

IEA Bioenergy Task 42  
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# **BUTANOL PRODUCTION FROM VOLATILE FEEDSTOCKS. DEVELOPMENT OF AN OPTIMIZED BIOPROCESS**

Florian Gattermayr<sup>1,2</sup>, Viktoria Leitner<sup>1</sup>, Christoph Herwig<sup>2</sup>

<sup>1</sup>Wood K Plus, Area Wood Chemistry and Biotechnology, Linz, Austria

<sup>2</sup>Vienna University of Technology, Institute of Chemical Engineering, Vienna, Austria.

# Combined Agro-Forest Biorefinery

## Overall goal

“Utilise a multifeedstock biorefinery process to efficiently convert lignocellulosic waste streams into high value-added chemicals such as butanol.”

# Multifeedstock biorefinery – challenges

- Volatile and complex substrates
  - Regional and seasonal variability
  - Homogeneity
  - Quality
  - Inhibitors
- Transport
  - Density of the resource
  - Economy – ecology

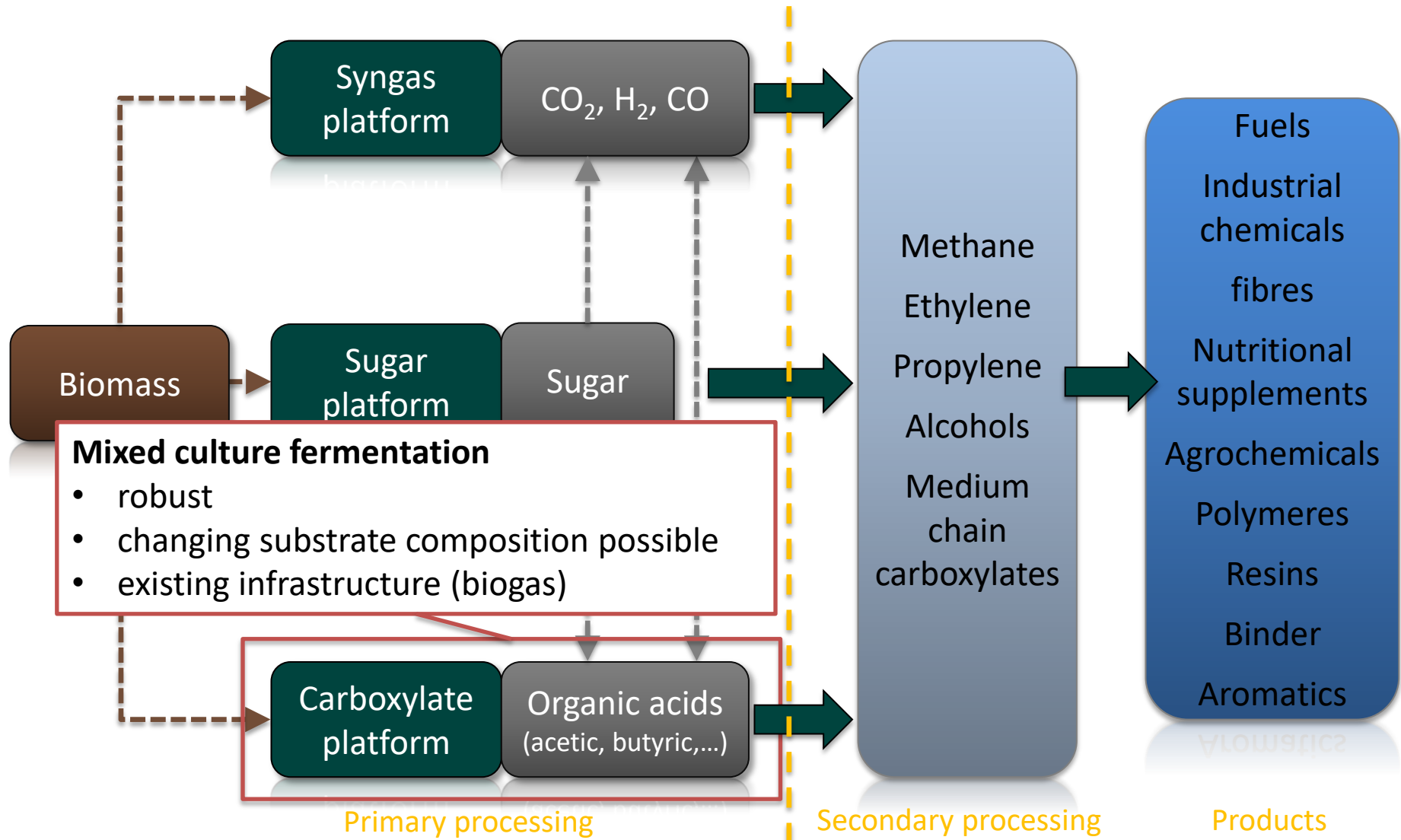


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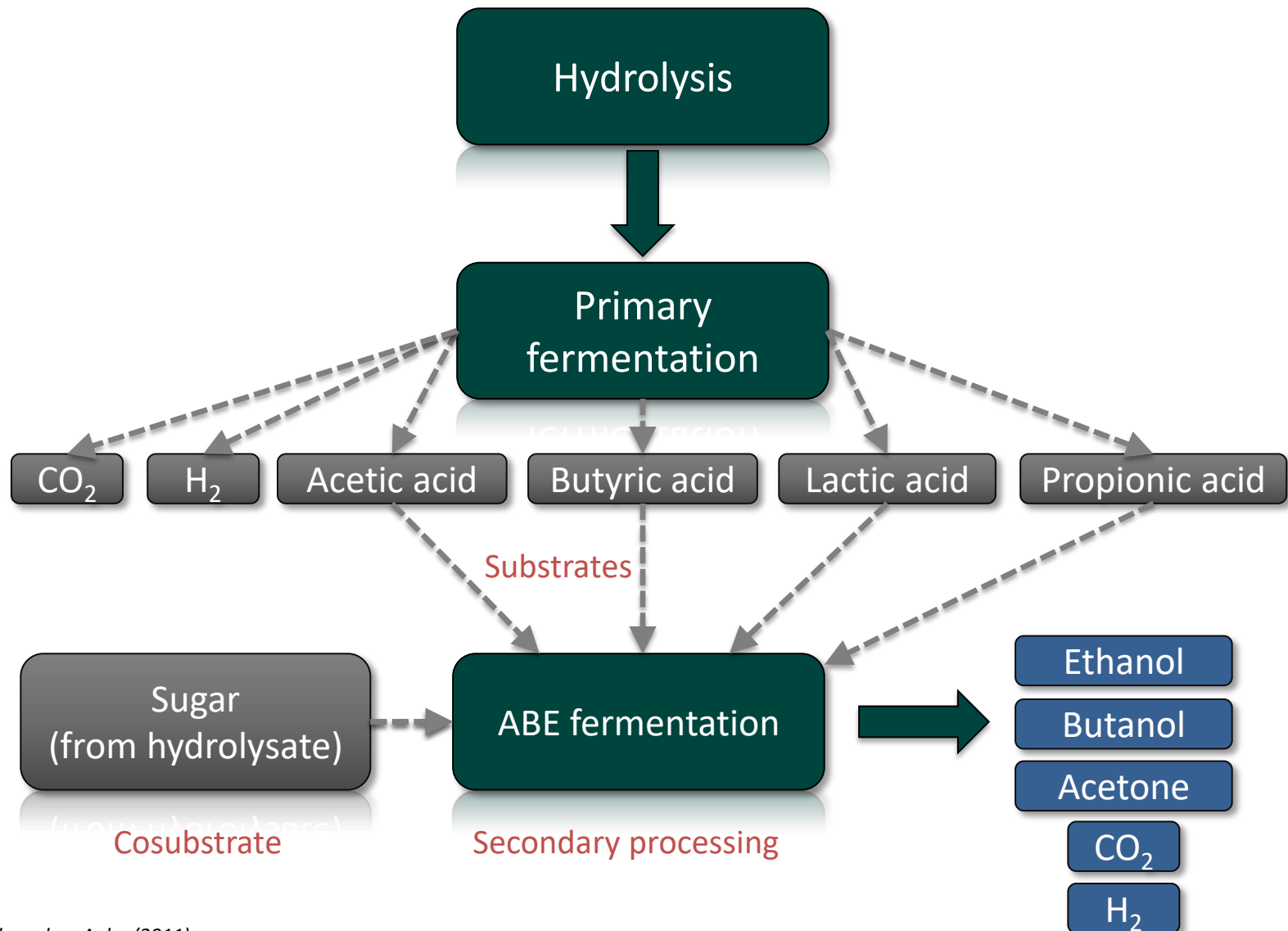


*Robust, flexible and  
decentralised solution*

# Biorefinery concepts - overview



# Carboxylate platform

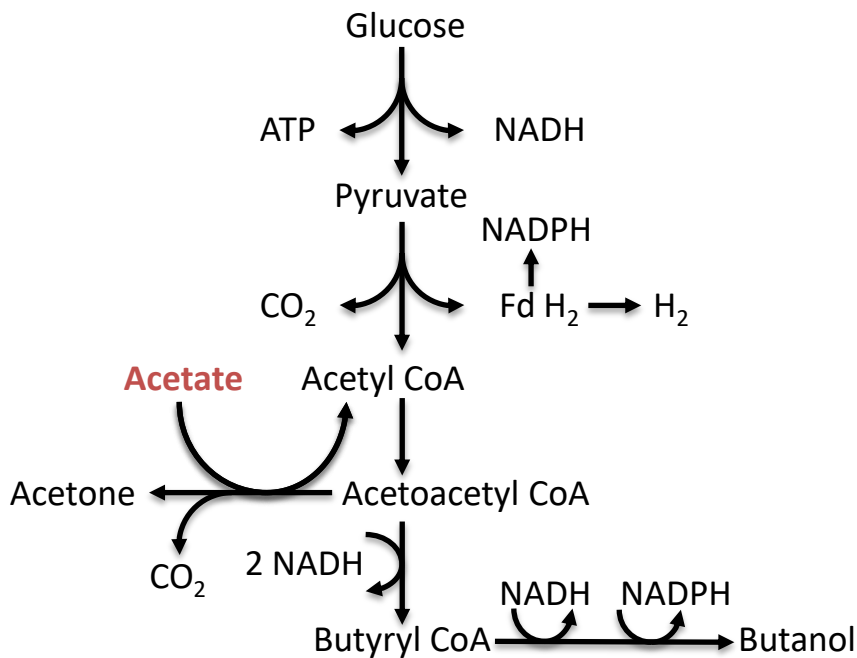


# ABE Fermentation

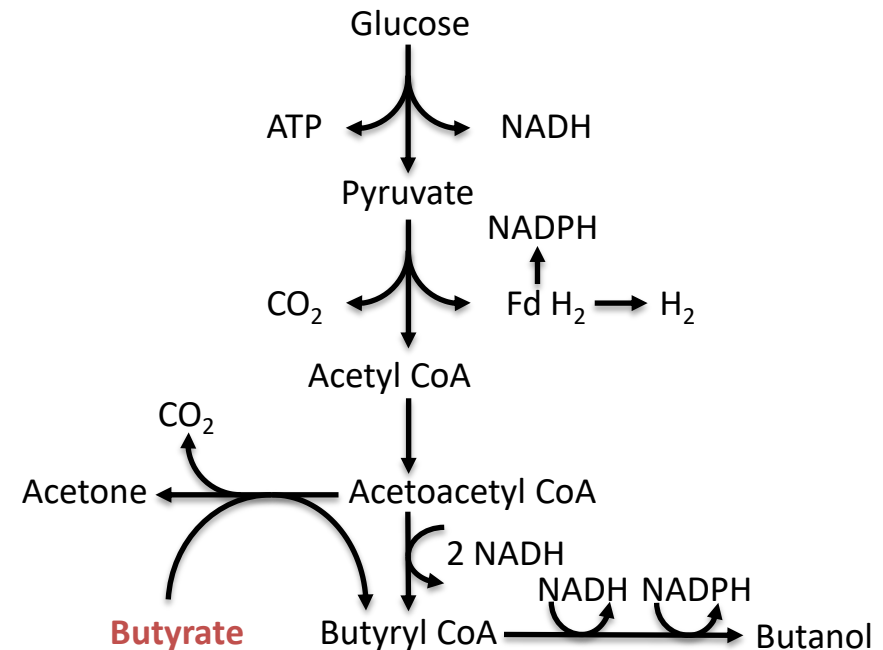
Two characteristic phases:

- Acidogenesis (production of acids)
- Solventogenesis (reutilisation of acids, production of solvents)

## Reutilisation of acetate



## Reutilisation of butyrate



# Research goals

## Goals

- Investigate the influences of acid feed fluctuation on process stability
- Design a model which is able to describe culture response and solvent production

## First steps

- Set up a fermentation system with the capability of getting reliable and consistent data
- Understand the fermentation kinetics through kinetic studies and model validation for varying input feed



# Fermentation experiments

## Objectives

- Specific uptake rates of glucose, xylose, butyric acid and acetic acid during solventogenic phase fermentation

## Why?

- Gain information on robustness of our culture
- Gain information for designing continuous fermentation experiments
- Gain knowledge and deep process platform understanding

## How?

- Pulse experiments in batch mode fermentations
- Pulse experiments in continuous mode fermentations



# Conclusions so far

- Set up a fermentation system for the determination of specific uptake rates
- Showed successful uptake of added butyric and acetic acid and their conversion to solvents
- Acids are only taken up when glucose is present
- Butyric acid seems to be more toxic than acetic acid (2.4 g L<sup>-1</sup> of butyric acid in the fermentation broth resulted in a complete collapse within 2 h)

# Outlook

- Transition to a semi continuous fermentation to conduct more pulse experiments in less time
- Continuous pH stat fermentation on acid feed with media fluctuation simulated
- Design a model which is able to describe culture response and solvent production
- Test prediction capability of model on actual medium based on lignocellulosic waste streams



Thank you  
for your attention!

Contact:  
Kompetenzzentrum Holz GmbH  
Altenberger Straße 69  
A-4040 Linz

E-Mail: [f.gattermayr@kplus-wood.at](mailto:f.gattermayr@kplus-wood.at)  
Homepage: [www.wood-kplus.at](http://www.wood-kplus.at)



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