Synthesis of New Organocatalysts and their Application on Asymmetric Green Epoxidation of *α,β*-Unsaturated Aldehydes

Anna Maria Deobald,* Arlene G. Corrêa, Márcio W. Paixão

Department of Chemistry, Federal University of São Carlos, São Carlos, 13565-905, SP, Brazil
*annamaria.de@gmail.com

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INTRODUCTION

The enantioselective synthesis of chiral compounds is an important research area.[1] In this context, organocatalysis is an useful tool in the synthesis of building blocks under conditions that comply with the principles of green chemistry. In this work, we highlight the synthesis of new organocatalysts from proline and their application in the enantioselective synthesis of epoxialdehydes in aqueous solvent. These compounds are widely used as intermediates in the synthesis of biologically active natural products (Figure 1).[2]

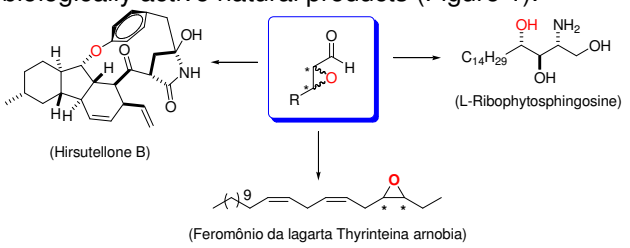
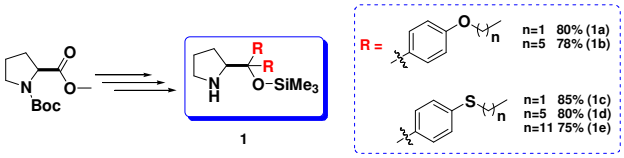


Figure 1. Application of epoxides as building blocks.

RESULTS AND DISCUSSION

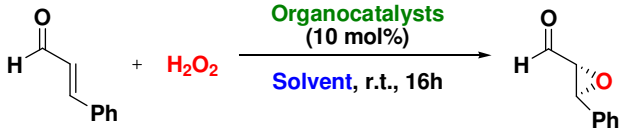
The catalysts were easily prepared from *N*-Boc-proline in good yields over 3 steps (Scheme 1).



Scheme 1. Synthesis of organocatalysts **1a-e**.

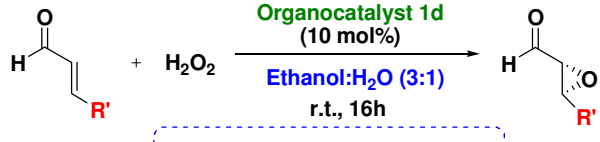
Organocatalysts **1a-e** were then applied in the epoxidation of cinnamaldehyde resulting in the epoxialdehydes with good yields and *ee*. The solvent, oxidant reagent, as well the amount of the organocatalyst applied were analyzed (Table 1). By using the optimal conditions (Entry 4), several α,β-unsaturated aldehydes have also been used and results are depicted in scheme 2.

Table 1. Epoxidation of cinnamaldehyde.



Entry	Organo catalyst	Solvent	Yield (%)[a]	*ee* (%)[b,c]
1	**1a**	EtOH/H_2O (3:1)	50	44
2	**1b**	EtOH/H_2O (3:1)	68	94
3	**1c**	EtOH/H_2O (3:1)	90	94
4	**1d**	**EtOH/H_2O (3:1)**	**85**	**98**
5	**1e**	EtOH/H_2O (3:1)	85	94
6	**1d**	EtOH	90	92
7	**1d**	EtOH/H_2O (1:1)	30	nd[d]
8	**1d**	H_2O	26	nd[d]
9	**1d**	EtOH/H_2O (3:1)	95	88[e]
10	**1d**	EtOH/H_2O (3:1)	32	99[f]
11	**1d**	EtOH/H_2O (3:1)	88	94[g]

[a]Isolated yield. [b]*ee*'s determined by HPLC and absolute configuration by comparison with data reported. [c] Determined to trans isomer. [d] Not determined. [e] Reagent concentration twice. [f]5 mol% of catalyst. [g] *t*-BuOOH was used.



	Yield(%)	ee (%)
R' = Ph	85	98
R' = C_7H_{15}	90	90
R' = *p*-ClPh	56	97
R' = *o*-ClPh	68	90
R' = CH_2OBn	*40*	*78*

Scheme 2. Epoxidation of α,β-unsaturated aldehydes.

CONCLUSION

We obtained new organocatalysts through a simple route and applied them efficiently in the enatioselective synthesis of epoxialdehydes under greener conditions.

ACKNOWLEDGEMENTS

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REFERENCES

[1] Noyori, R.; Kitamura, M. *Modern Synthetic Methods*, Springer, Berlin, p. 115. [2] (a) Jiang, H.; Elsner, P.; Jensen, K. L.; Falcicchio, A.; Marcos, V.; Jørgensen, K. A. *Angew. Chem. Int. Ed.* **2009**, *48*, 6741. (b) Nicolaou, K. C.; Sarlah, D.; Wu, T. R.; Zhan, W. *Angew. Chem. Int. Ed.* **2009**, *48*, 6878. (c) Du, Y.; Zheng, J.; Wang, Z.; Jiang, L.; Ruan, Y.; Huang, P. *J. Org. Chem.*, **2010**, *75*, 4619.