Breaking the Barrier of Biomass Conversion using Wet Explosion pretreatment

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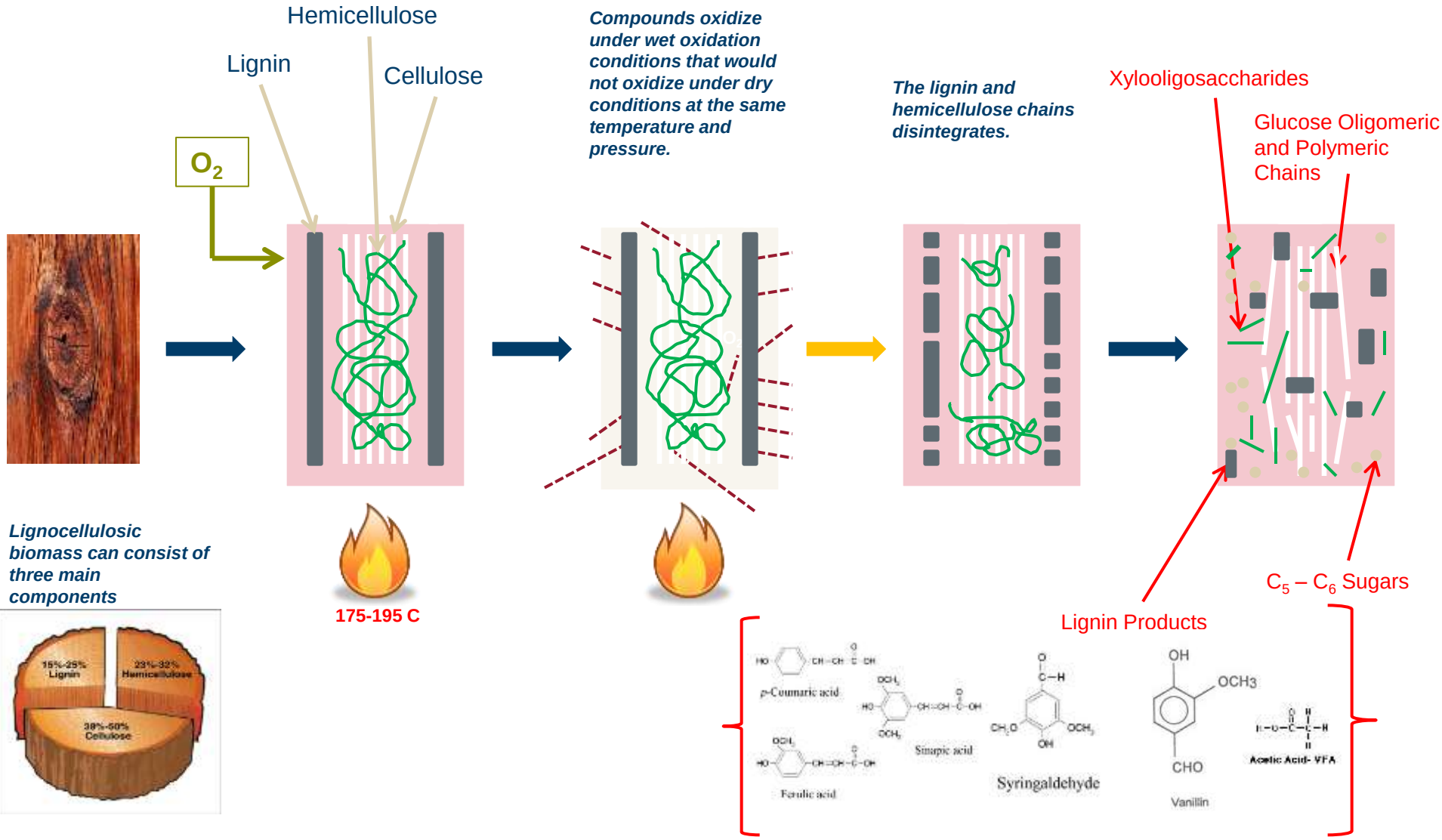
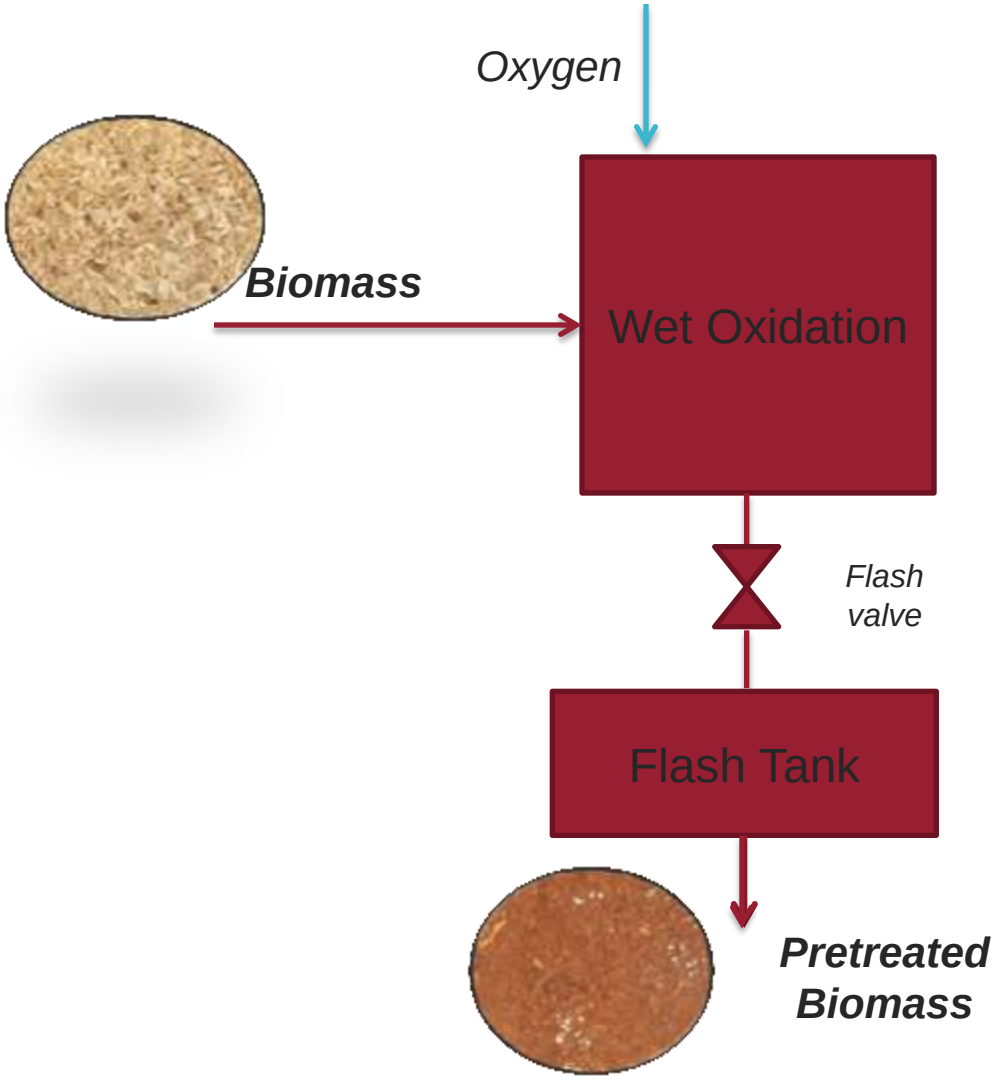
WET OXIDATION

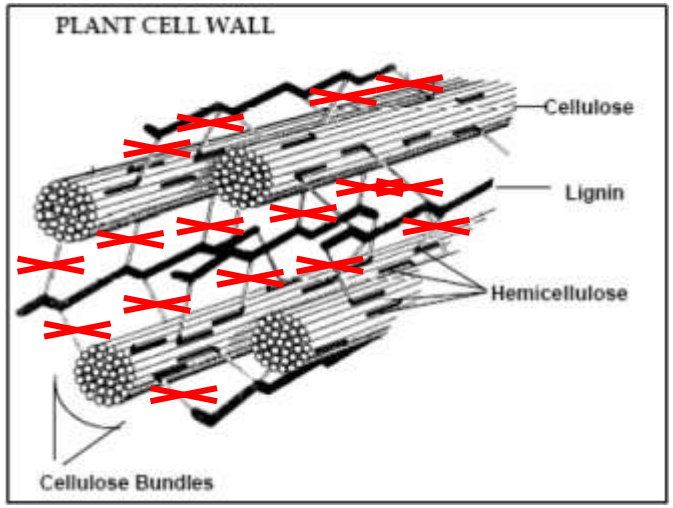


Lignocellulosic biomass can consist of three main components

WET EXPLOSION PRETREATMENT



Process parameters
Temp: 175 – 195 ℃
Time: 15-30 min
Oxygen < 8 % of DM



PILOT PLANT

Flash Tank

Pretreatment Reactor

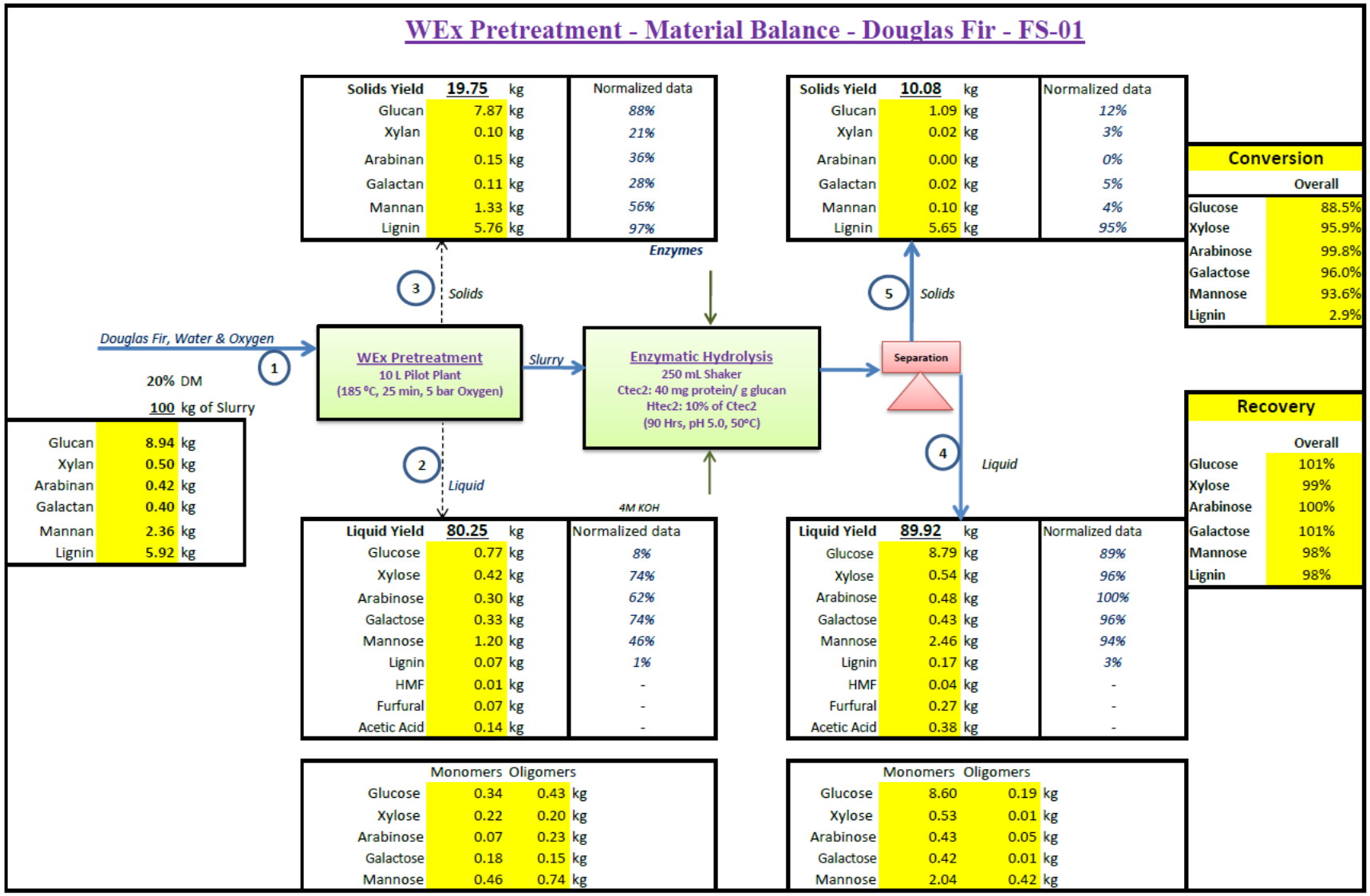
Softwood to Hydrolysate and Sugars

Milling

Pretreatment

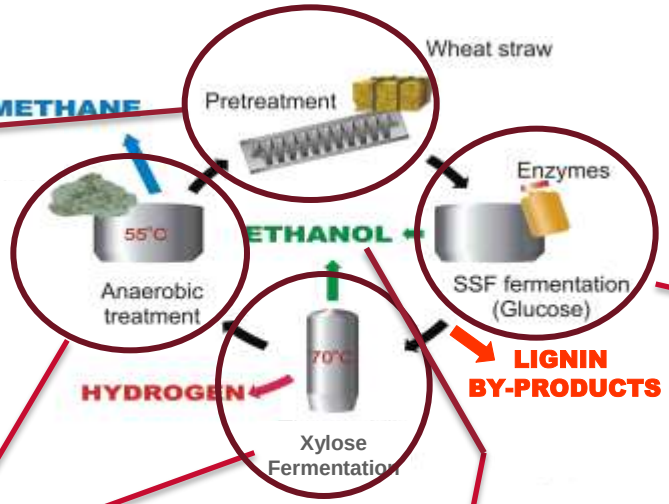
Enzymatic Hydrolysis

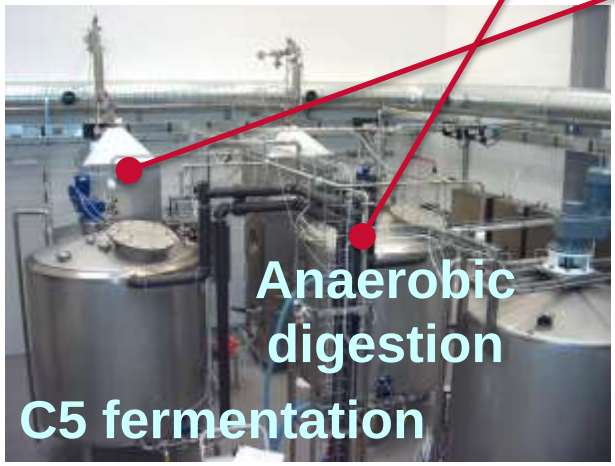
WEx Pretreatment - Material Balance - Douglas Fir - FS-01



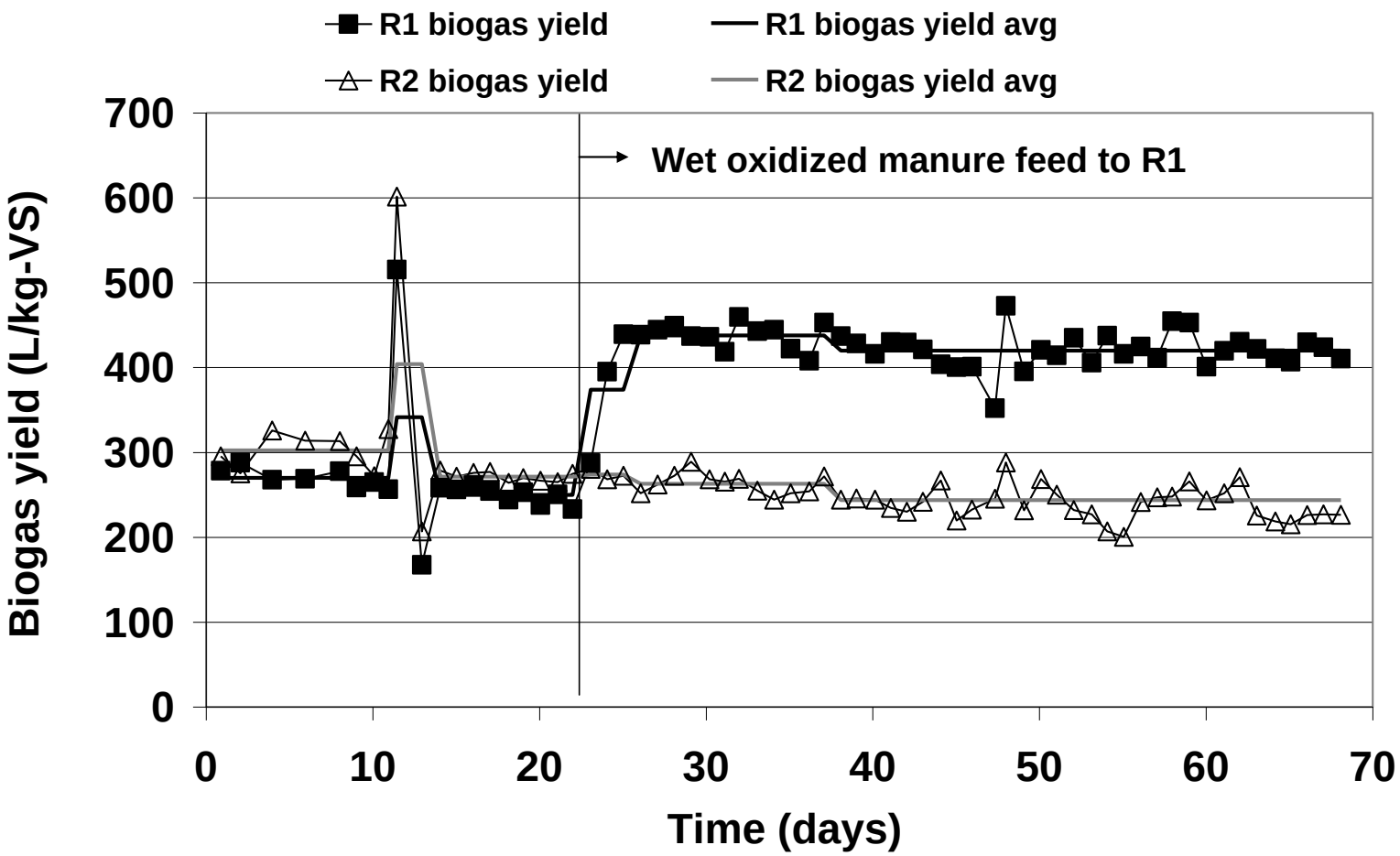
Maxifuels Pretreatment

Maxifuels Biorefinery Concept





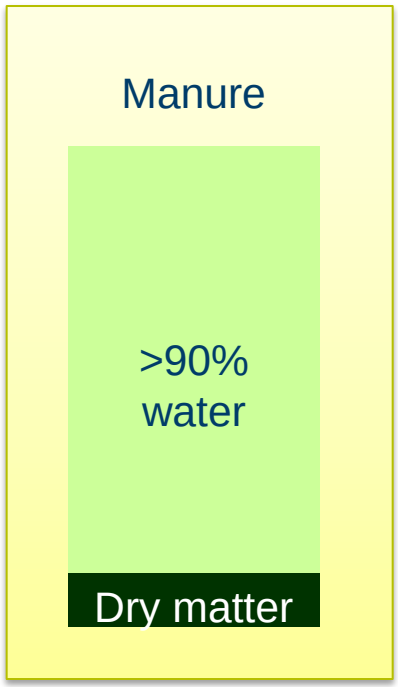
Biogas Yields with/without Pretreatment



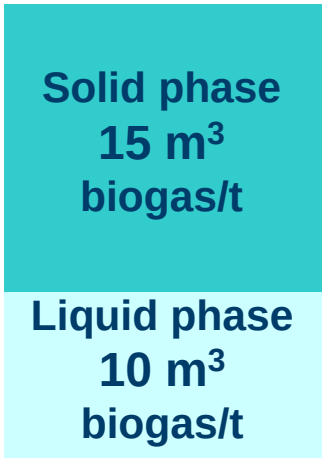
Biogas Yield from Manure

Wet oxidation of fibers:

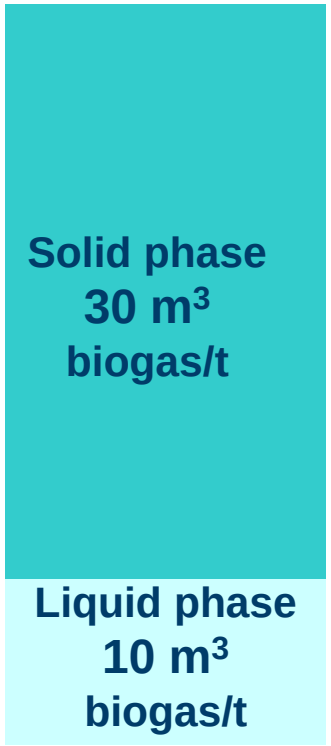
Increase of biogas yield per ton manure



< 25 m^3biogas/t

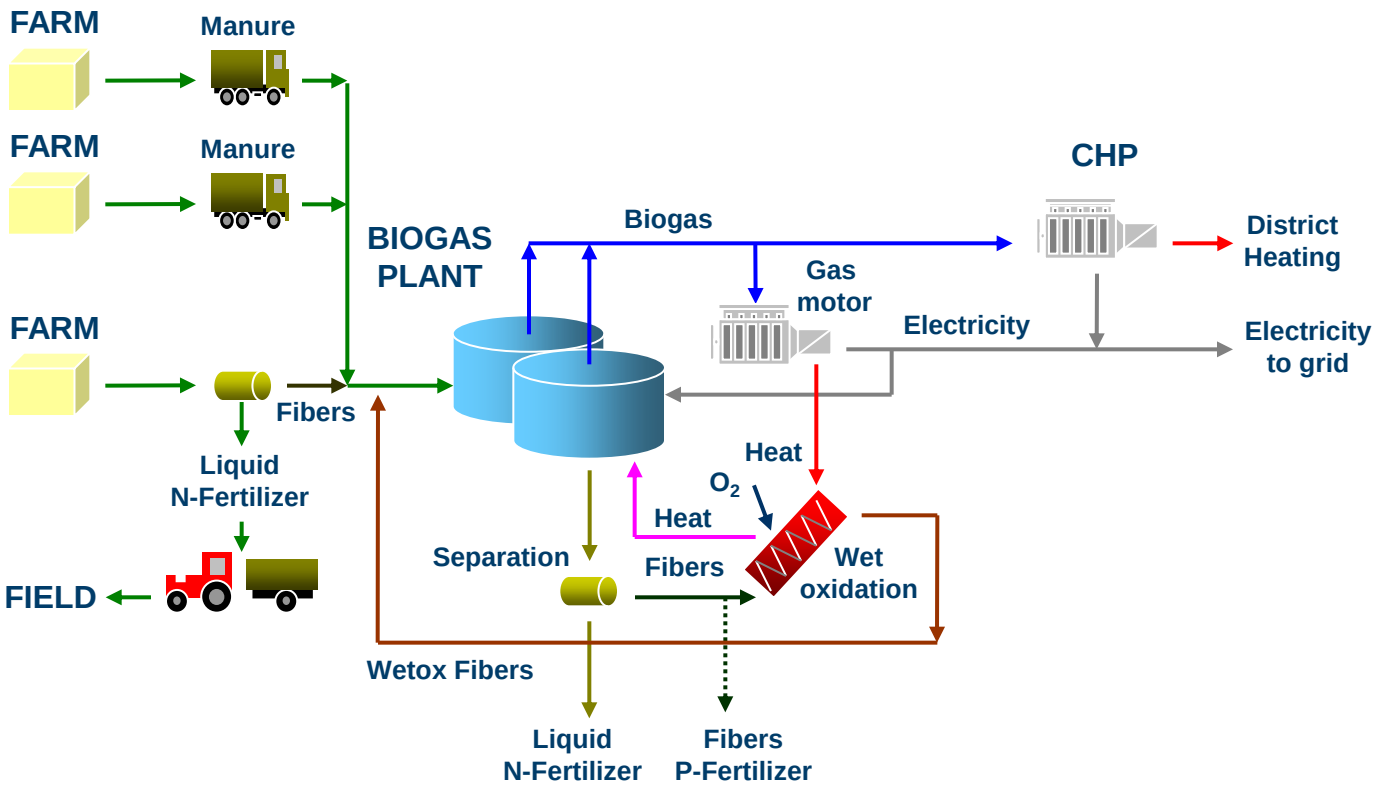


40 m^3biogas/t



Biogas Plant Integration Layout

Separation of fibers + wet oxidation of recycled fibers



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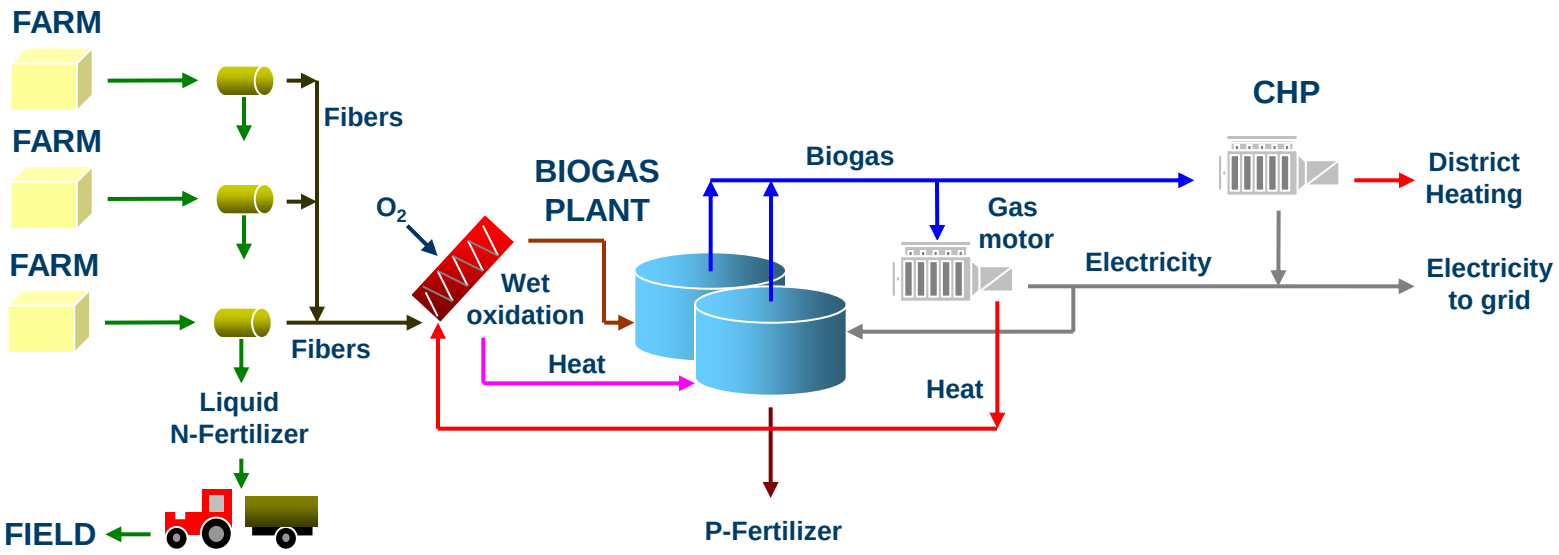
Separation + wet oxidation of fibers



Wet Oxidation Investment

Biogas plant capacity: 180,000 t manure/year (500 t/d)
=> Treatment of 18,000 t fibers/year

Investment costs for wet oxidation: **€ 840,000**

Revenue				**Payback time**
m^3_{biogas}/t	kWh/ t	EURO/t ($0.27 EURO/m^3_{biogas}$)	EURO/year ($20{,}000\ t_{fibers}$/year)	years
30	200.4	8.10 €	162.000 €	5.2
40	267.2	10.80 €	216,000 €	3.9
50	334.0	13.50 €	270,000 €	3.1
60	400.8	16.20 €	324,000 €	2.6

Wet Oxidation Economics

Wet explosion will have lower capital cost & operational cost than dilute acid pretreatment despite cost for oxygen addition

- No need for acid tolerant steel
- Lower cost for enzymes (significant factor)
- Less chemicals for neutralization
- Hydrolysis can occur with high dry matter

Capital cost can be decreased by continuous operations without prior downsizing of the biomass materials

Continuous Pretreatment

Wood chips in industrial scale

- From 2” to hydrolysate in 15 mins with no cutting or grinding
- Continuous operation
- Technology is scalable and has already been tested at industrial scale (10 ton per hour)
- Low complexity, low risk
- Market ready

CONCLUSION

- **Wet explosion is well suited as a pretreatment method for production of ethanol and biogas from agricultural residues**
- **Wet oxidation is superior for softwood**
- **Very high bio-accessibility can be obtained through pretreatment**

  ⇒ e.g. high sugar concentrations (both C6 and C5) can be obtained from softwood
- **Continuous wet explosion pretreatment can be done today without the need for downsizing of the woody materials**