3 h	91	[13]
8	[H-NMP] ⁺ [CH ₃ SO ₃] ⁻ , 90 °C, solvent-free	4	97	This work

- [26] F.L. Zumpe, M. Flu, K. Schmitz, A. Lender, Tetrahedron Lett. 48 (2007) 1421-1423.
- [27] Y. Ma, C. Qian, L. Wang, M. Yang, J. Org. Chem. 65 (2000) 3864-3868.
- [28] S. Zhang, Z.C. Zhang, Green Chem. 4 (2002) 376-379.
- [29] D. Elhamifar, F. Hosseinpoor, B. Karimi, S. Hajati, Microporous Mesoporous Mat. 204 (2015) 269-275.
- [30] F. Dong, L. Jun, Z. Xinli, Y. Zhiwen, L. Zuliang, J. Mol. Catal. A: Chem. 274 (2007) 208-211.
- [31] F. Heidarizadeh, E. Rezaee Nezhad, S. Sajjadifar, Sci. Iran. C 20 (2013) 561-565.
- [32] F. Tamaddon, S. Moradi, J. Mol. Catal. A: Chem. 370 (2013) 117-122.
- [33] R. Tayebee, M.M. Amini, M. Ghadamgahi, M. Armaghan, J. Mol. Catal. A: Chem. 366 (2013) 266-274.
- [34] H.G.O. Alvim, E.N. da Silva Júnior, B.A.D. Neto, RSC Adv. 4 (2014) 54282-54299.
- [35] L.M. Ramos, B.C. Guido, C.C. Nobrega, J.R. Corrêa, R.G. Silva, H.C.B. de Oliveira, A.F. Gomes, F.C. Gozzo, B.A.D. Neto, Chem. Eur. J. 19 (2013) 4156-4168.