

Lipids production from microalgae and process optimisation with acoustic filter

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MAIN CONSIDERATIONS

ECO-FRIENDLY ECONOMY

Reducing as much as possible the environmental impact of processes and products

- Recycling water, carbon dioxide and other flows
- Choosing photosynthetic production to extract CO₂ from atmosphere
- Few needs for the microalgae

COMPETITION AGAINST FOSSIL FUELS

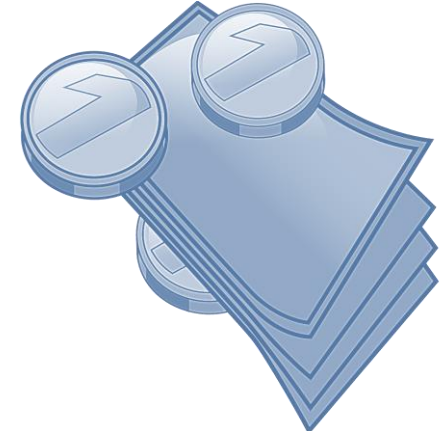
The current economic system with fossil fuels imposes:

- A low price
- A high calorific potential
- A low viscosity compared to fuels from plant

MAIN STEPS

NITROGEN PRIVATION

NITROGEN =
GROWTH

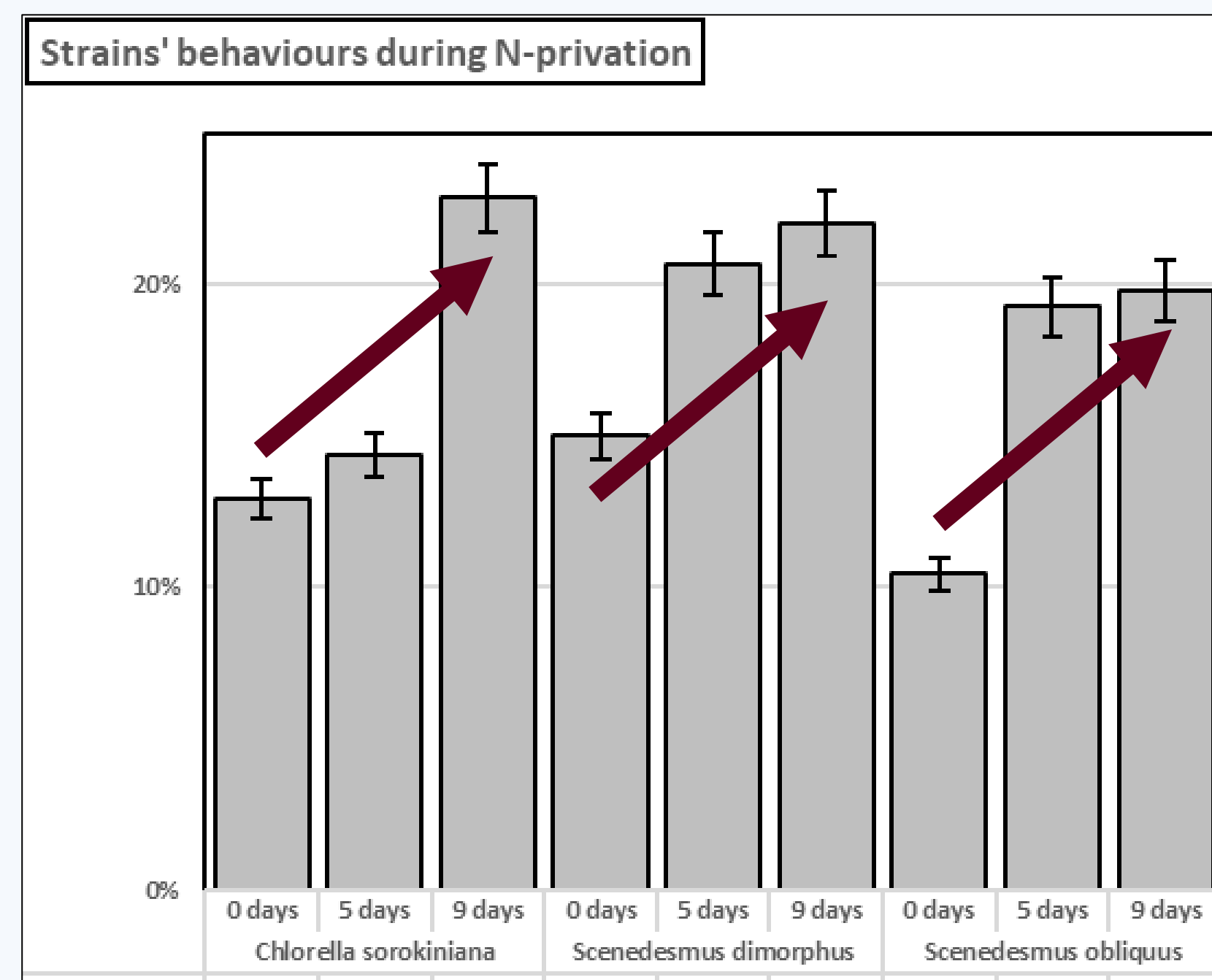


VS



NO NITROGEN =
LIPID ACCUMULATION

⇒ CULTIVATION IN TWO STEPS: GROWTH then LIPID ACCUMULATION



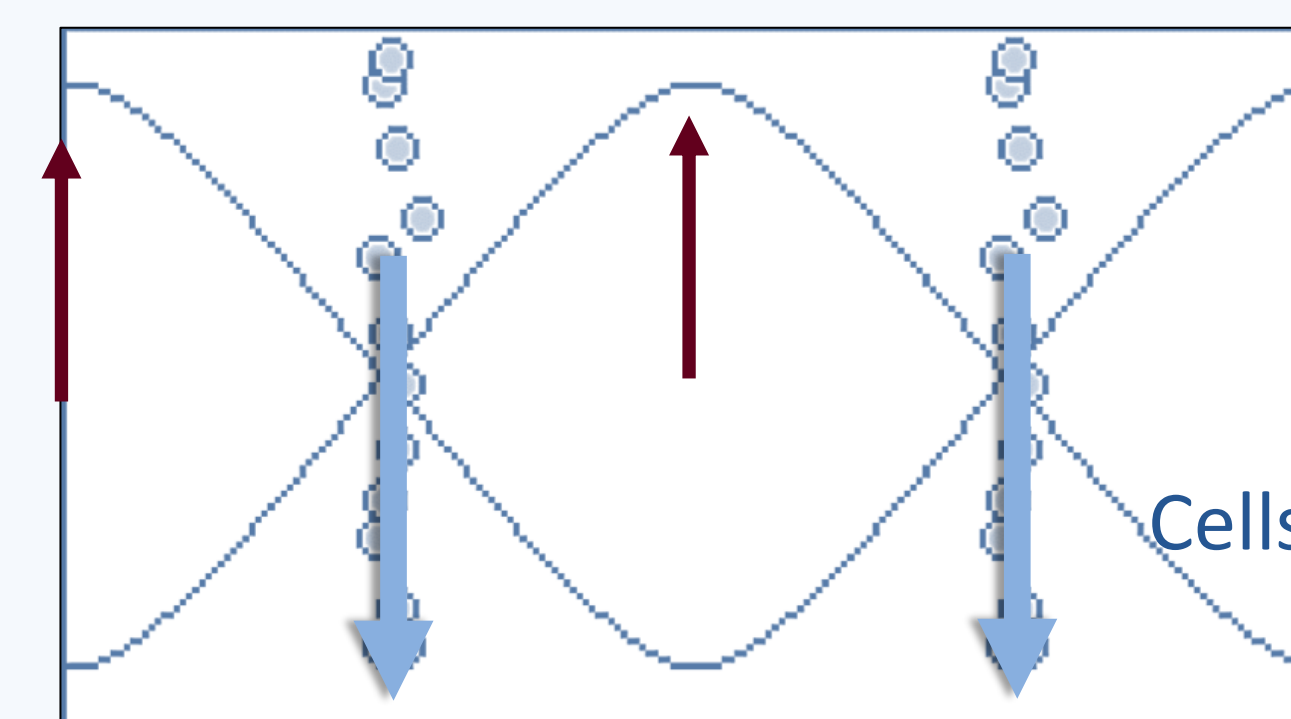
Under various stresses, we can induce accumulation of interesting biochemical compounds like starch. For example, Nitrogen deprivation on freshwater microalgae strains as *Chlorella sorokiniana* or *Scenedesmus dimorphus* can improve lipids content by more than 200% (Adams et al. 2013)

ACOUSTIC FILTER

GENTLE SOUND-INDUCED FILTRATION

- Gentle sedimentation
- Medium recycling
- Medium replacement
- Continuous mode possible

⇒ SOFT SEPARATION OF CELLS AND NITROGEN

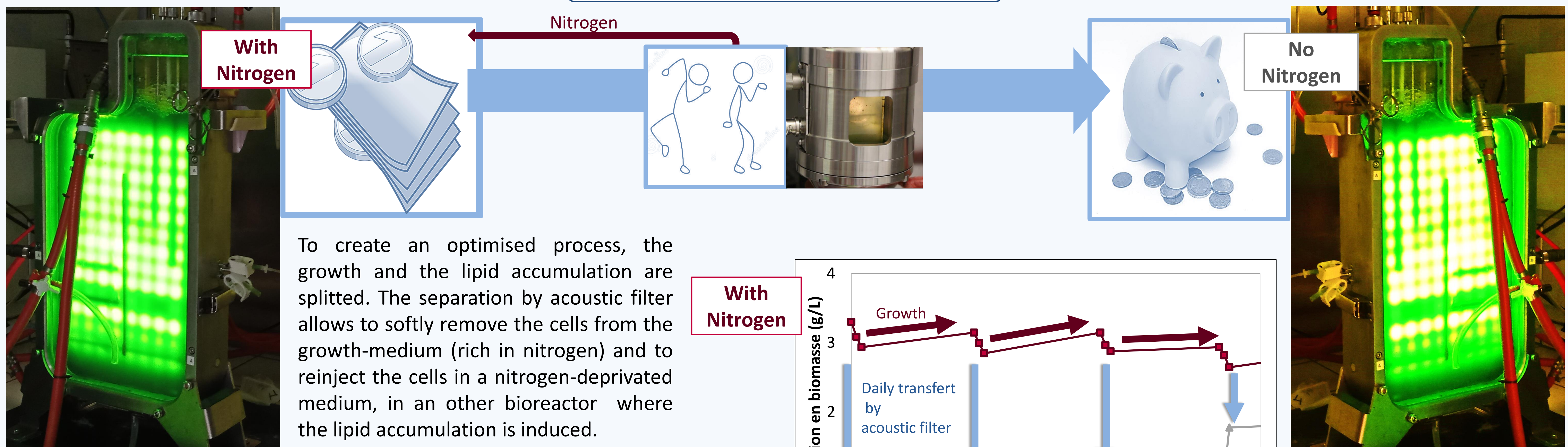


Medium with nitrogen

Cells falling by gravitation

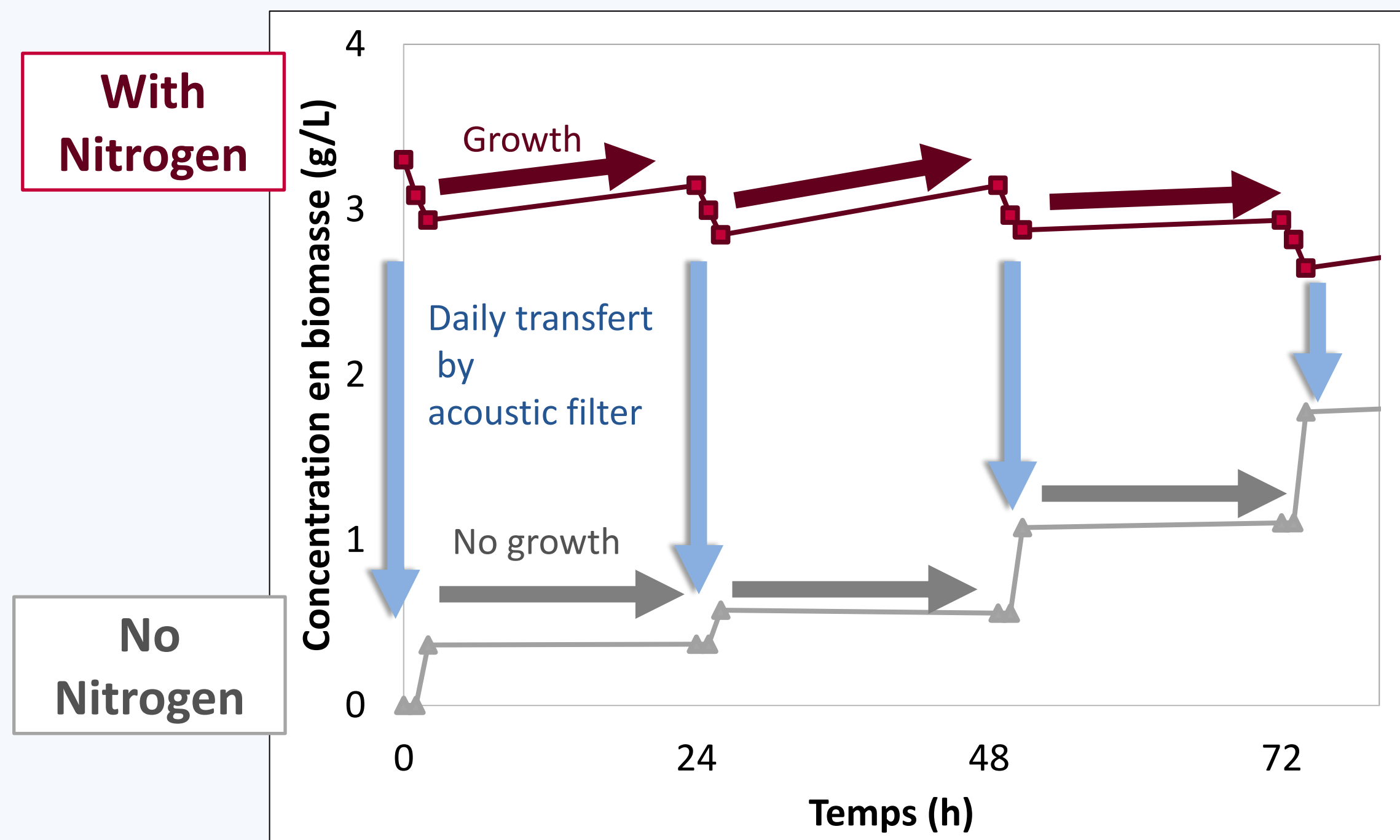
An acoustic settler allows to concentrate cells of a culture by settling it thanks to acoustic waves. It is a soft, temporary and stressless method to aggregate cells and it induces no biofouling. The acoustic settling process work through a cycle of mainly pumping and settling cells from growth culture. At the end of the cycle, the aggregated cells falls at the bottom of the settling chamber are softly pushed back to culture vessel.

TWO-STEPS PROCESS



To create an optimised process, the growth and the lipid accumulation are splitted. The separation by acoustic filter allows to softly remove the cells from the growth-medium (rich in nitrogen) and to reinject the cells in a nitrogen-deprived medium, in an other bioreactor where the lipid accumulation is induced.

In this two-steps process, the growth phase and the accumulation phase can be optimised separately, and so with the possibility to have very different conditions (light intensity, pH, nutrients concentrations, etc.). The separation process allows also to recycle the nitrogen-rich medium by reinjecting it into the growth phase.



BULLET POINTS

- Nitrogen needed for cells growth
- Lipid accumulation is better in a medium without nitrogen
- ⇒ **Growth and lipid accumulation hardly compatible in a one-step process**
- Sonoperfusion allows a soft separation between medium and cells
- Sonoperfusion can work in a continuous process
- ⇒ **Sonoperfusion can be used to transfer the cells from a nitrogen-rich medium to a nitrogen-deprived medium**

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