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# Deep eutectic solvent pre-treatment of residual biomass streams – effects on anaerobic degradability –

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Miyase Deniz Cam, Ozge Sakiyan, Martin Kaltschmitt

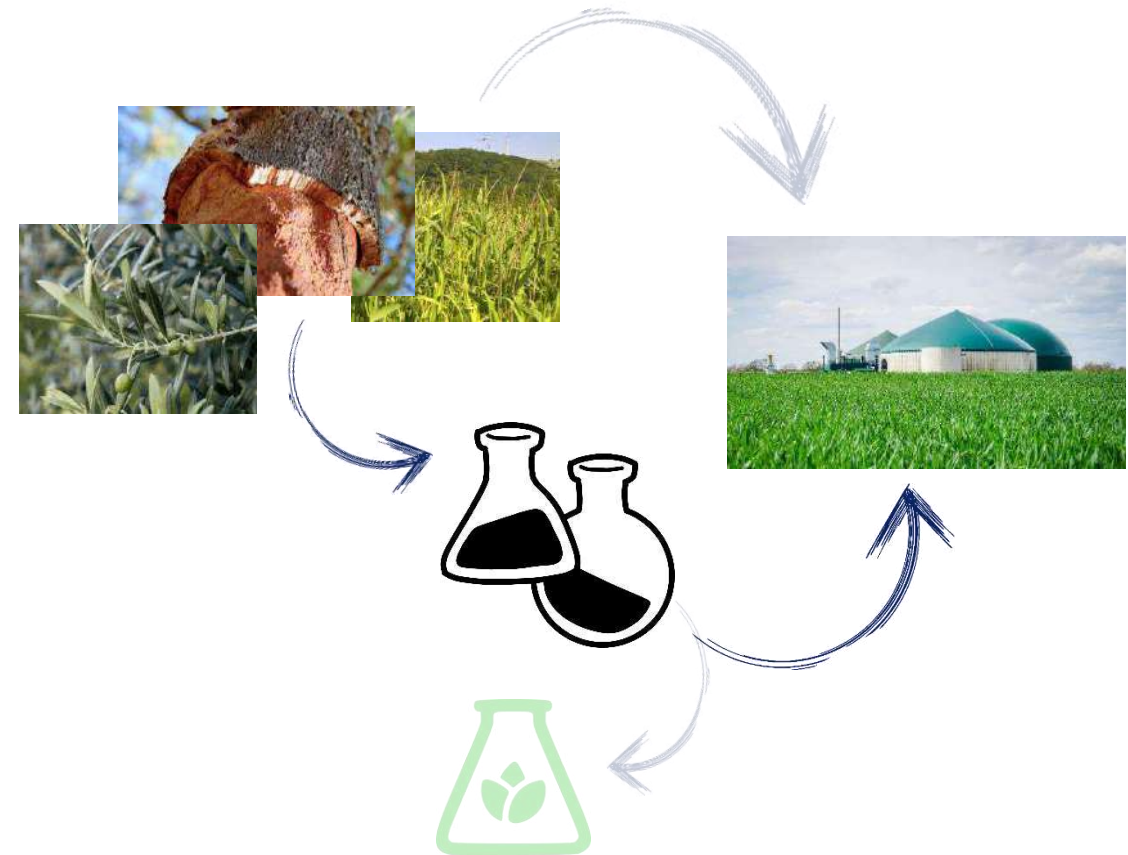


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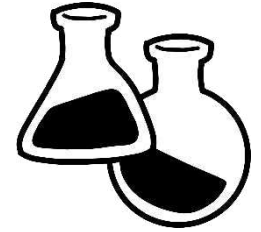
ORCID: <https://orcid.org/0009-0003-5039-0772>



- Management of wastes and residues from
    - Agricultural production
    - Processing of agricultural goods
  - Provision of renewable energy
  - Provision of organic fertilizer
- 
- Treatment of lignocellulosic biomass for
    - Production of value-added products
    - Improvement of anaerobic degradability



- Mix of hydrogen bond donor and hydrogen bond dacceptor
- Melting point of mixture < melting point of individual substances
- Good solvation properties
  
- Advantages over conventional solvents
  - Biodegradability, biocompartibility
  - Low toxicity
  - High thermal stability
  - Low volatility
  - Non-flammability



Cork dust

Olive pruning

Common reed



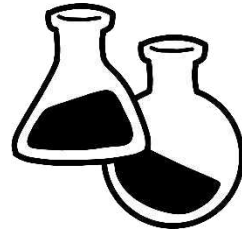
[6]



Comminution

DES pre-treatment

- 1:10 solid : solvent ratio
- 1:2 Choline chloride : formic acid
- 90 °C / 110 °C / 130 °C
- 20 min / 40 min / 60 min



# Deep eutectic solvent pre-treatment of residual biomass streams

Materials and methods

Cork dust

Olive pruning

Common reed



[6]



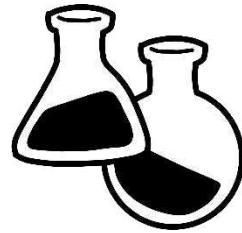
Comminution

DES pre-treatment

Solid/liquid separation → Valorization of liquid fraction

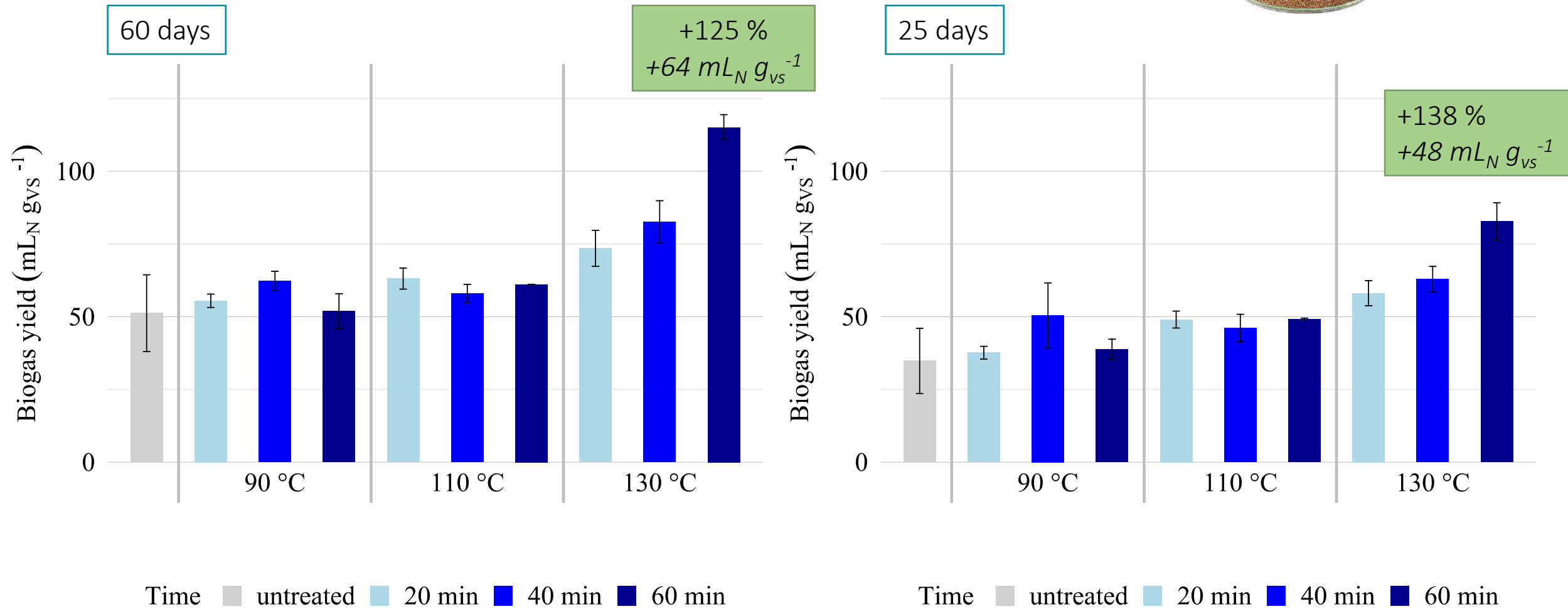
Anaerobic digestion of solid residuals

- $37 \pm 1$  °C
- 60 days
- Gas compositional analysis



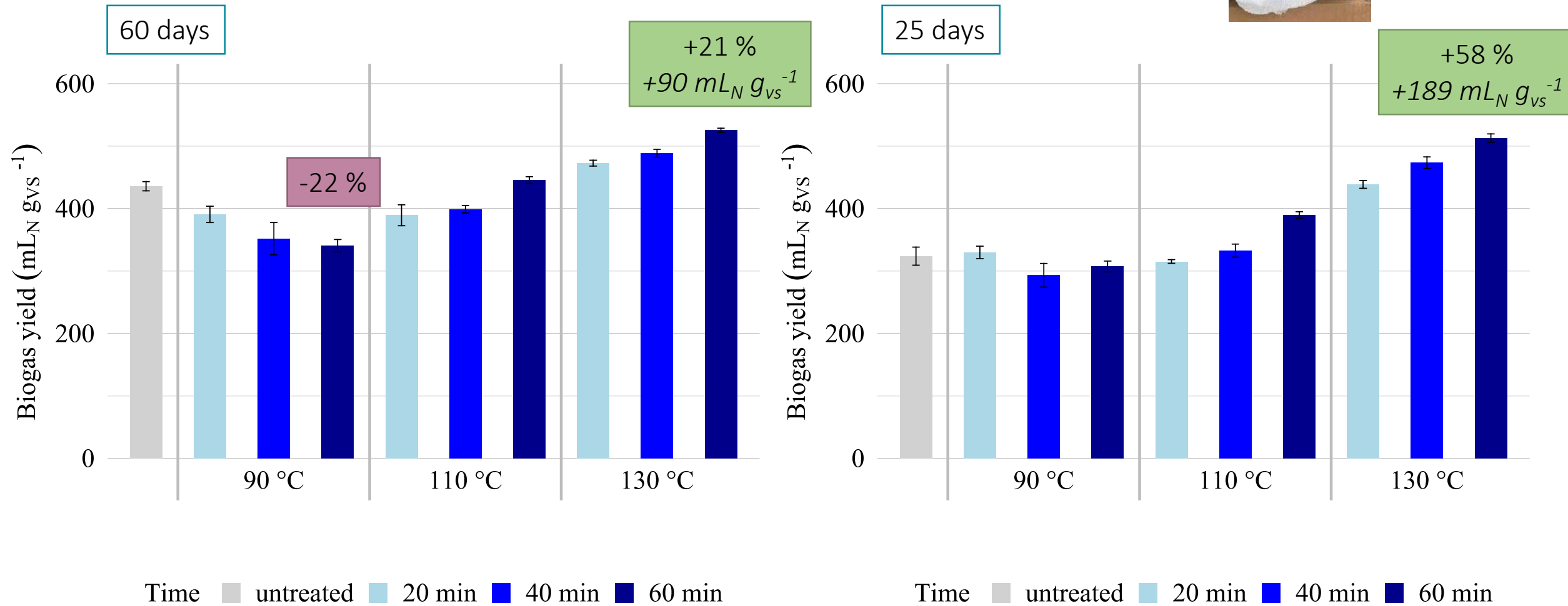
# Anaerobic degradability of DES pre-treated biomass

Results - Cork dust



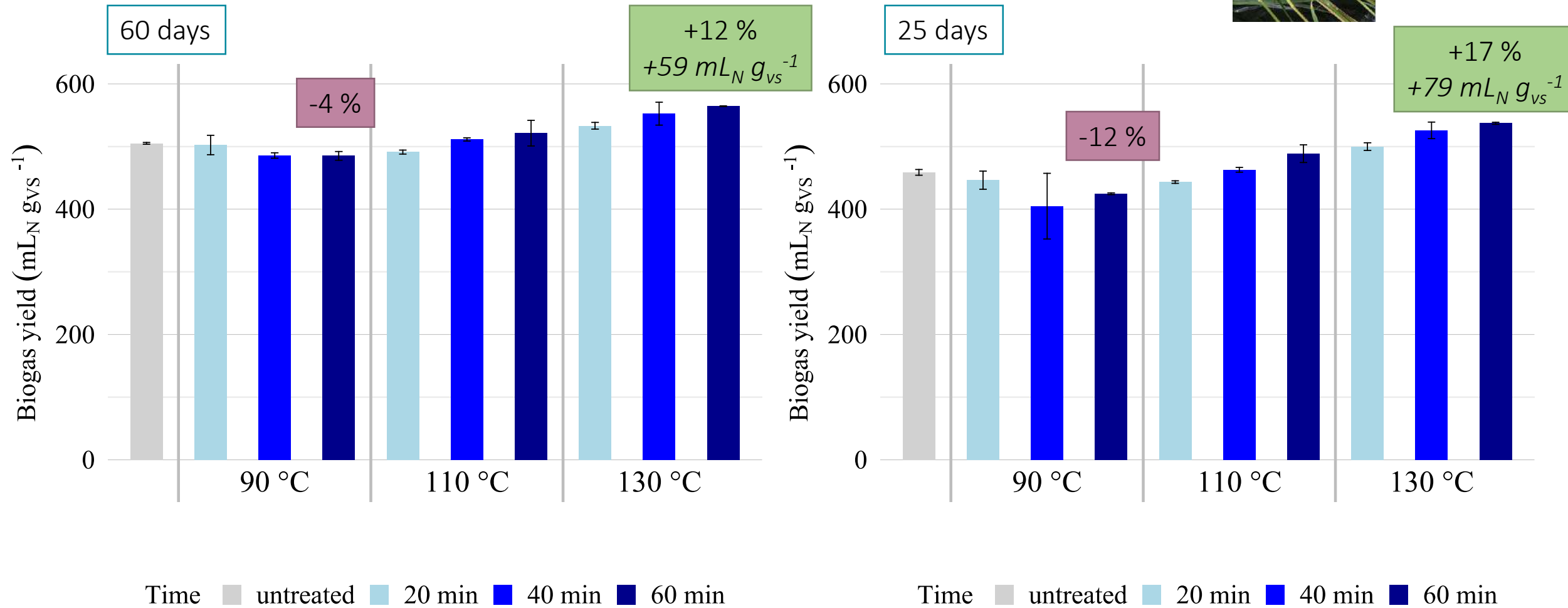
# Anaerobic degradability of DES pre-treated biomass

Results - Olive tree pruning



# Anaerobic degradability of DES pre-treated biomass

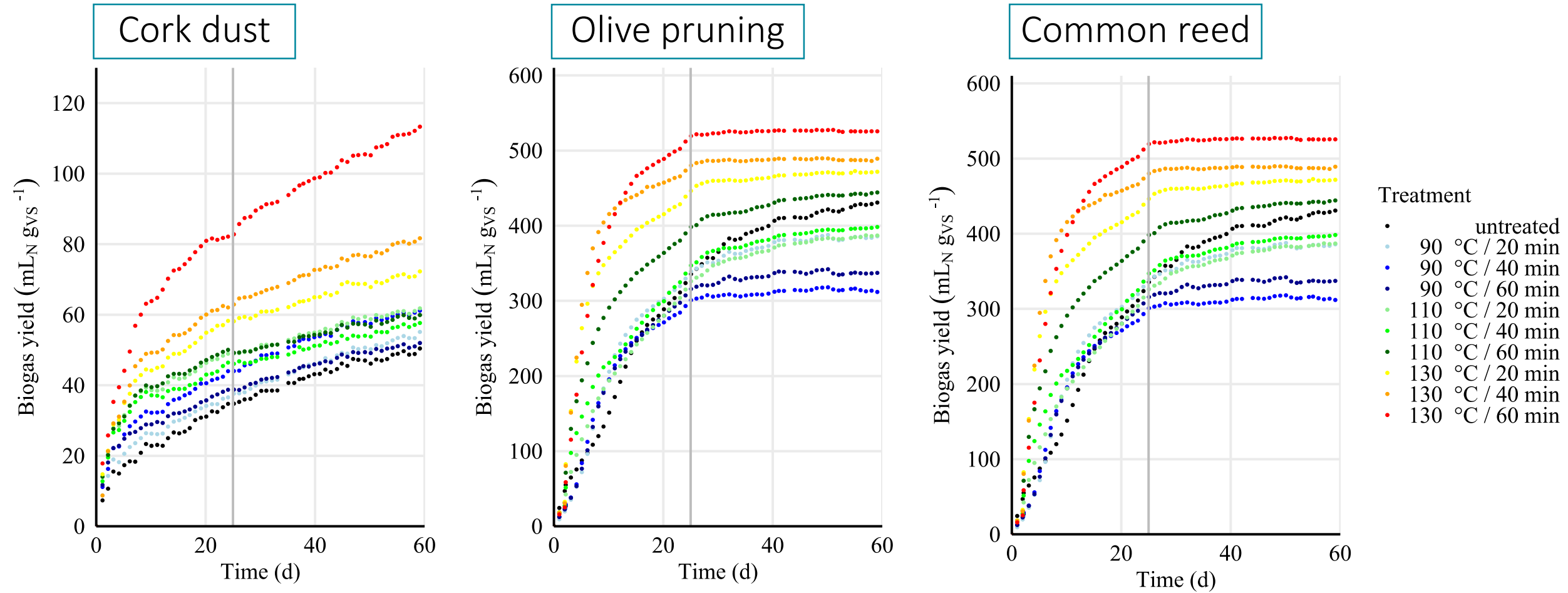
Results - Common reed





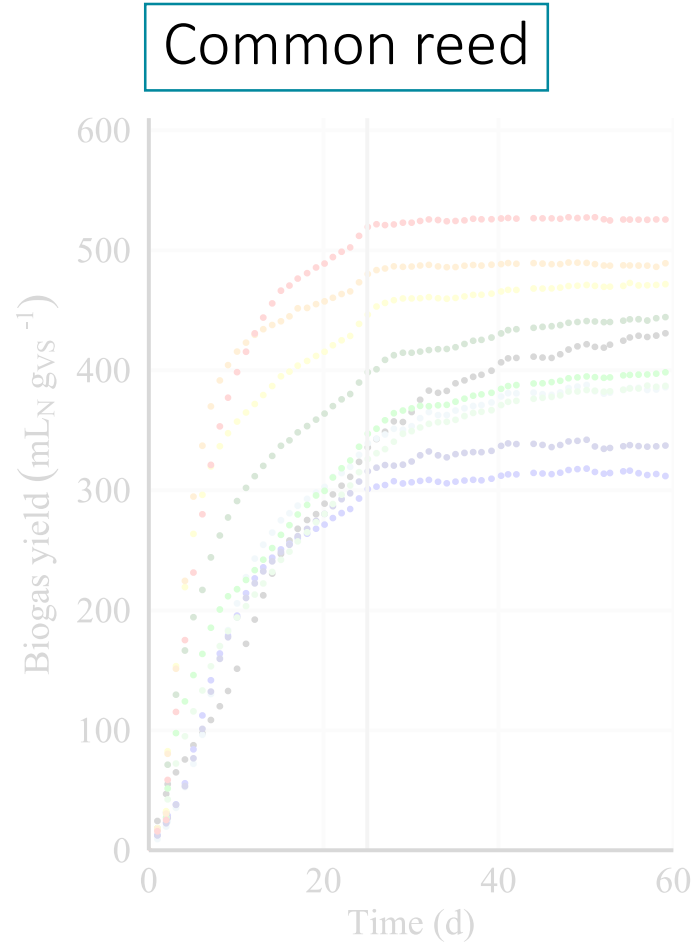
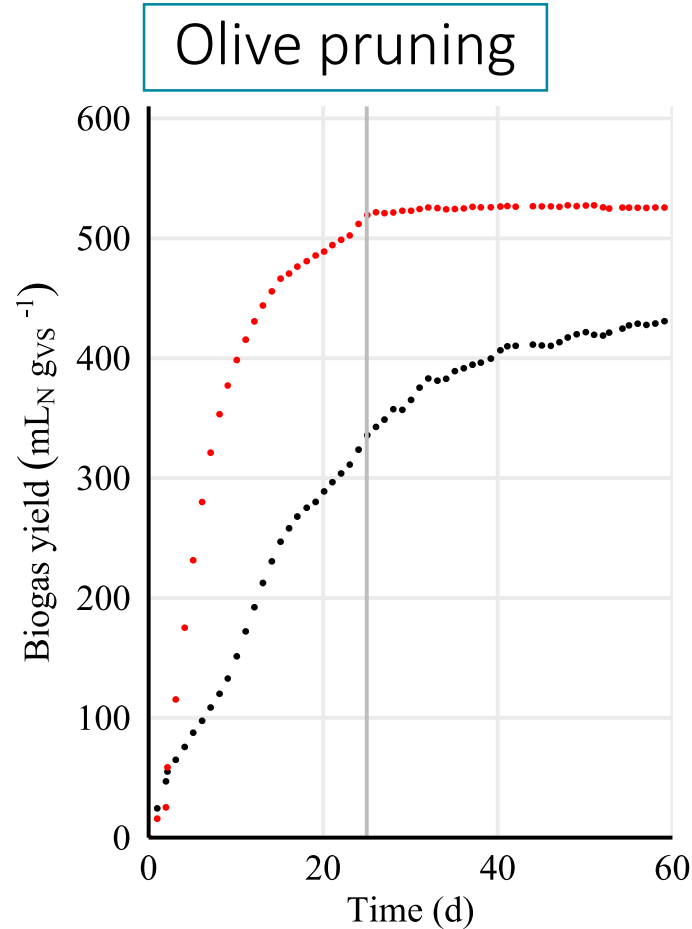
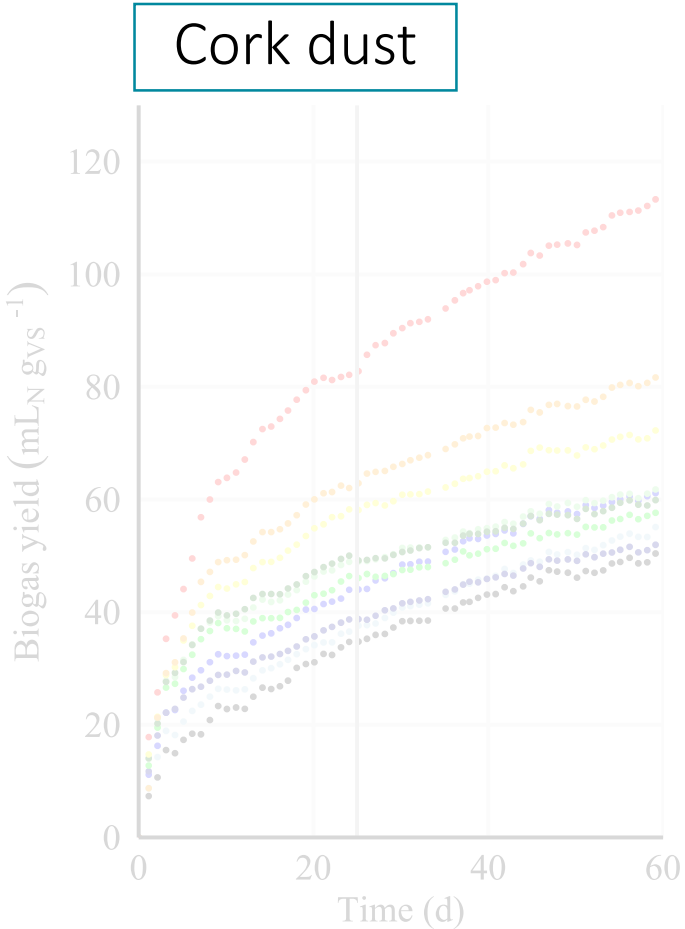
# Anaerobic degradability of DES pre-treated biomass

Results - Changes in degradation kinetics



# Anaerobic degradability of DES pre-treated biomass

Results - Changes in degradation kinetics



- Treatment
- untreated
  - 90 °C / 20 min
  - 90 °C / 40 min
  - 90 °C / 60 min
  - 110 °C / 20 min
  - 110 °C / 40 min
  - 110 °C / 60 min
  - 130 °C / 20 min
  - 130 °C / 40 min
  - 130 °C / 60 min

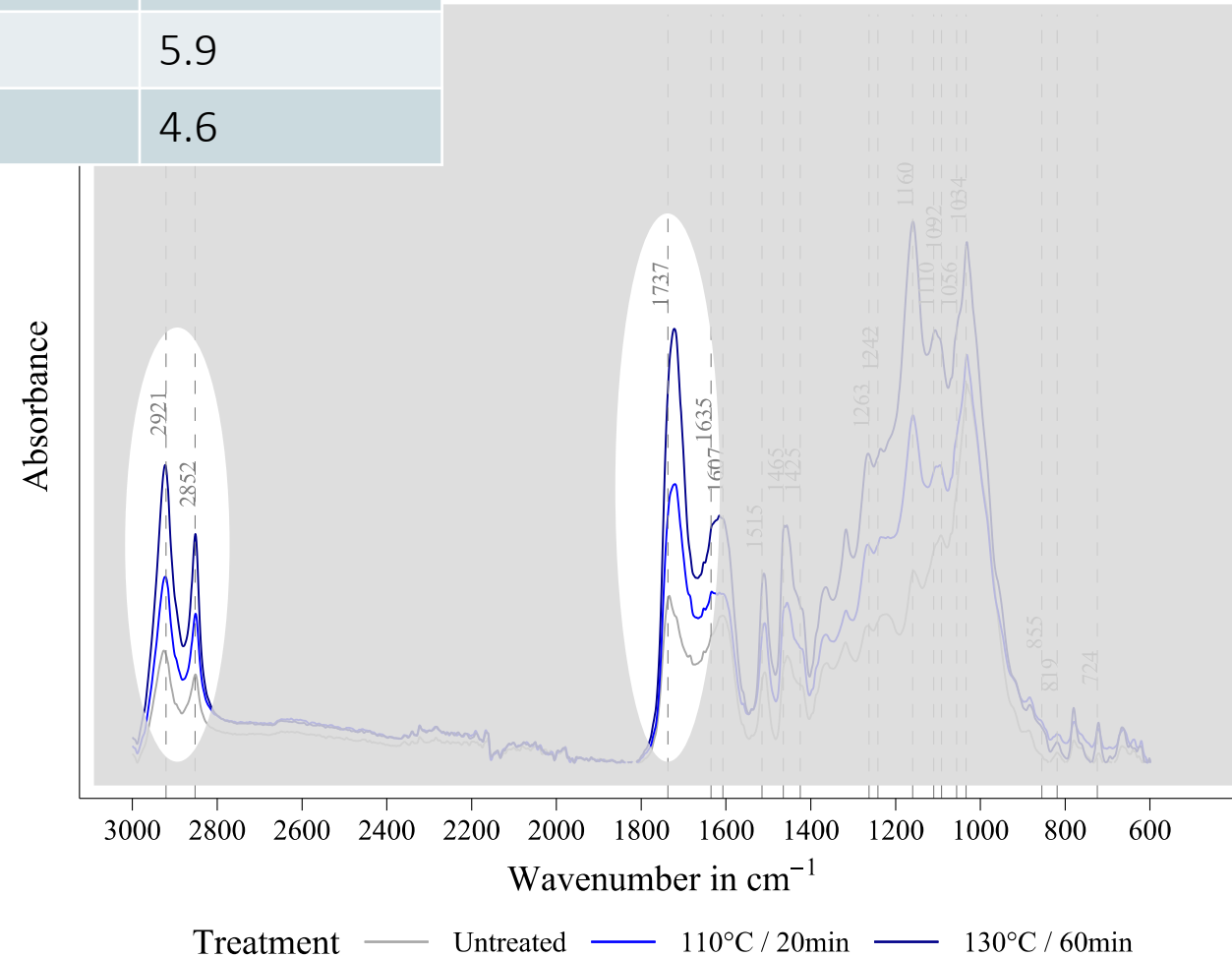
# Anaerobic degradability of DES pre-treated biomass

Results - Cork dust



|                 | Glucose (%) | Lignin (+ suberin %) | Ash (%) |
|-----------------|-------------|----------------------|---------|
| Untreated       | 9.0         | 52.0                 | 2.1     |
| 110 °C – 20 min | 12.6        | 53.5                 | 5.9     |
| 130 °C – 60 min | 17.2        | 56.7                 | 4.6     |

- Increase in suberin



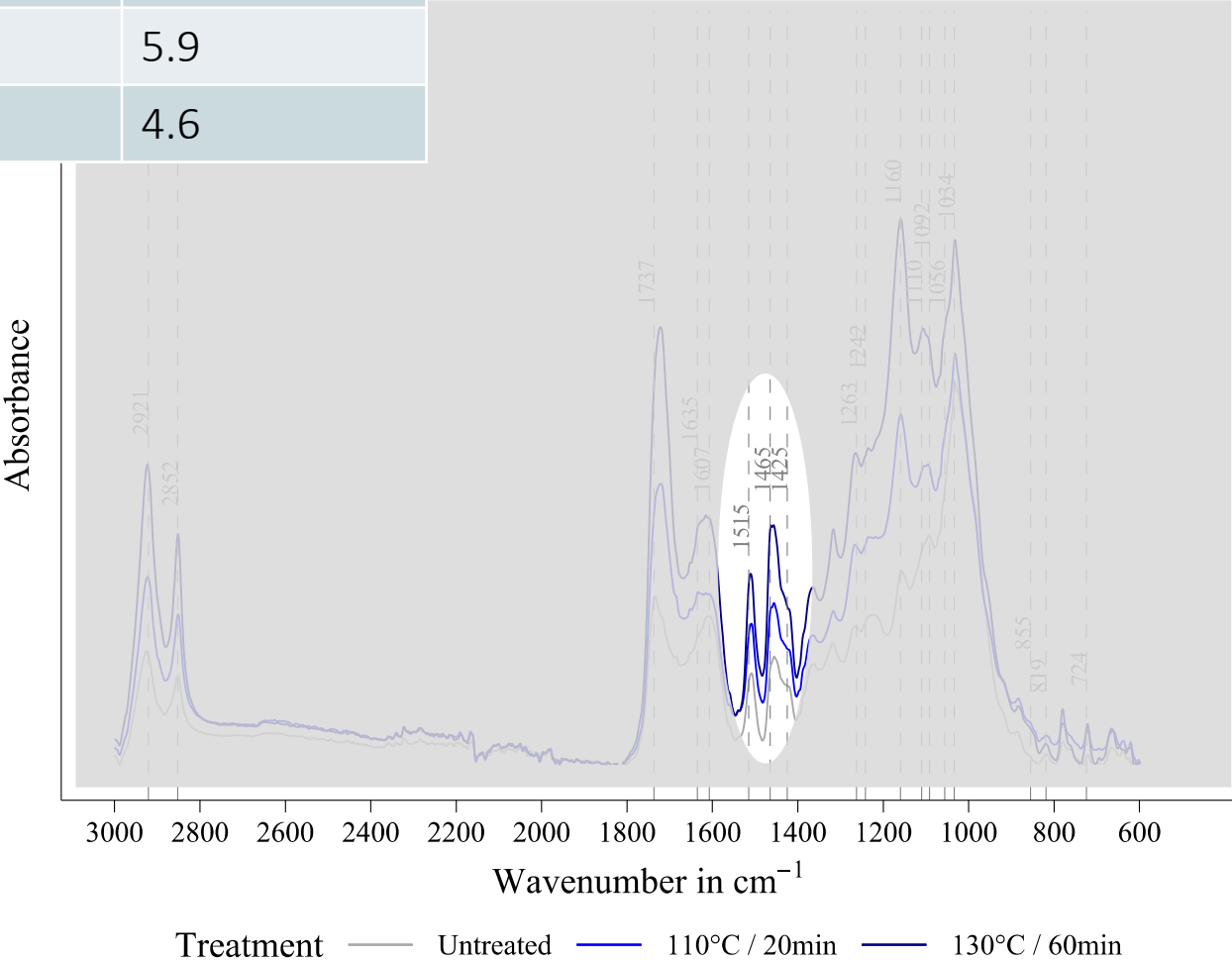
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- Increase in suberin and lignin



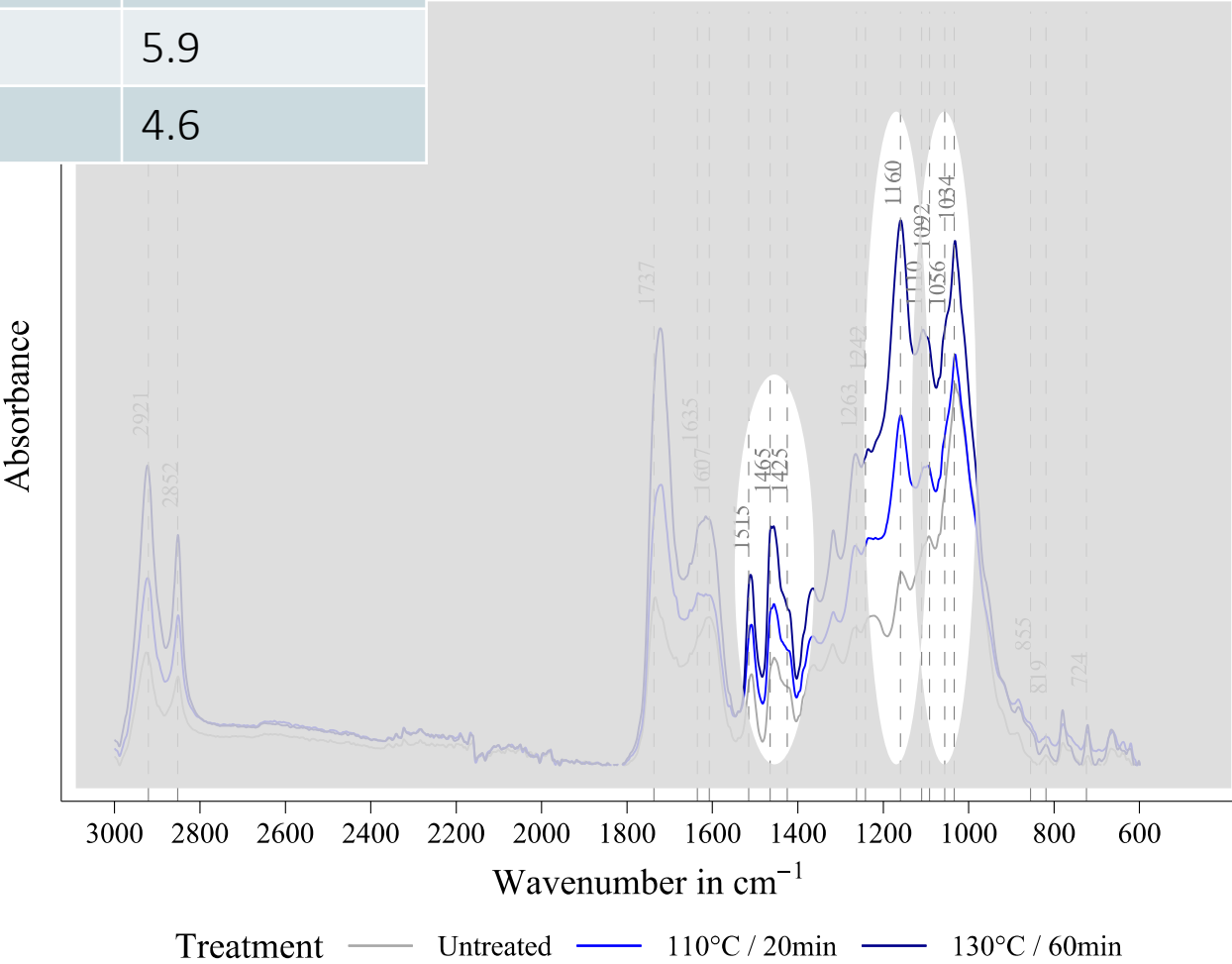
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Results - Cork dust



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- Increase in suberin and lignin
- Increase in glucose



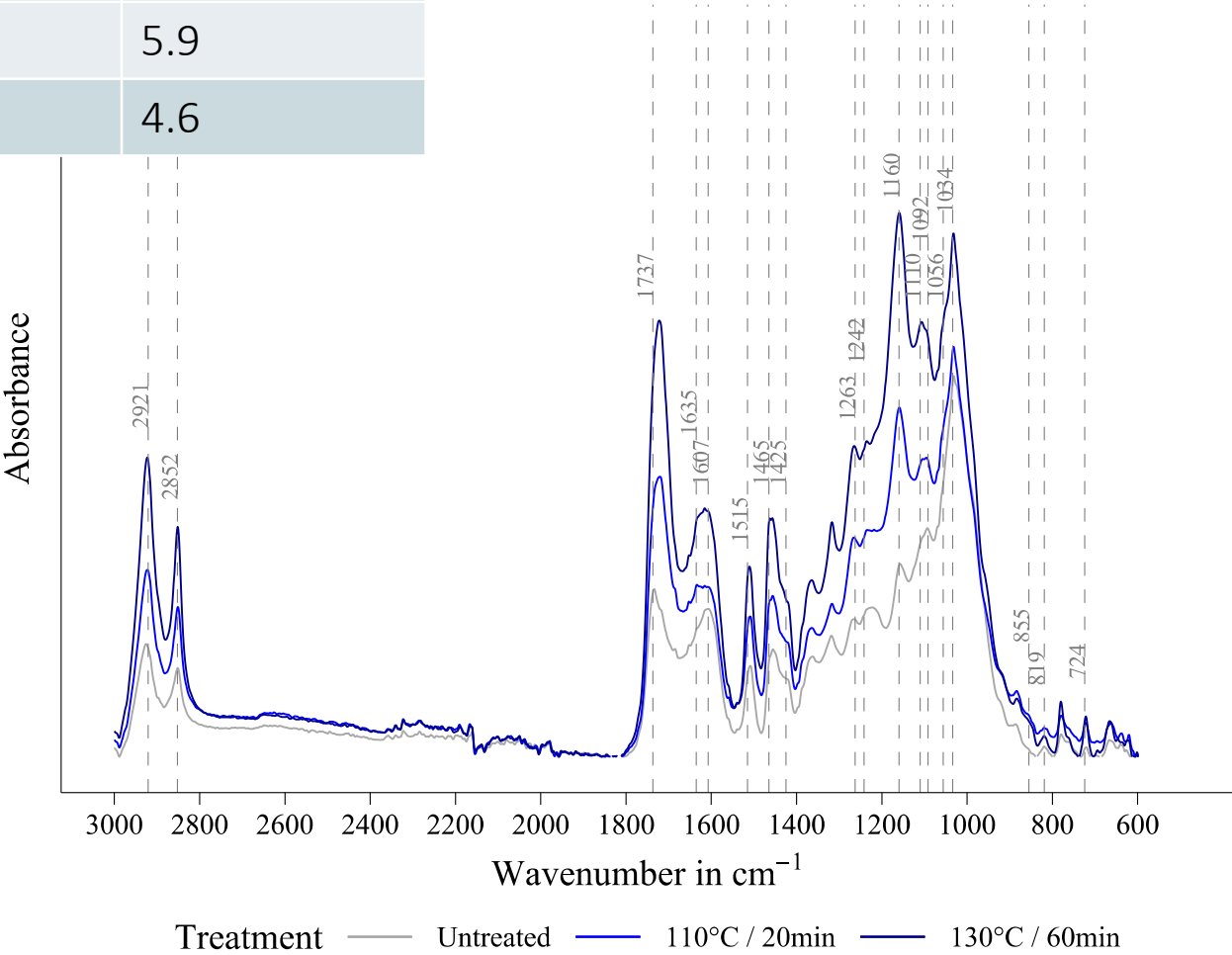
# Anaerobic degradability of DES pre-treated biomass

Results - Cork dust



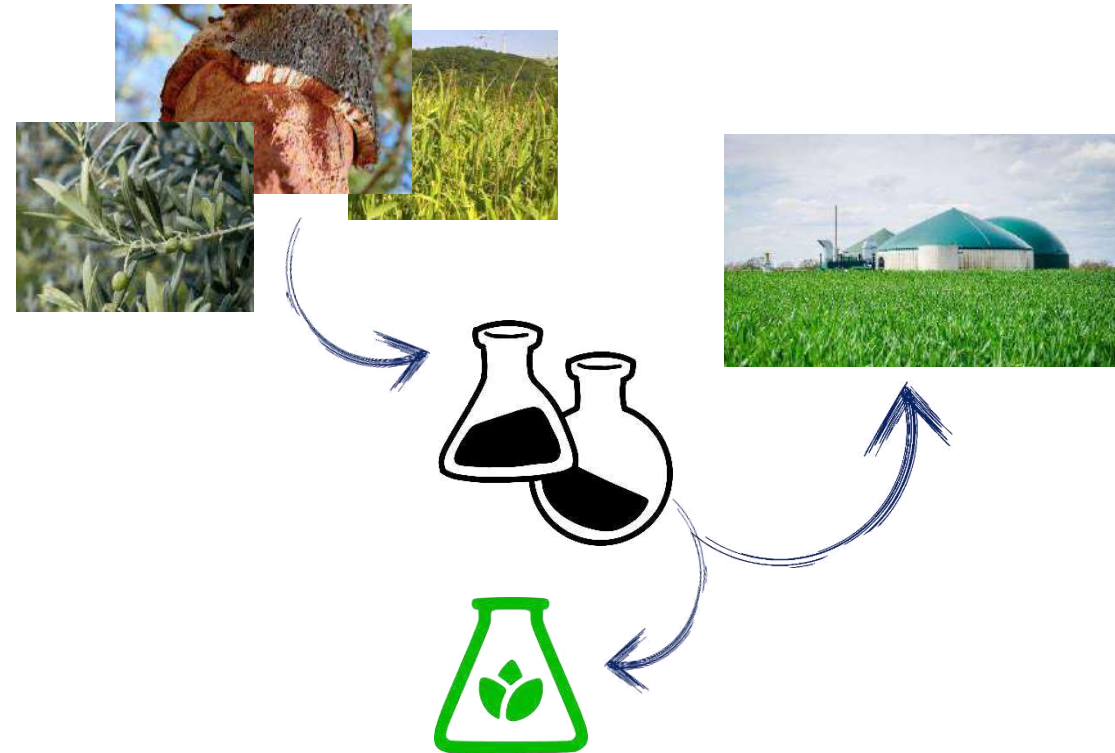
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- Increase in suberin and lignin
- Increase in glucose
- Relative increase of cellulose to lignin ratio



## Conclusion

- Huge differences among investigated biomass streams
- Two major effects on biogas formation
  - Increase of biogas yield
  - Change of degradation kinetics
- Increase associated with increased cellulose:lignin ratio



Thank you for your attention!

Questions?

TUHH IUE



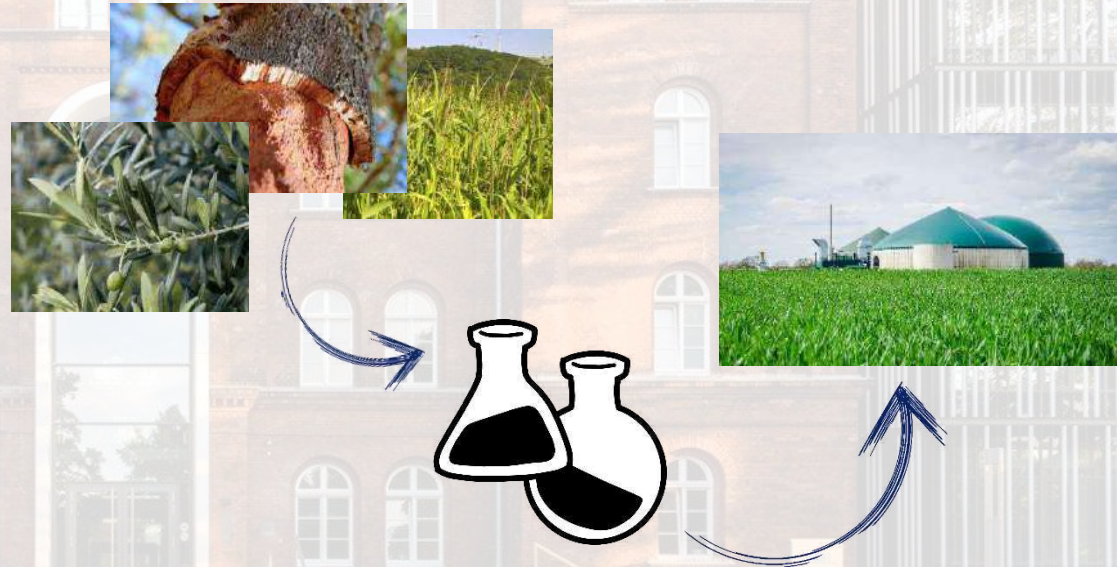
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Thank you for your attention!

Questions?

# Anaerobic degradability of DES pre-treated biomass



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