FOODBIOMES

"Sustainable carotenoid synthesis from cheese whey: Evaluation of key fermentation parameters and carotenoid profile using two novel *Rhodosporidium kratochvilovae* strains"

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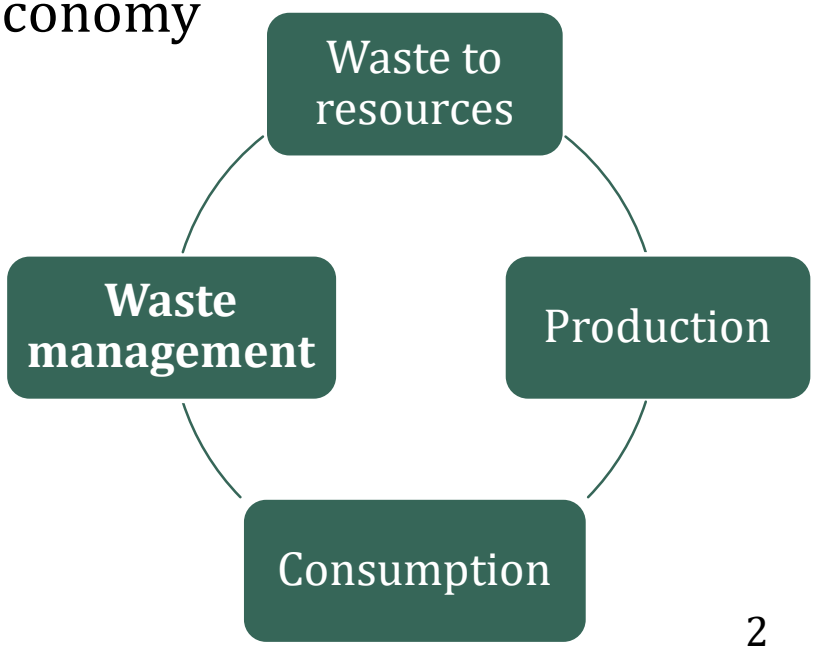
Renewable resources: the key of Circular Economy

From linear economy

To a **circular** economy



28.7%
reduction of food waste in 2020 (vs.2016)

Target: 50%
by 2025

Renewable resources: the key of Circular Economy

Dairy factory

Dairy products

Dairy by-products (cheese whey)

Resources

Environmental pollution

Waste management

High value- added products

CAROTENOIDS

Production of high value-added compounds: Carotenoids

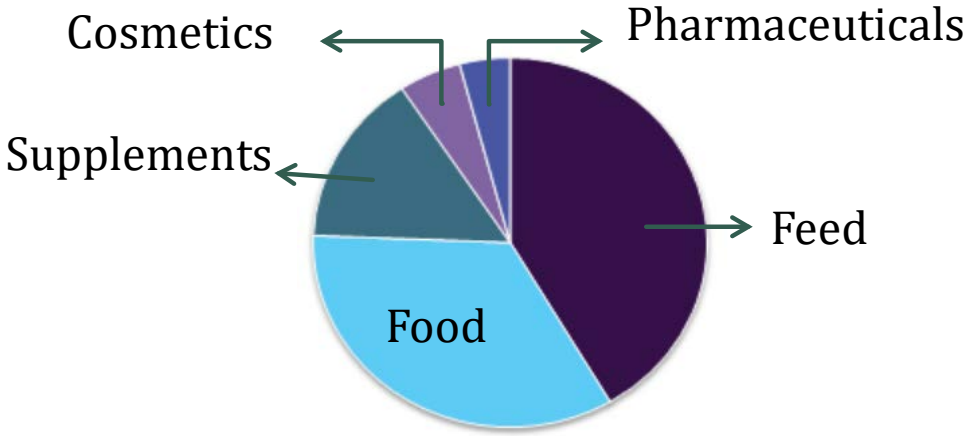
Global Carotenoid Market Value

2018:
1.25 billion
71% synthetic

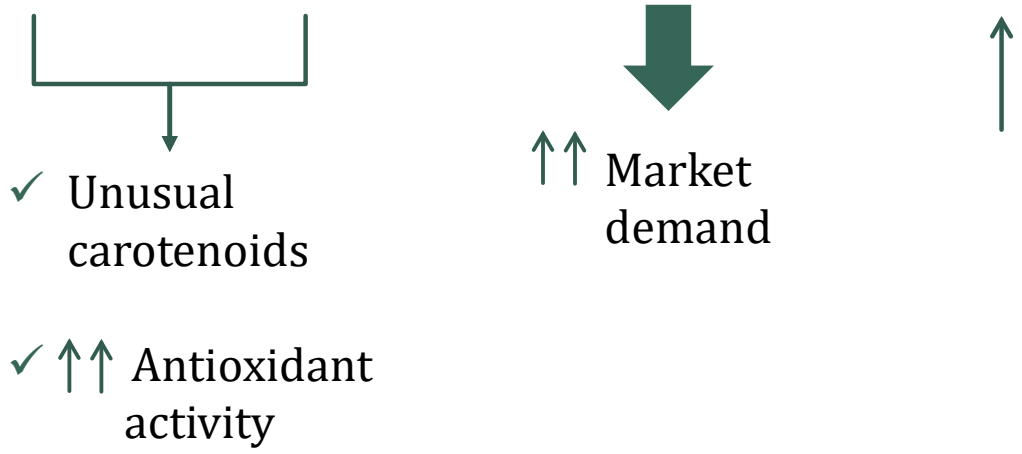
2025:
1.74 billion

2028:
↑ **3.7%**

Shift to **natural carotenoids**



Production of high value-added compounds: Carotenoids



Biotechnological production of carotenoids

Synthetic

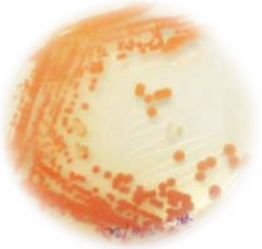
- (-) Only colorants
- (-) Toxic effects
- (-) Generate **waste**

Natural

- (+) Antioxidant
- (+) Vitamin A precursor
- (+) Anti-inflamatory activity

Microbial

- (+) Control cultivation parameters
- (+) ↓Production time
- (+) Wide color range



Biotechnological production of carotenoids by red yeasts

Importance of **red yeasts**

High growth rate

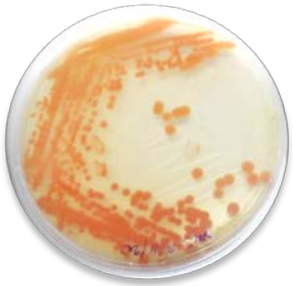
Low cost raw materials

Variety of culture parameters (°C, pH)

Rhodosporidium kratochvilovae

- ✓ Unusual carotenoids
- ✓ Oleaginous

Novel unexplored yeasts



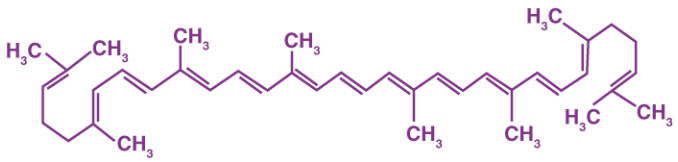
Objectives

Submerged fermentations

Novel yeasts
Rh. kratochvilovae
Y-42, Y-43

Enzymatically hydrolyzed cheese whey

HPLC analysis



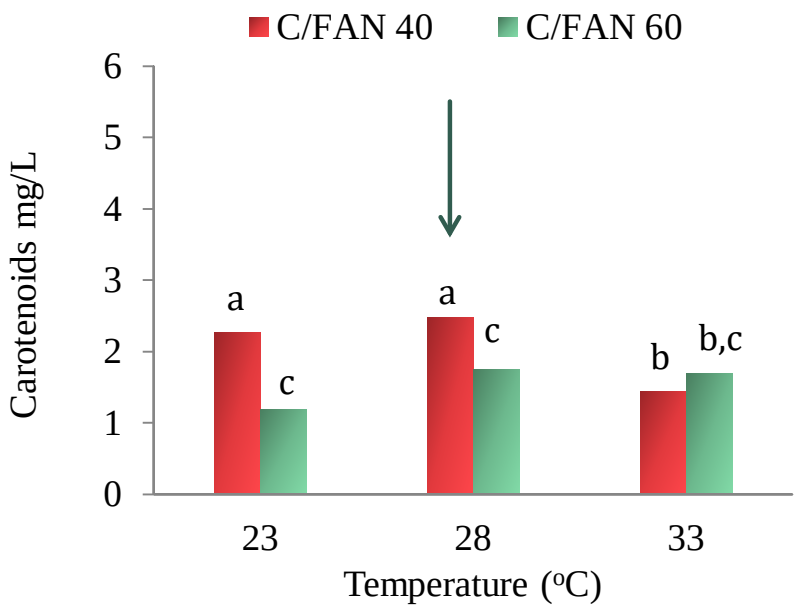
Carotenoids

Optimization:

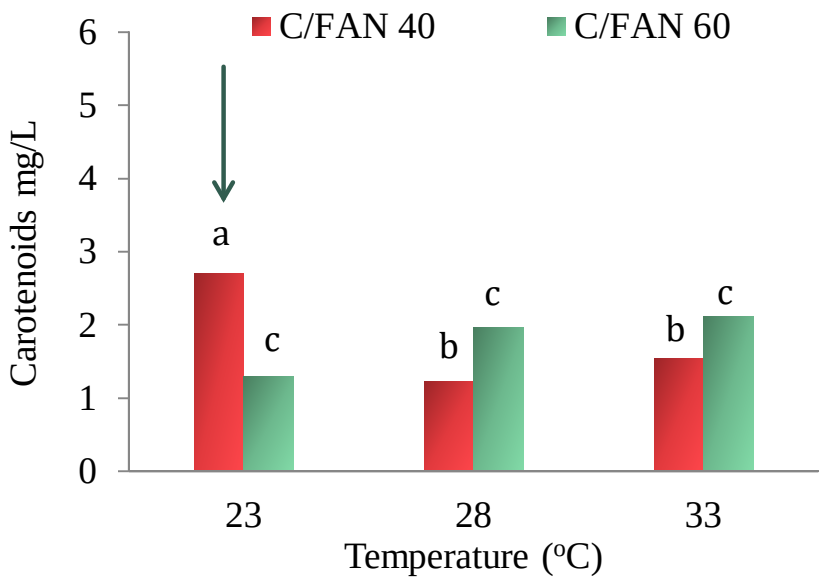
- ✓ C/FAN 40, 60
- ✓ Temperature (23, 28, 33°C)

Effect of C/FAN & temperature

Rh. kratochvilovae **Y-42**

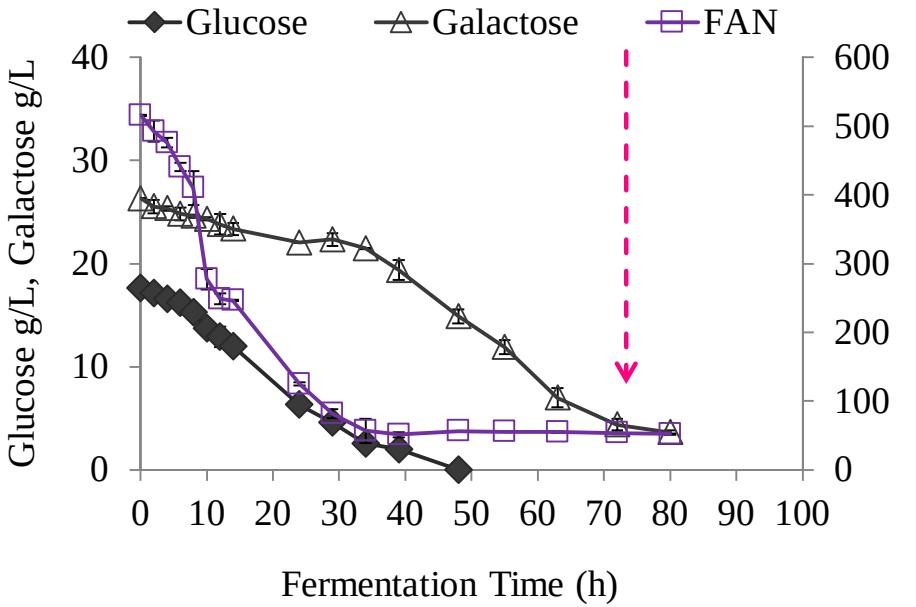


Rh. kratochvilovae **Y-43**



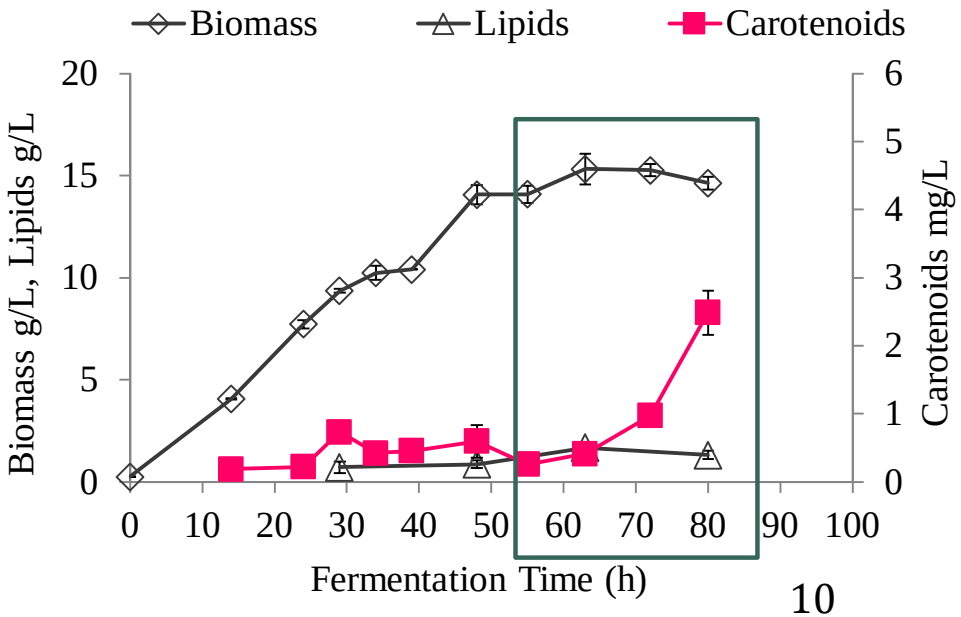
- Optimum incubation temperature → strain- dependent
- Lower C/FAN → higher carotenoid production

Fermentation pattern at optimum culture conditions



Rh. kratochvilovae **Y-42**

Conditions:
C/FAN 40
28 °C

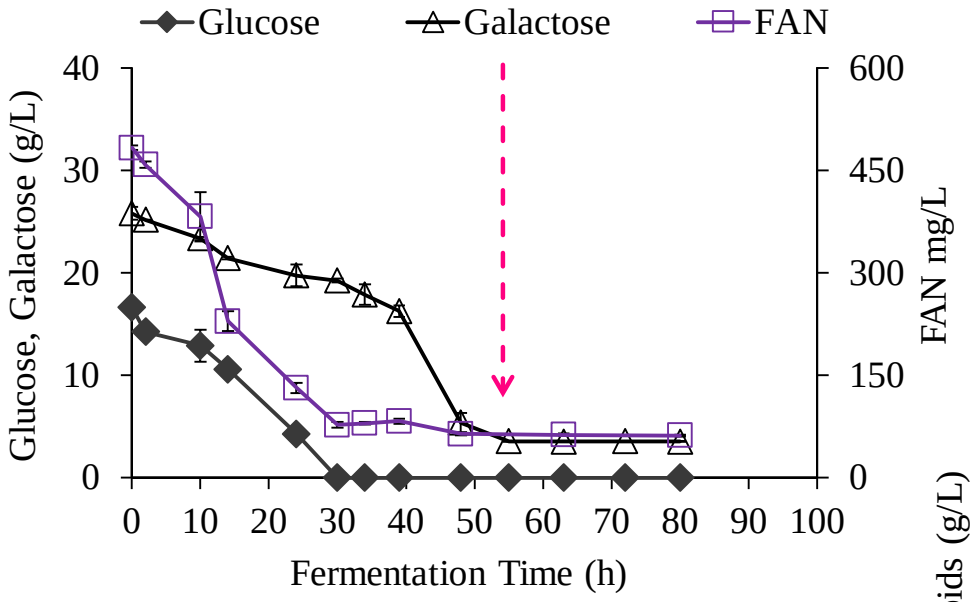


Total biomass: 15.3 g/L

Max carotenoid production:

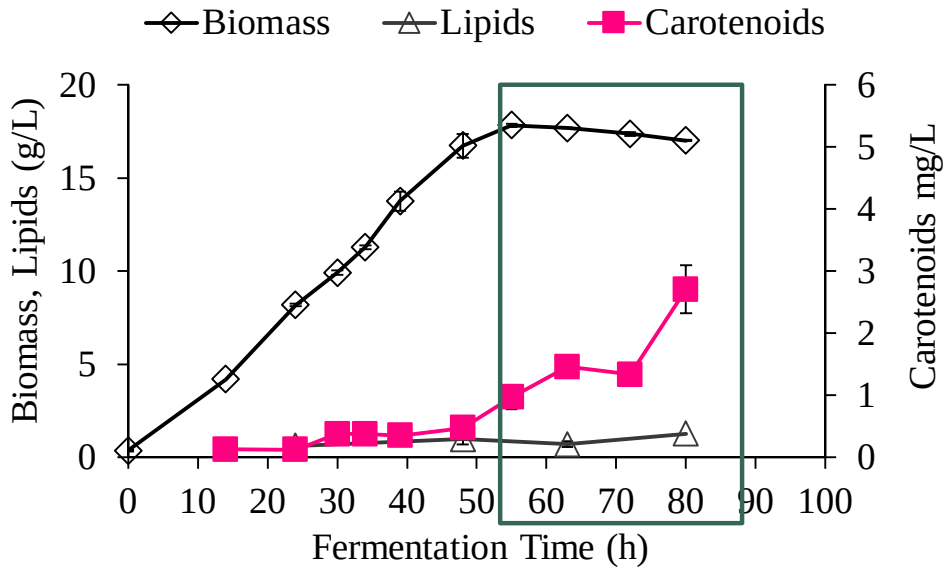
2.5 mg/L

Fermentation pattern at optimum culture conditions



Rh. kratochvilovae **Y-43**

Conditions:
C/FAN 40
23 °C



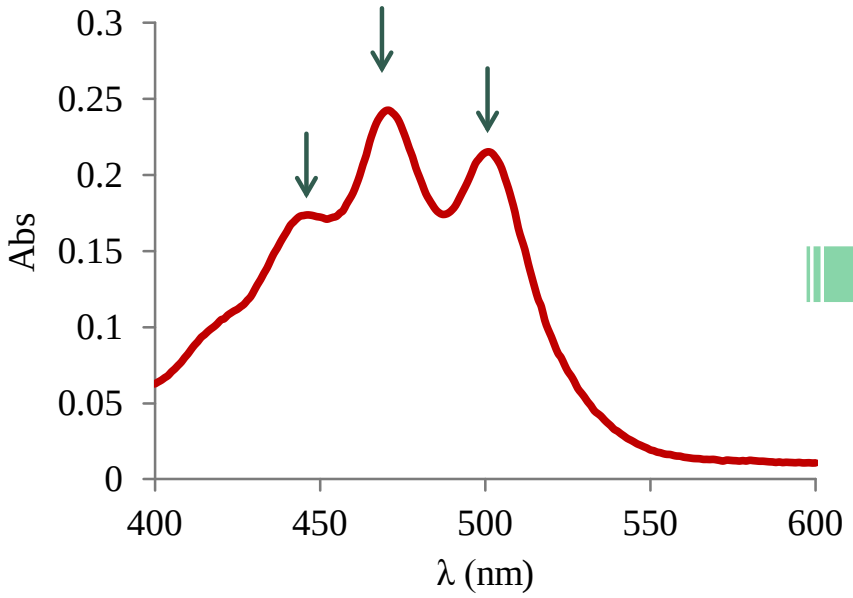
Total biomass: 17.8 g/L

Max carotenoid production:

2.7 mg/L

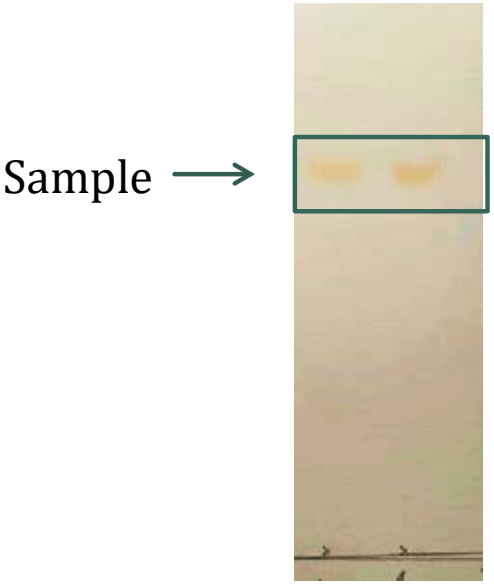
Identification of produced carotenoids

Spectrophotometric analysis



445 nm
470 nm
502 nm
→ Lycopene

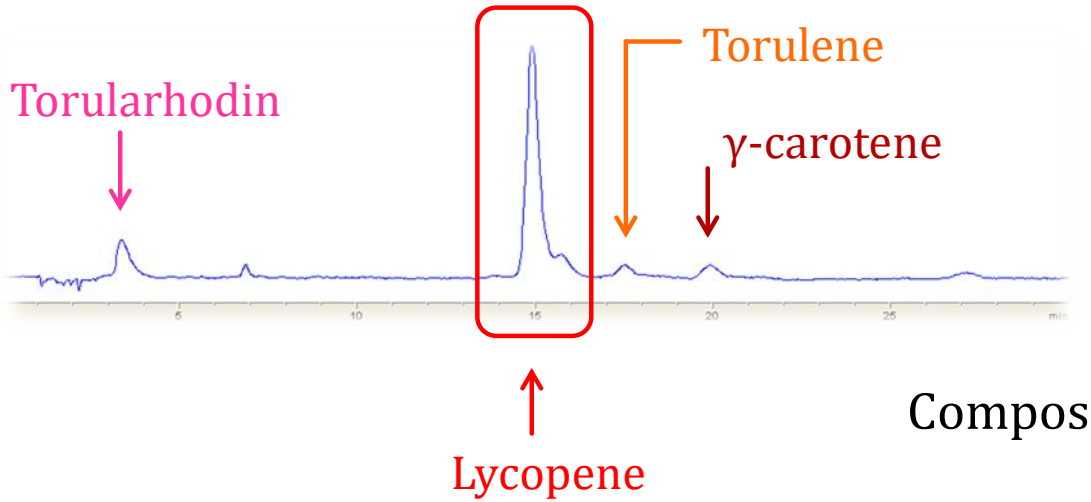
TLC analysis



Similar Rf : 0.75
Developing Solvents → Acetone: Hexane (3:7)

Identification of produced carotenoids: HPLC analysis

HPLC- DAD analysis



Lycopene: **95-98%** of produced carotenoids

Composition of produced carotenoids

Independent of:

- ✓ Culture conditions
- ✓ Strain

Conclusions

- Cheese whey ⟶ alternative low-cost fermentation substrate
- Best culture conditions :
  - Y-42 ⟶ C/FAN 40, 28 °C ⟶ **2.5 mg/L** carotenoids
  - Y-43 ⟶ C/FAN 40, 23 °C ⟶ **2.7 mg/L** carotenoids
- Carotenoids **composition** was **independent** of culture conditions
- Bioprocess resulted in **high purity of lycopene**
- Next steps:
  - ✓ Bioreactor fermentations
  - ✓ Green extraction methods

THANK YOU FOR YOUR ATTENTION!

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https://foodbiomes.eu/

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