



# **Industrial deployment of recycled-carbon fermentation: A translational framework for low-emission bioprocesses**

**Tambi KAR, Pieter VAN DER WEEËN**

Galactic R&D



# Galactic Group

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Created in 1994  
**> 30 Years of experience**



Serving  
**> 1.000 Customers**  
In > 75 countries



A dedicated team of **250+ employees**

A rigorous **quality system** to ensure  
safety & high product quality



- 6** Sales office & customer care support locations
- 3** Labs around the world
- 3** Production locations

### Expertise pillars

Green Chemistry  
Industrial Fermentation  
Food Solutions & Applications  
Analytical Development



# Why recycled carbon?

## Current situation

Industrial fermentations with refined sugars



## Opportunity

- ❑ Valorization of industrial side streams
- ❑ Reduced greenhouse gas emissions
- ❑ Improved resource efficiency

Fermentation as a climate-friendly manufacturing platform

## Challenge

Industrial implementation beyond proof-of-concept





From concept to industry

## HOW TO SELECT THE RIGHT RECYCLED CARBON FEEDSTOCK?



### **Carbon concentration**

High carbon productivity

### **Fermentability**

Yield , Productivity

### **Downstream compatibility**

Easy purification, Lower costs

### **Availability, Stability**

Continuous supply, Low variability

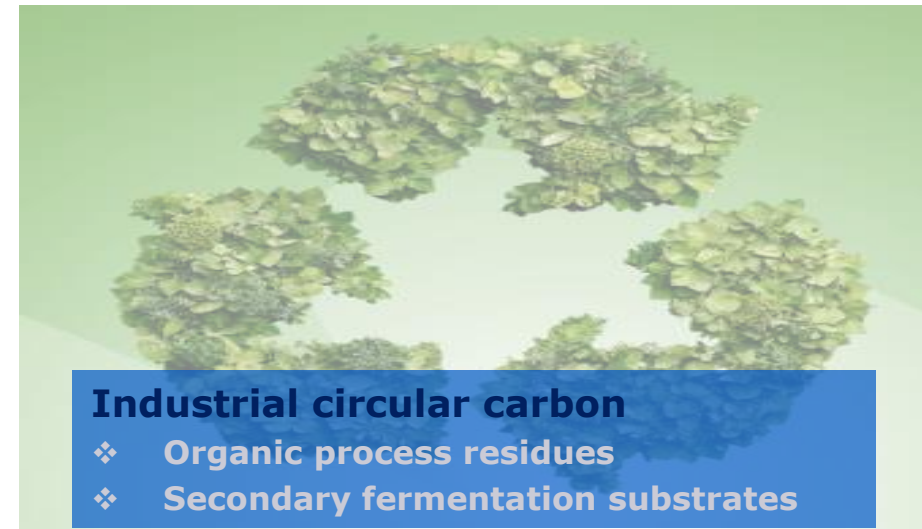
### **Risk contamination**

Robust process reliability

### **Regulatory acceptance**

Compliance, Market access

# Potential recycled carbon sources for industrial fermentation





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# DRIVERS FOR INDUSTRIAL ADOPTION OF RECYCLED CARBON



**Environmental drivers**

**Business drivers**



**Regulatory drivers**



# Case study at Galactic : Whey permeate as a recycled carbon source to produce lactic acid

## ★ Advantages:

- ☐ High carbon content
- ☐ Existing industrial stream
- ☐ Circular economy benefits

## Challenges

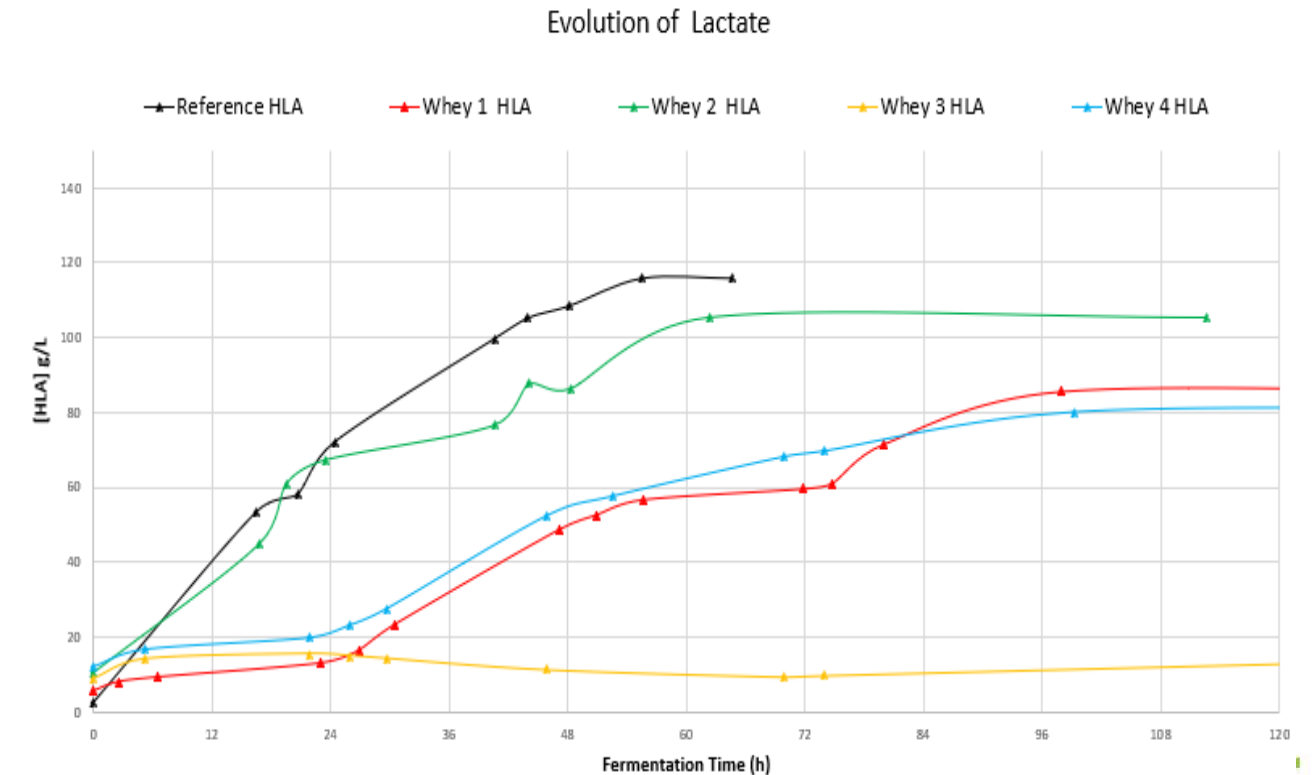
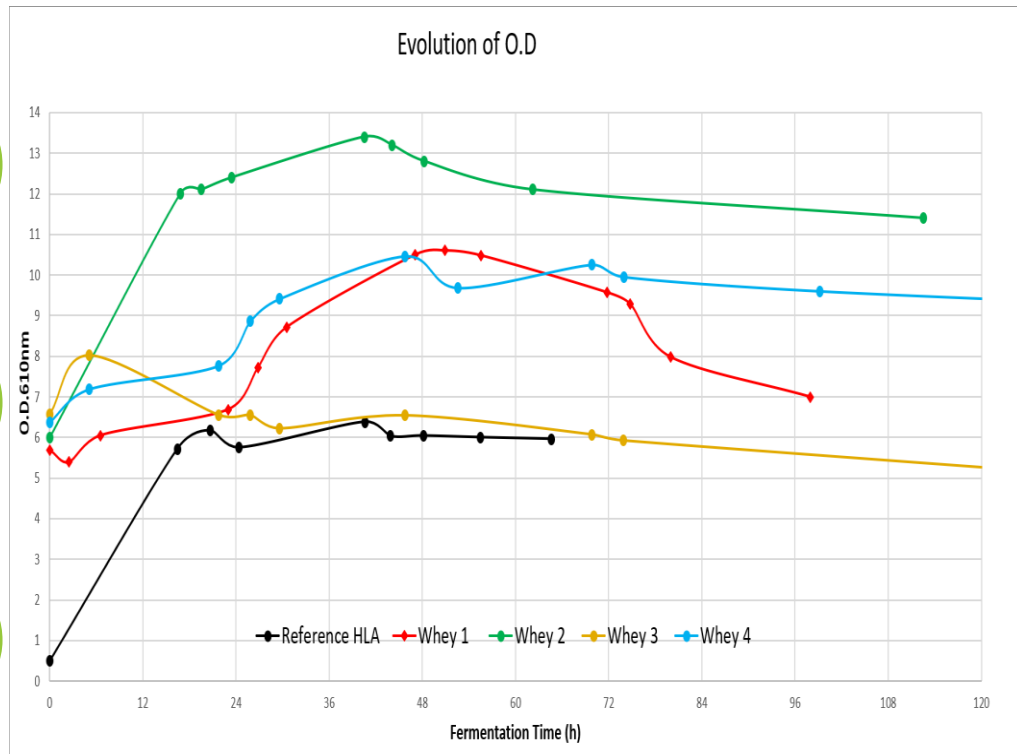
- ☐ Variable composition
- ☐ Nitrogen variability
- ☐ Process adaptation
- ☐ DSP difficulty
- ☐ Contamination risk
- ☐ Economic viability



# Impact on fermentation performance

## Supplier-to-Supplier variability impacts fermentation performance

Same process + Same microorganism + Similar lactose source  $\neq$  Same fermentation performance



# Impact on fermentation performance

**Carbon availability alone does not guarantee successful fermentation performance.**

| Batch     | Generated biomass [OD] | [HLA] g/L | Time (h) | Yield | Productivity |
|-----------|------------------------|-----------|----------|-------|--------------|
| Reference | 6.4                    | 115.8     | 56       | 92.5% | 2.04         |
| Whey 1    | 4.6                    | 85.5      | 98       | 63.1% | 0.80         |
| Whey 2    | 8                      | 105.4     | 63       | 78.9% | 1.59         |
| Whey 3    | 2.2                    | 14.4      | /        | 0%    | 0.0          |
| Whey 4    | 4.6                    | 70.4      | 99       | 52.8% | 0.59         |



# DSP challenges associated with whey-derived feedstocks

- ❑ Lactic acid was recovered through conventional downstream processing steps.
- ❑ During the final concentration step, unexpected precipitation and viscosity increase were observed.



**Industrial deployment requires compatibility across the entire bioprocess, not only during fermentation.**



## Our message

- ❑ The challenge is not the availability of recycled carbon, but it is transforming variable waste streams into reliable industrial feedstocks.
- ❑ Recycled carbon sources are available for lactic acid production with adaptation of both DSP and USP.
- ❑ Development of feedstock pretreatment and standardization strategies to improve process consistency

## What is needed next

- ❑ Stronger collaboration between feedstock suppliers, fermentation experts, and downstream processing specialists.
- ❑ The future of low-emission biomanufacturing will not be built by a single company, but through collaboration across the entire bioeconomy ecosystem



# Close to you

With our global presence



[galactic@lactic.com](mailto:galactic@lactic.com)

