



Utilization of woody biomass and residues for production of energy products and high-value natural compounds – a case study using biomass from costal forestry resources

Kristoffer Mega Herdlevær

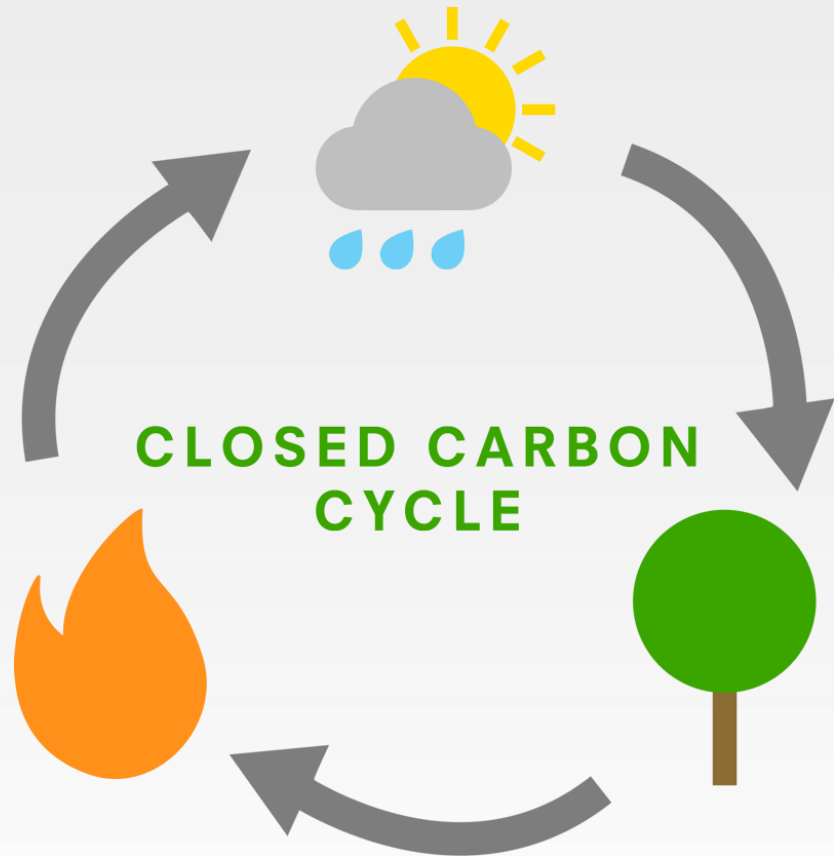
Supervisors:
Tanja Barth
Inger E. Måren
Camilla Løhre





Background

- Fossil fuels are a finite resource
- CO₂-emissions
- Carbon neutral biomass cycle





Background

- Biofuels as a part of the energy mix
- Materials and chemicals derived from petrol
 - Plastics
 - Food additives
 - Medicine
 - Cosmetics
 - Platform chemicals

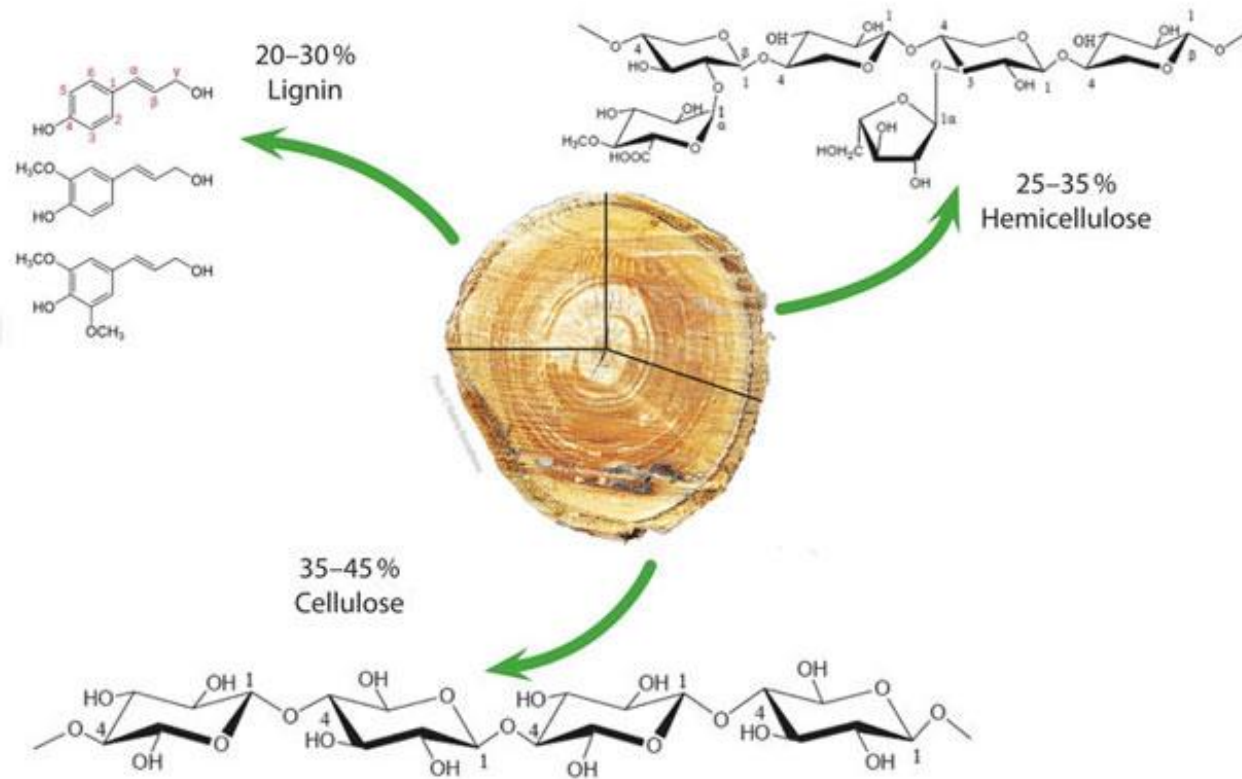




Background

- First generation biofuels
 - Rape seeds, sugar beets, sunflower etc.
- Second generations biofuels
 - Trees, plants, residues from agriculture





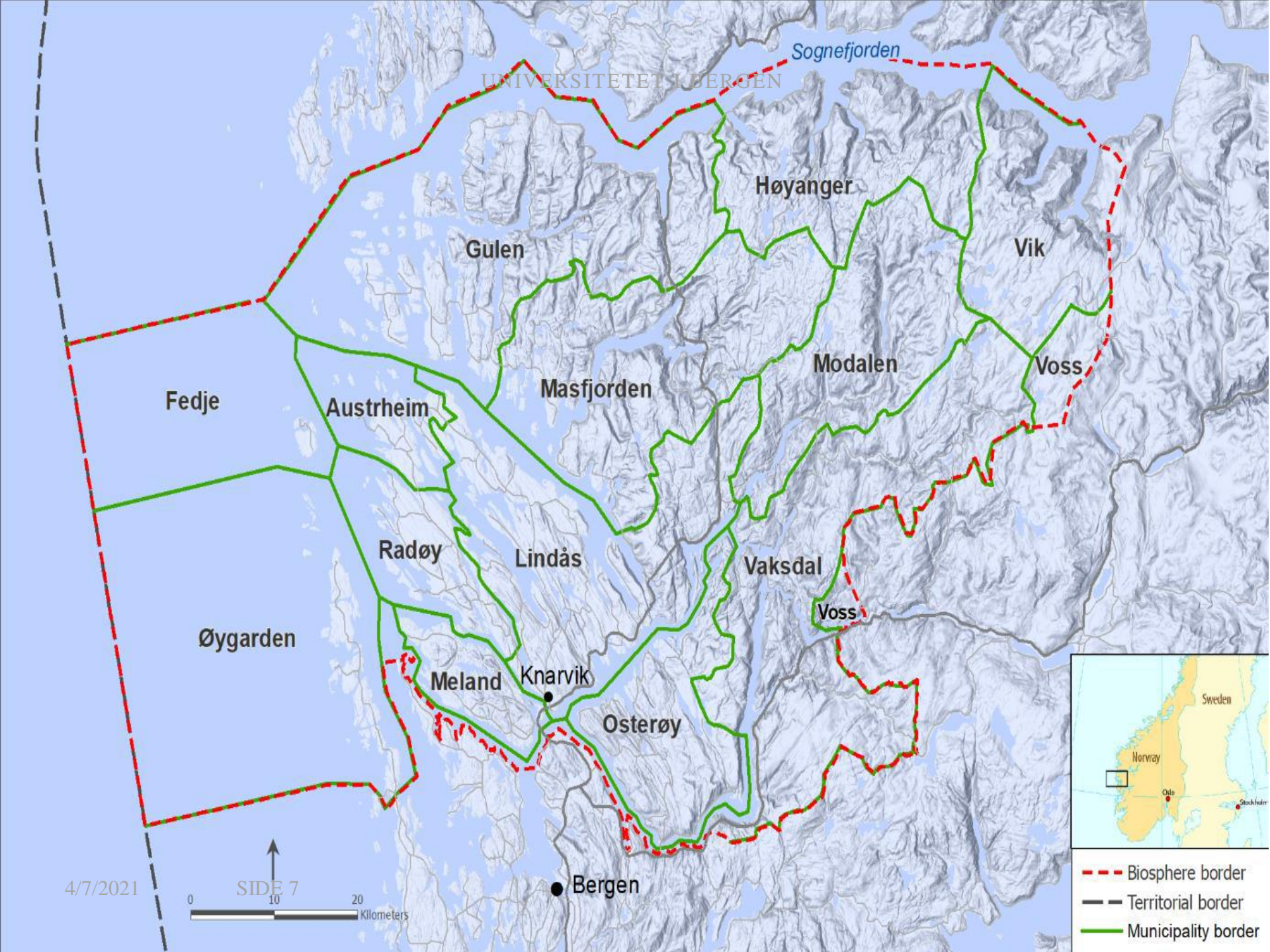


Norway

- Norwegian forests¹
 - 978 000 000 m³ of forest
 - 16,2 % increase since 2010
- UNESCO Nordhordaland Biosphere Reserve
- Sitka/norwegian spruce, pine, birch and juniper

1. <https://www.ssb.no/jord-skog-jakt-og-fiskeri/faktaside/skogbruk>.
Accessed April 2020







Focus points

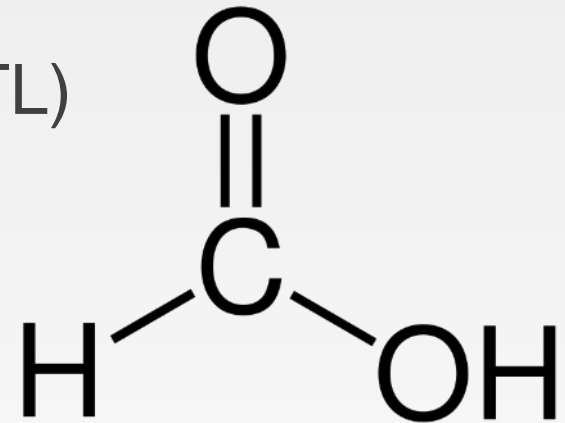
- Residue from forestry
- Variation among tree species
- Low quality wood





Method

- Extraction of biologically active components
- Hydrothermal liquefaction (HTL)
 - Converts wet biomass
 - Lignin-to-liquid (LtL)²



2. Kleinert, M.; Barth, T., Towards a lignincellulosic biorefinery: Direct one-step conversion of lignin to hydrogen-enriched biofuel. *Energy Fuels* 2008, 22 (2), 1371-1379.

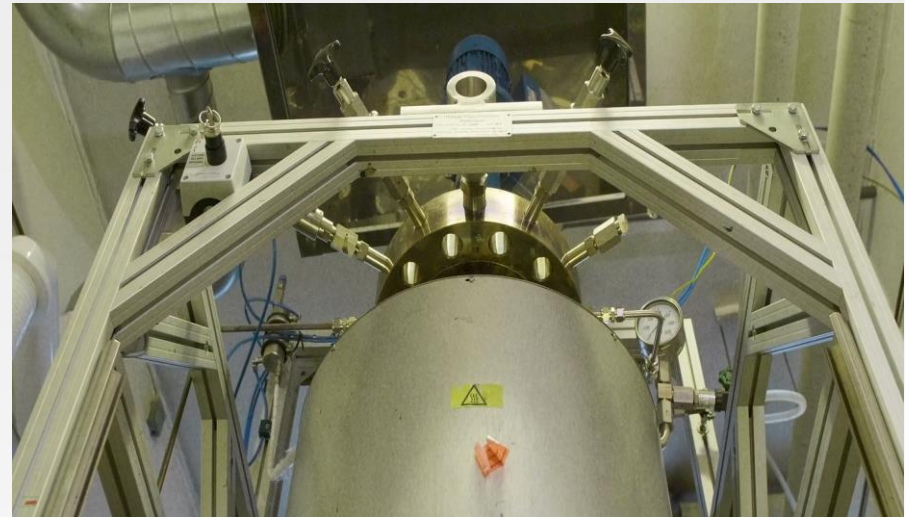




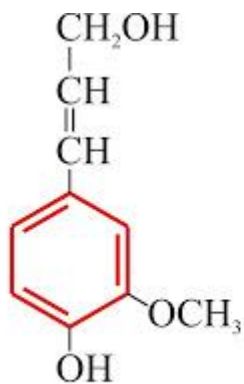
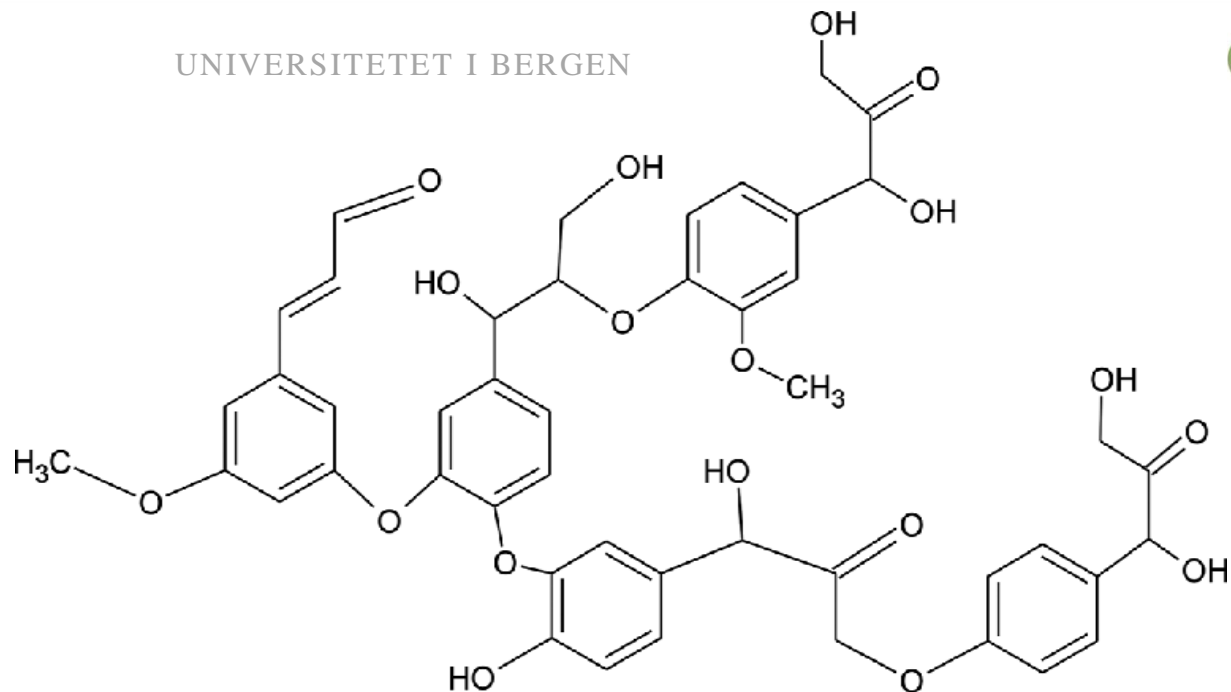
Method

- Added to the reactor
 - Feedstock
 - Water
 - Formic acid
- Products
 - Gas
 - Bio oil
 - Solid phase (coke)
 - Water

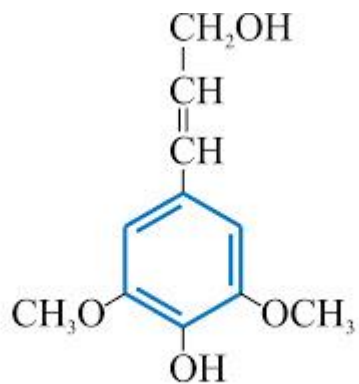




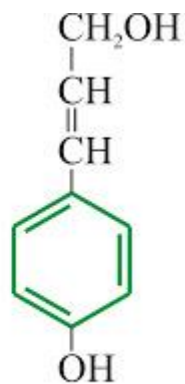
Lignin



coniferyl alcohol



sinapyl alcohol

*p*-coumaryl alcohol



Current work

- How does feedstock affect the product?
- Mapping of the chemical variation in different tree samples
- IR and NIR based prediction model

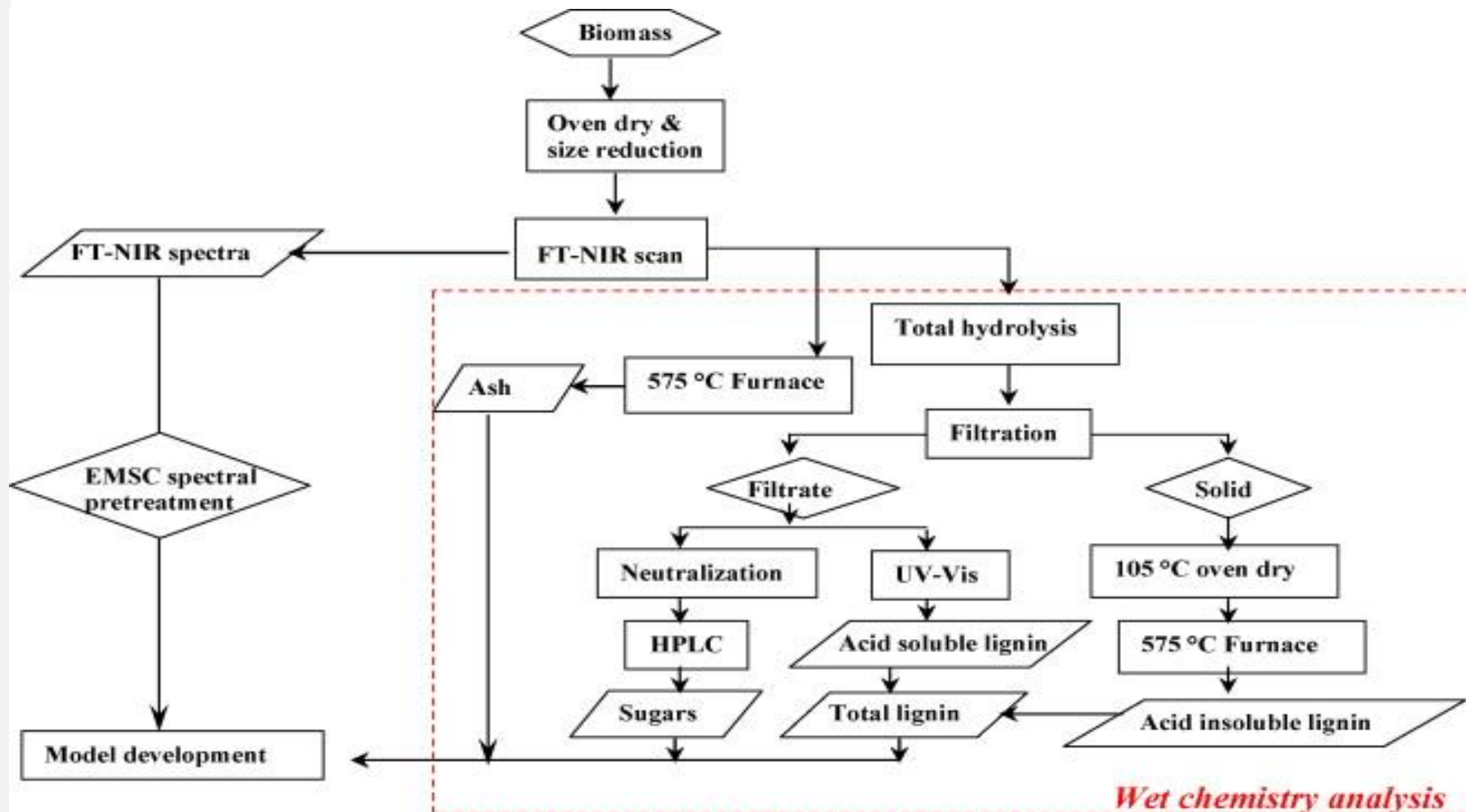




Current work

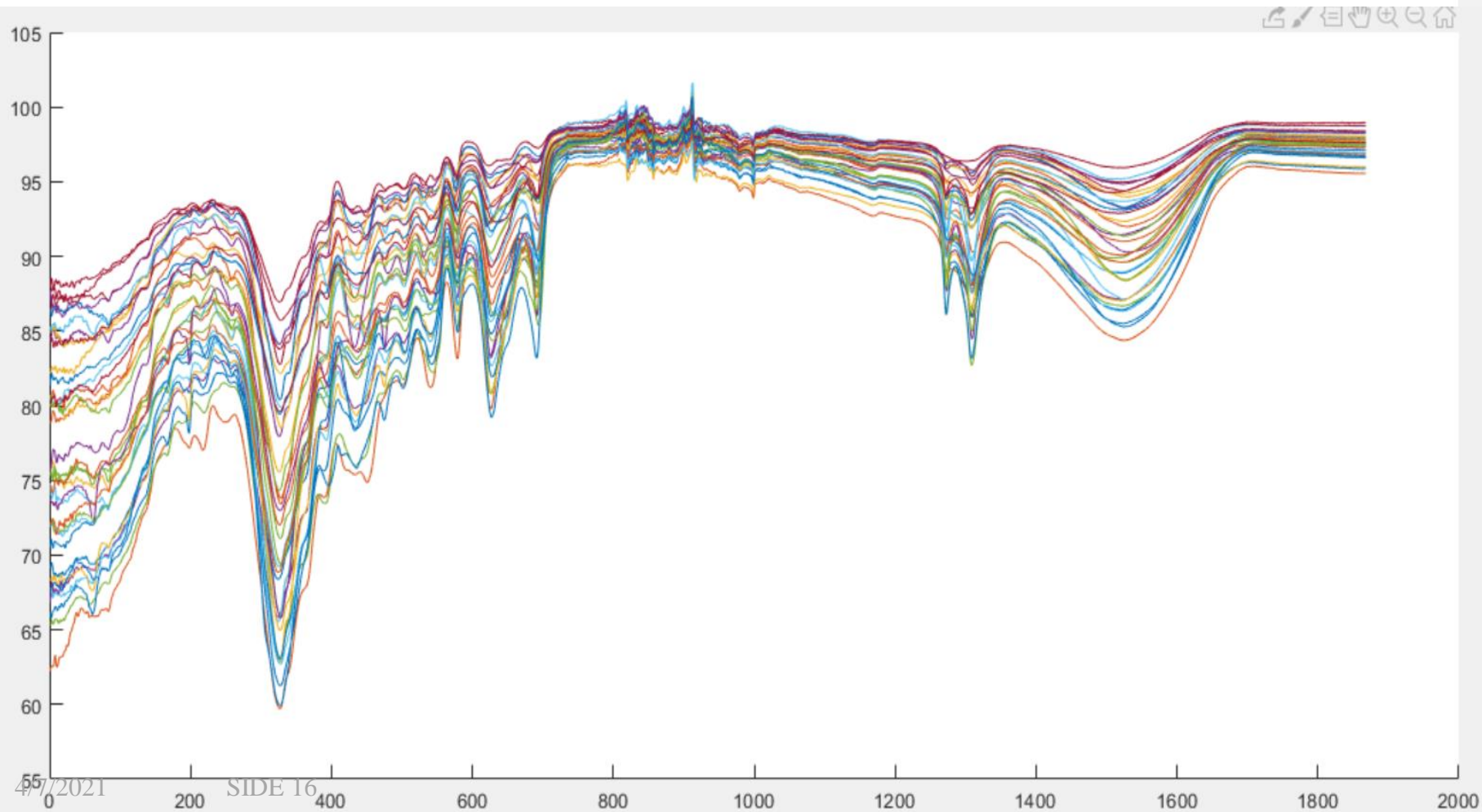
- Spruce, birch and pine
- 3 of each species to cover variability
- Separated into:
 - Heartwood, bark, twigs and leaves/needles
- To determine the ratios of
 - Carbohydrates, lignin, extractives and ash







IR spectra





Further work

- Compare converting methods
- High quality vs. Low quality wood
- Extraction and HTL of needles





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