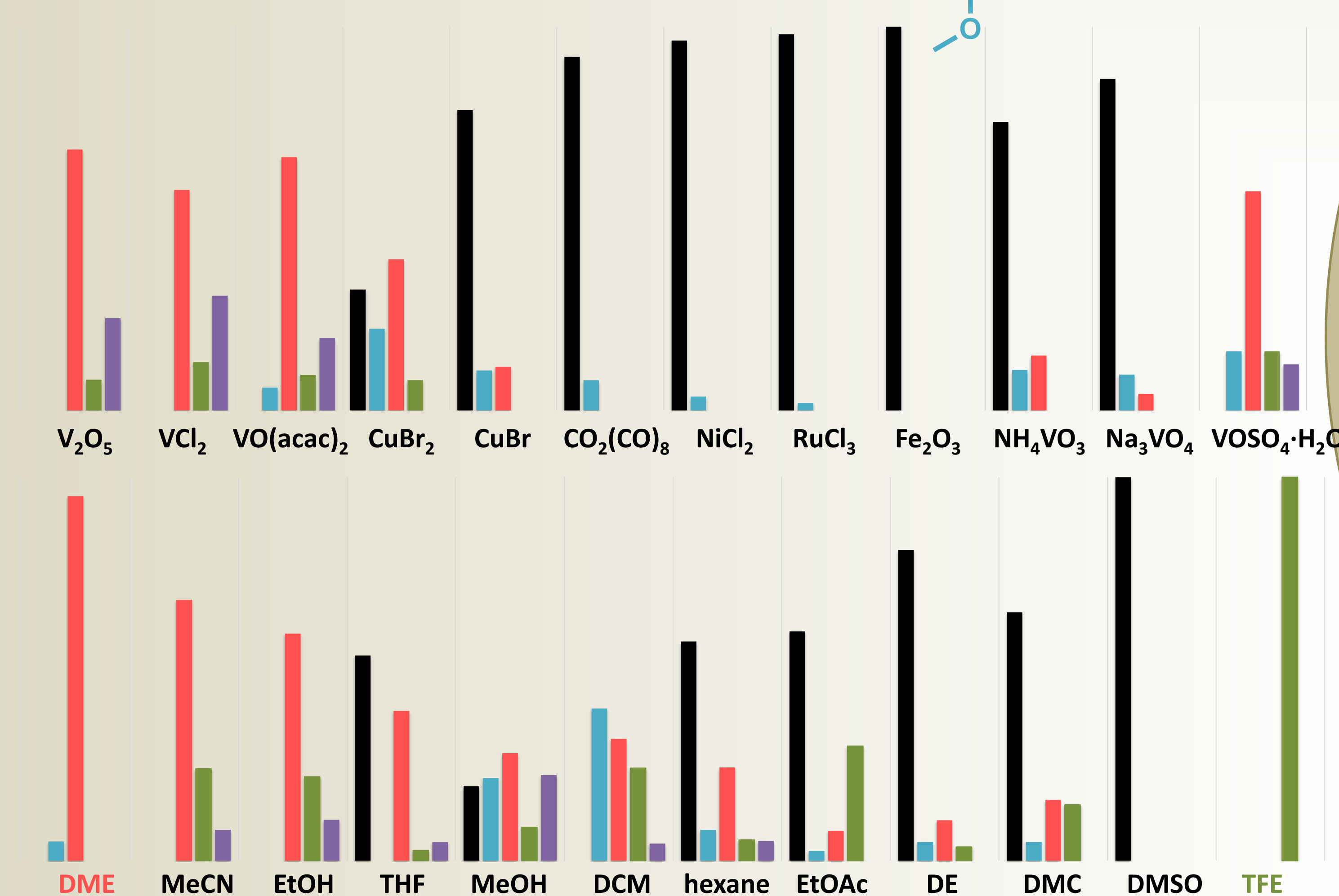
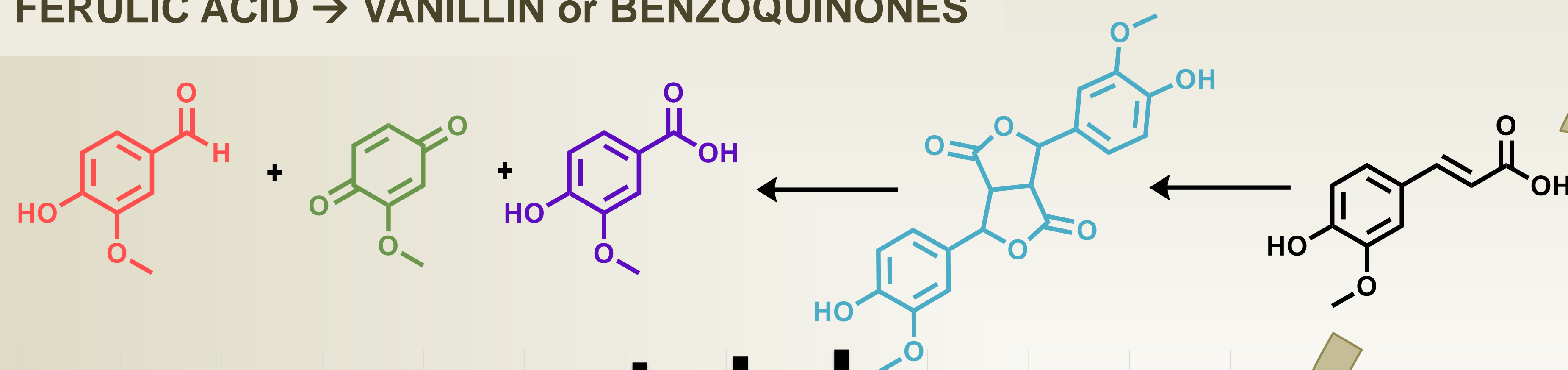


INTRODUCTION

Selective oxidative cleavage of unsaturated bonds such as carbon-carbon double bonds is a synthetically important reaction to introduce oxygen functionality into molecules or to degrade complex compounds, especially those from natural sources and biomass. The production of aromatic compounds from biomass resources could provide a sustainable alternative to conventional methods. Thus, oxidative cleavage of olefins represents one of the most important reactions in organic chemistry. It is also a very fundamental reaction in industrial organic synthesis, as it can provide several important products, such as vanillin, benzaldehydes, and aromatic carboxylic acids.

FERULIC ACID → VANILLIN or BENZOQUINONES



SELECTIVE OXIDATIVE CLEAVAGE OF C-C DOUBLE BOND BY HYDROGEN PEROXIDE

Monika Horvat, Jernej Iskra*

University of Ljubljana,
Faculty of Chemistry and Chemical
Technology,
Monika.horvat@fkkt.uni-lj.si



OXIDATIVE CLEAVAGE OF C-C DOUBLE BOND

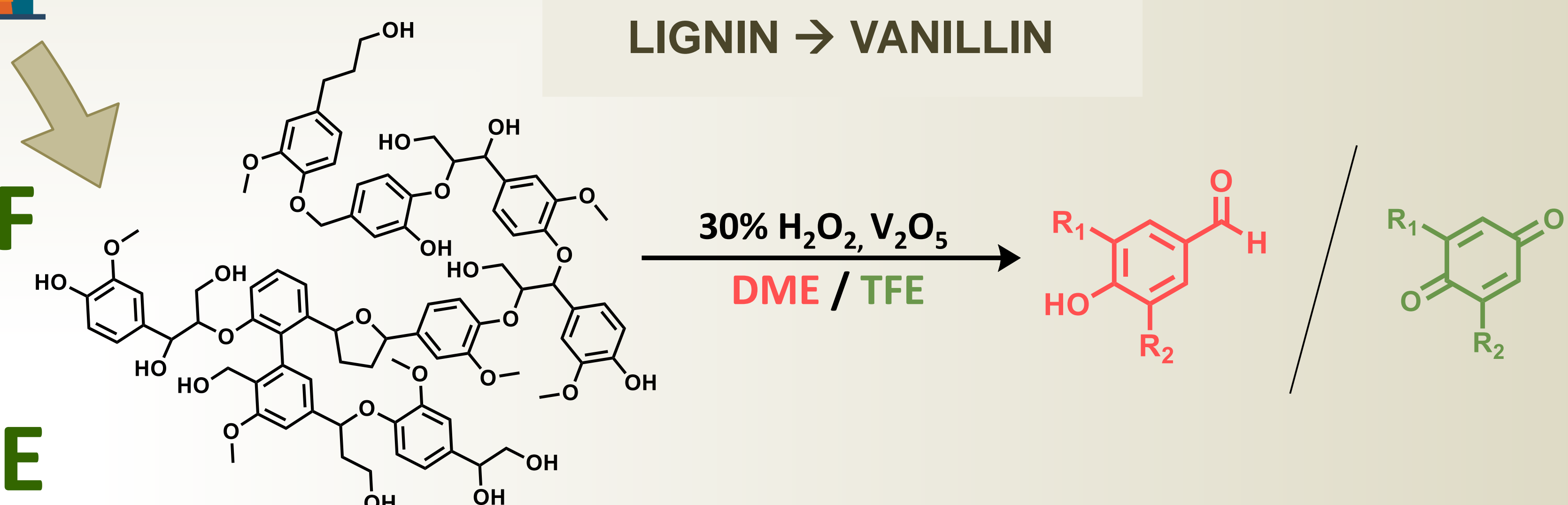
The conversion of ferulic acid and other lignin monomeric compounds to the corresponding benzaldehydes, acids and benzoquinones occurs by oxidative cleavage of the C-C double bond. Environmentally friendly and green oxidant hydrogen peroxide represent a promising reagent for the conversion of ferulic acid model compounds to benzaldehydes and benzoquinones, cinnamic acid model compounds to benzoic acids and also lignin to vanillin.

BIOMASS

Biomass chemically consists of cellulose, hemicellulose, **lignin** and extractives. Lignin, second most abundant natural material on the earth, is commercially generated as a waste product from the paper and ethanol production.

It can be converted to ferulic acid by alkaline or enzymatic hydrolysis. About 300 tons of ferulic acid is produced annually, which is the most available aromatic compound. It is also found in the lignocellulosic biomass in the cell walls of plants, grasses, grains, vegetables, leaves, seeds ...

LIGNIN → VANILLIN



CONCLUSION

- We have developed three general methods for the conversion of cinnamic acid related compounds to corresponding aromatic benzaldehydes, benzoquinones, or aromatic carboxylic acids.
- The reaction of oxidative cleavage of the C-C double bond takes place under mild reaction conditions with the green and environmentally friendly oxidant H₂O₂.
- The choice of solvent (DME, TFE, MeCN) significantly influences the course of the reaction.
- The process also offers a simple and cost-effective alternative for the conversion of ferulic acid to vanillin.

REFERENCES

- F. Chen, T. Wang, N. Jiao, *Chemical Reviews* **2014**, 114 (17), 8613-8661.
- P. Sivaguru, Z. Wang, G. Zanoni, X. Bi, *Chemical Society Reviews* **2019**, 48 (9), 2615-2656.
- K. Miyamoto, N. Tada, M. Ochiai, *Journal of the American Chemical Society* **2007**, 129 (10), 2772-2773.

CINNAMIC ACID → BENZOIC ACID

