Supporting Information

Cascade catalysis via dehydration and oxidation: One-pot synthesis of 2,5-diformylfuran from fructose using acid and V_2O_5/ceramic catalysts

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Table S1 Comparison of yield of 2,5-DFF from 5-HMF using vanadium-based catalysts.

Number	Substrate	Catalyst	Oxidant	Solvent	DFF Yield (%)	Ref.
1	5-HMF	$VOSO_4$ and $Cu(NO_3)_2$	O_2	Acetonitrile	98.0	[1]
2	5-HMF	V_2O_5/H-Beta	Air	DMF	83.2	[2]
3	5-HMF	V_2O_5/AC	O_2	MIBK	91.2	[3]
4	5-HMF	$C_{14}VOHPO_4$	O_2	Toluene	81.2	[4]
5	5-HMF	V-CP	O_2	DMSO	85.7	This work

Table S2 Comparison of yield of 2,5-DFF from fructose using different catalysts.

Number	Substrate	Catalyst	Oxidant	Solvent	T (K)	DFF Yield (%)	Ref.
1	Fructose	$Cs_{0.5}H_{2.5}PMo_{12}$	Air	DMSO	433	69.3	[5]
2	Fructose	Fe_3O_4@SiO_2-SO_3H /Fe_2O_3@HAP-Ru	O_2	DMSO/ p-Chlorotoluene	383	79.1	[6]
3	Fructose	V–g-C_3N_4(H+) /V–g-C_3N_4	O_2	DMSO	393	63	[7]
4	Fructose	NaBr	Air	DMSO	423	67	[8]
5	Fructose	$CsH_3PMo_{11}VO_{40}$	O_2	DMSO	383	60	[9]
6	Fructose	Fe_3O_4-SBA-SO_3H /K-OMS-2	O_2	DMSO	383	80	[10]
7	Fructose	H_2SO_4/V-CP	O_2	DMSO	413	68.4	This work

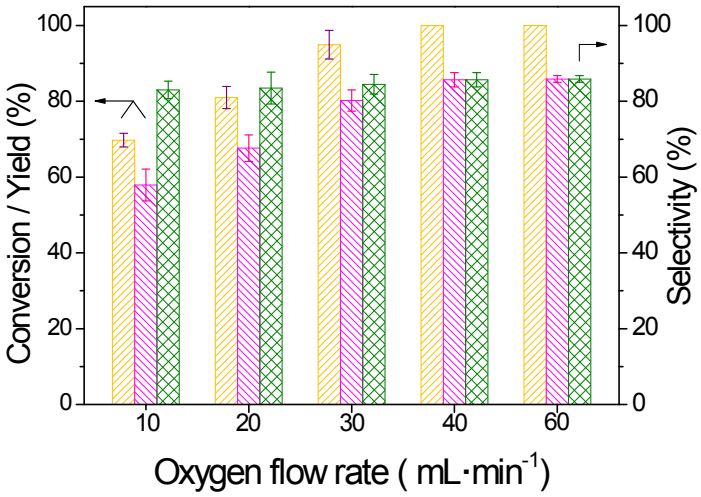

Figure S1 The effects of different flow rate of O_2 on the preparation of 2,5-DFF by the catalytic oxidation of 5-HMF using V-CP

References

[1] J. Ma, Z. Du, J. Xu, Q. Chu, Y. Pang, ChemSusChem 4 (2011) 51-54.

[2] I. Sádaba, Y.Y. Gorbanev, S. Kegnæs, S.S.R. Putluru, R.W. Berg, A. Riisager, ChemCatChem 5 (2013) 284-293.

[3] C.A. Antonyraj, B. Kim, Y. Kim, S. Shin, K.-Y. Lee, I. Kim, J.K. Cho, Catalysis Communications 57 (2014) 64-68.

[4] F.L. Grasset, B. Katryniok, S. Paul, V. Nardello-Rataj, M. Pera-Titus, J.-M. Clacens, F. De Campo, F. Dumeignil, RSC Advances 3 (2013) 9942-9948.

[5] Y. Liu, L. Zhu, J. Tang, M. Liu, R. Cheng, C. Hu, ChemSusChem 7 (2014) 3541-3547.

[6] Z. Zhang, Z. Yuan, D. Tang, Y. Ren, K. Lv, B. Liu, ChemSusChem 7 (2014) 3496-3504.

[7] J. Chen, Y. Guo, J. Chen, L. Song, L. Chen, ChemCatChem 6 (2014) 3174-3181.

[8] C. Laugel, B. Estrine, J. Le Bras, N. Hoffmann, S. Marinkovic, J. Muzart, ChemCatChem 6 (2014) 1195-1198.

[9] R. Liu, J. Chen, L. Chen, Y. Guo, J. Zhong, ChemPlusChem 79 (2014) 1448-1454.

[10] Z.-Z. Yang, J. Deng, T. Pan, Q.-X. Guo, Y. Fu, Green Chemistry 14 (2012) 2986-2989.