



SYNTHESIS OF LIGNIN MONOMERS

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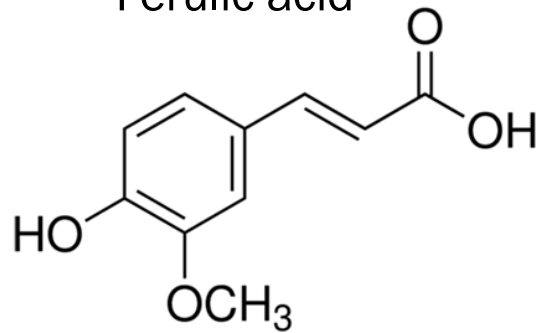
Overview

- Background: What is lignin?
- Synthesis of ferulic acid
- Advancements in synthesis
- Future work

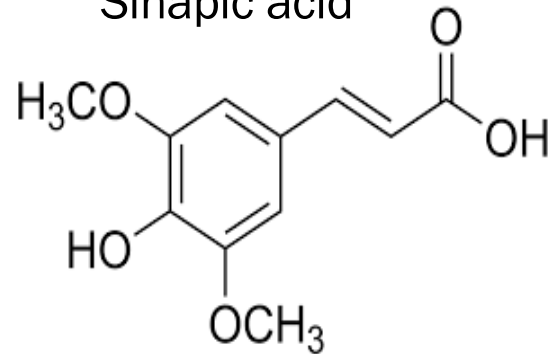
What is lignin?

- Lignin is the second most abundant natural polymer in the world
- A polymer built up of three monomers

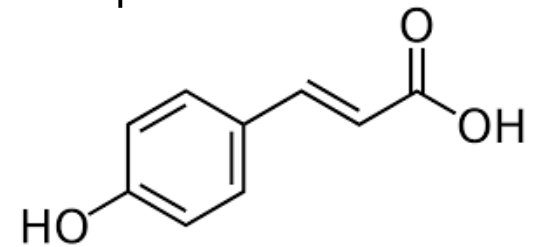
Ferulic acid

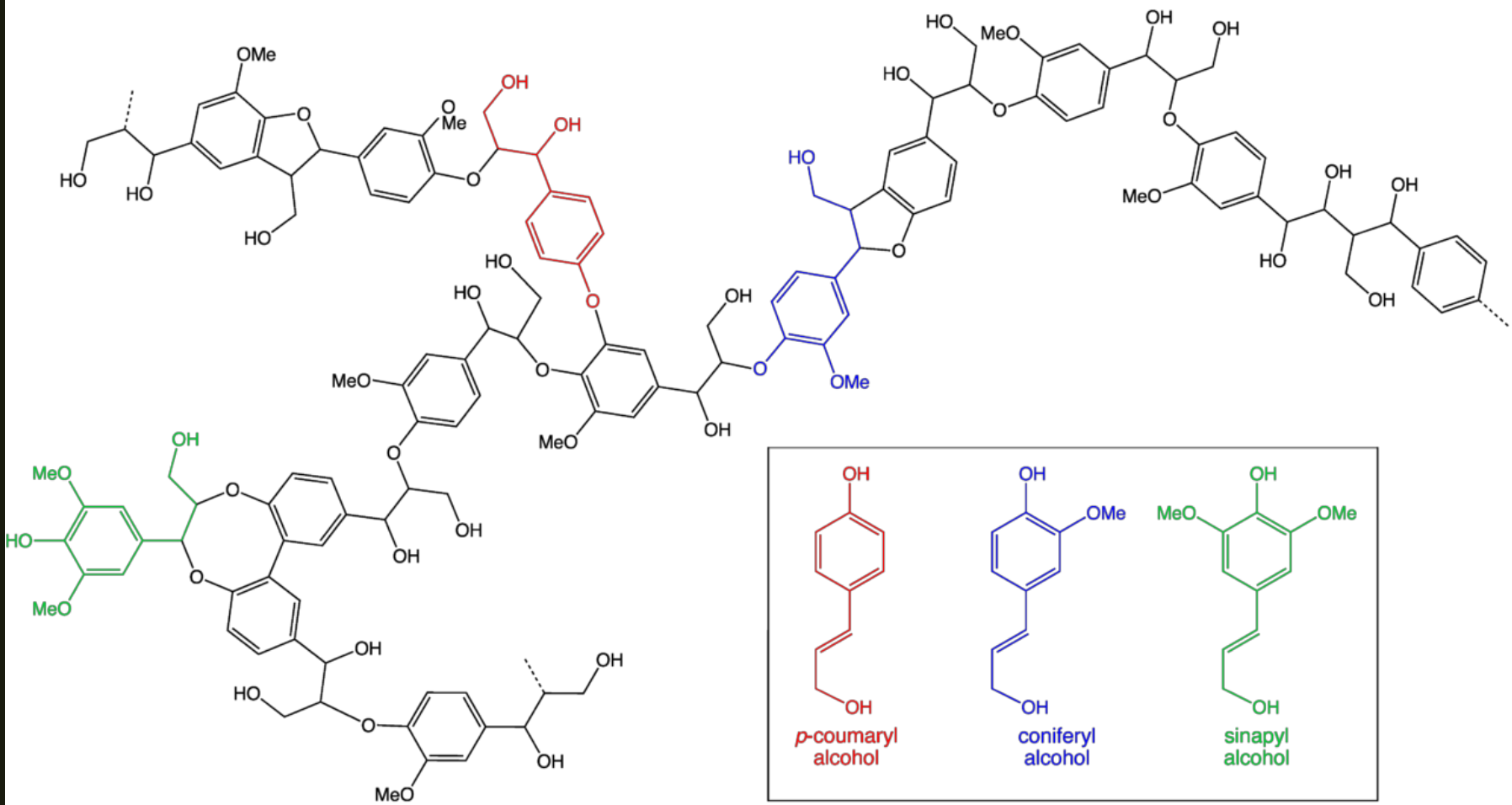


Sinapic acid

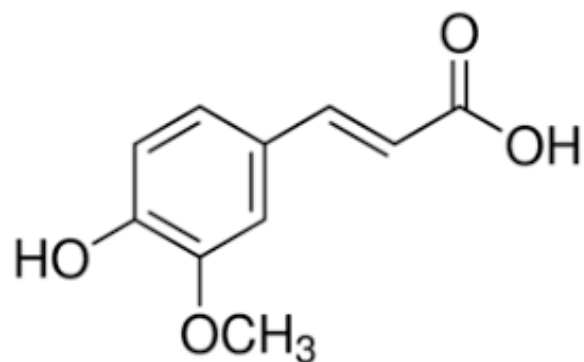


p-Coumaric acid



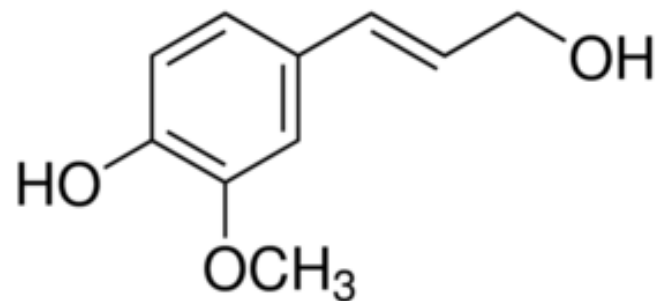


Ferulic Acid



~\$7.25

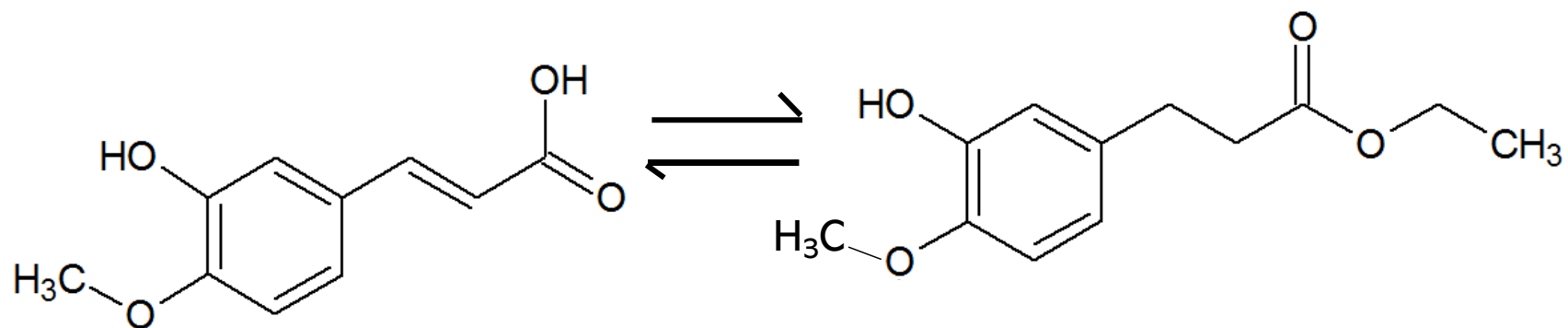
Coniferyl Alcohol



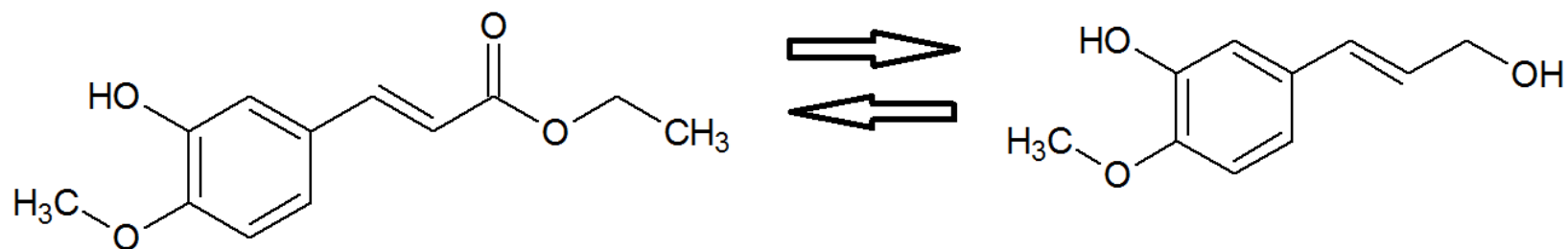
\$345.00

*Sigma-Aldrich website

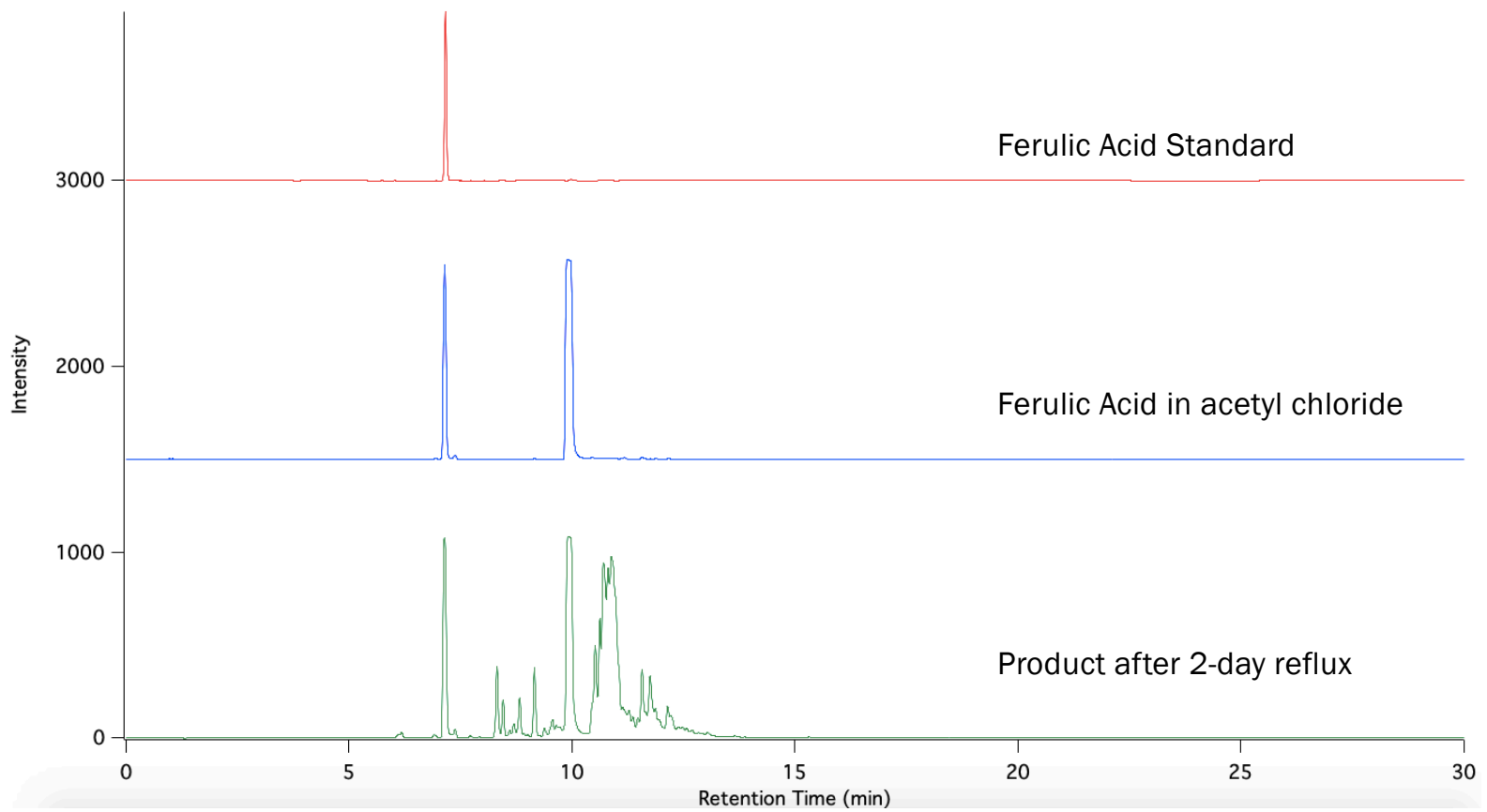
Synthesis

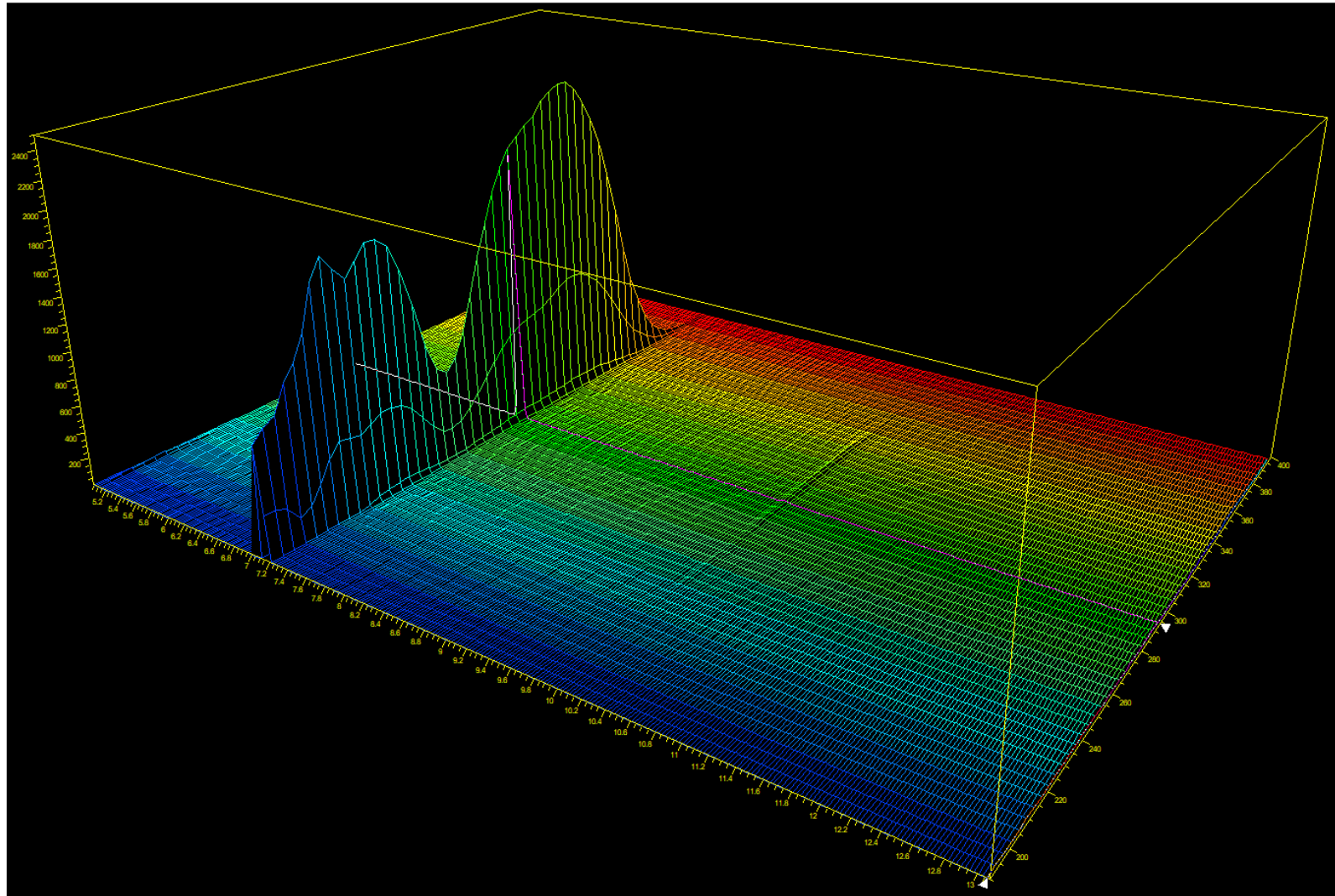


Synthesis



HPLC Data





Microwave Synthesis

- Monowave 400
 - *High performance microwave reactor*
- Benefits:
 - *Allows for higher temperature reactions*
 - *Complete control over parameters*
 - *Energy efficient*
 - *Rapid synthesis results in less evaporation of solvents*



* Anton Paar website



Microwave Synthesis

Time Decrease

- 2 day reflux → at 80 °C
- 1 day → at 90 °C
- 12 hours → at 100 °C
- 6 hours → at 110 °C
- 3 hours → at 120 °C
- 1.5 hours → at 130 °C
- 45 min → 140 °C

Water Saving

- 500 mL flows through every 30 sec
- Every minute is 1000 mL
- Each day is 1,440,000 mL
- For 2 days is 2,880,000 mL
- Converting to 760 gallons of water



Green Chemistry

- With the microwave synthesis
 - *Save about 800 gallons of water*
 - *Save 2 days*
 - *Save power*



Future Research

- Finalize second step of synthesizing ferulic acid
- Synthesize other lignin monomers



Acknowledgments

- Dr. Bradley E. Sturgeon
- Steve Distin
- Monmouth College Chemistry Department



Questions