

A
Biorefinery
Approach to
Renewable Energy
and Chemicals



Climate Change and Global Energy Demand

- IPCC climate report
 - Drastic change is needed
- Out phasing of fossil fuels
 - Fossil fuels cover 80% of demand
- Covering the global energy demand
 - Many promising innovative technologies
- Advantages of biomass utilization
 - Usable with existing infrastructure
 - Energy and chemicals



Figure 1: Global warming vs Climate change from ASA(<https://climate.nasa.gov/resources/global-warming-vs-climate-change>)

What is a Biorefinery?

- Refinery converting biomass to a wide range of products
 - Energy products
 - Commodity and fine chemicals
 - Feed and food
- Circular economy
 - Extracting the full value from the raw materials

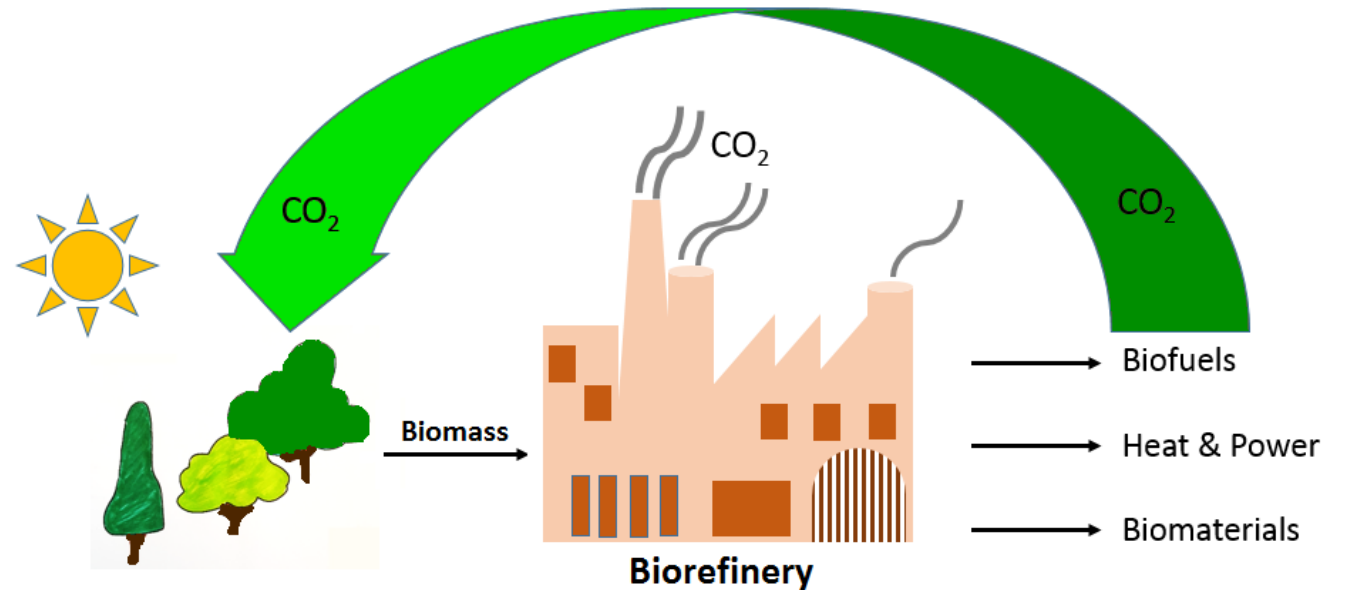


Figure 2: Biorefinery by S. Ghoreishi

About Arbaflame

- Norwegian biotech company
- Production of ArbaCore energy pellets
- Biorefining of wood
- Extracting value from side streams



Fig 3: ArbaOne, Arbaflame.no

Arbaflame's Vision

- ArbaOne, Arbaflame's first commercial biorefinery
- Delivering pellets to power plants around the world to be used as an alternative to coal
- Using a biorefinery approach to extract valuable chemicals from the waste streams of the treated wood

Steam Explosion Pretreatment

- Steam explosion pretreatment of small wood chips
 - Saturated steam
 - Moderately high pressures and temperatures
 - Explosive decompression
- The steam exploded biomass is collected in a tank (flash tank)
- Steam released during the decompression is condensed and collected in a separate tank

Fig 4: Biomass before (L) and after (R) steam explosion



ArbaCore Pellets

- The treated biomass is sent through a drying process before being pressed into pellets
- Properties similar to coal
- Easy conversion of power plants



Fig 5: Arbacore pellets, Arbaflame.no



Extraction of Valuable Chemicals

- Biomass energy also creates chemicals
- Condensed steam contain valuable compounds
- Separation of valuable components from the wastewater stream
- Quality assurance

Fig 6: Chemical valorization, Arbaflame.no



Furans

- Furfural
- Hydroxymethylfurfural (HMF)

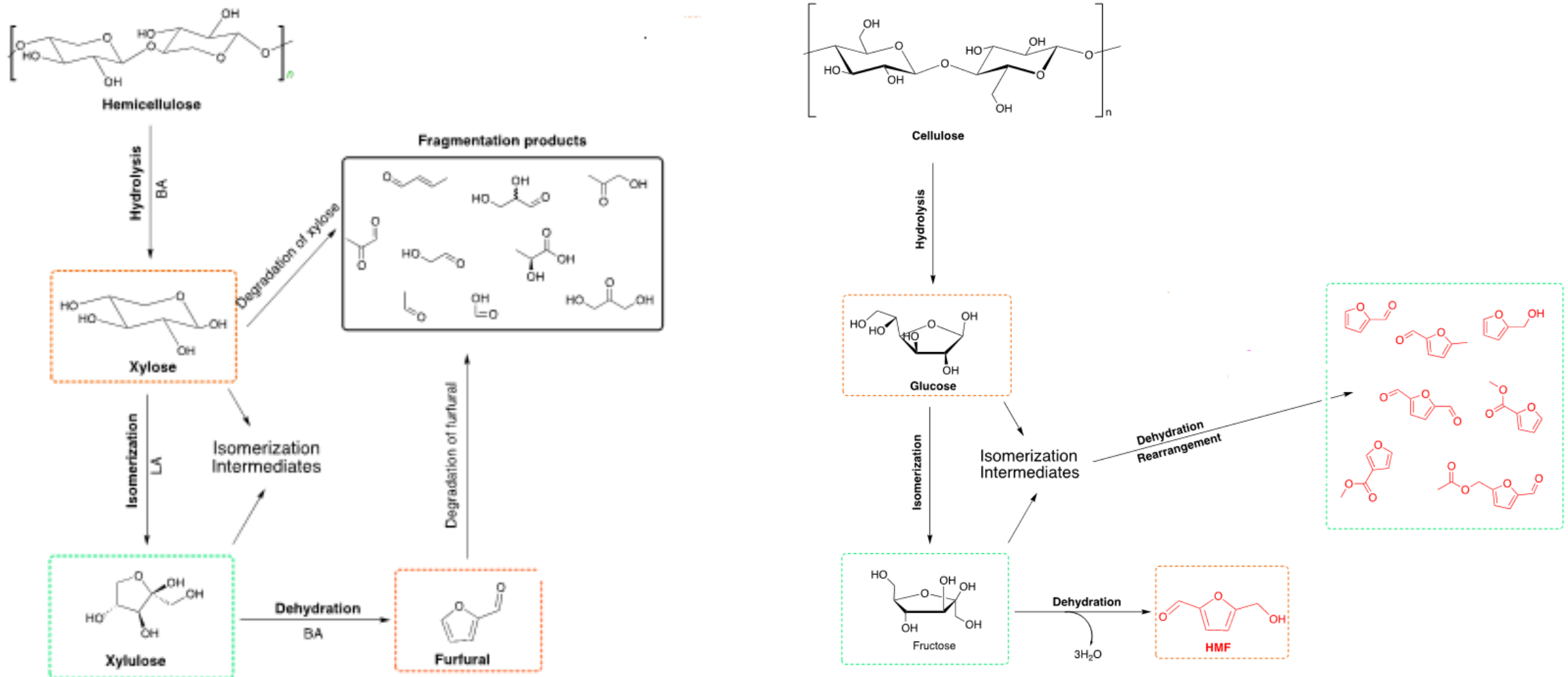


Fig 7: Degradation pathways of FUR and XYL. (L) and pathways for glucose and HMF (R). Redrawn and adapted from (Vilonen et al., 2011)

Research and Funding

- Wide institutional cooperation
 - UiB, NTNU, PFI-RISE, TNO, SINTEF and more
- Horizon2020 program
 - ArbaHeat
- Norwegian Research Council
 - ArbaBioRef
 - ArbaFeed
 - My PhD project

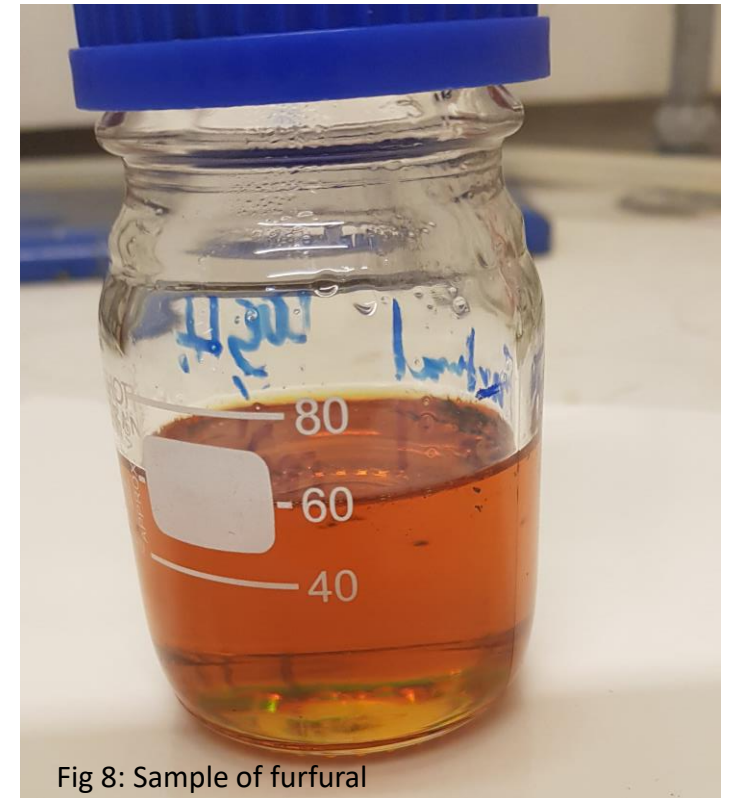


Fig 8: Sample of furfural

Thank you for your
attention