ACV-ProPABio project

Simplified LCA methodology taking into account scaling up considerations for the development of eco processes in agroindustry and biotechnology


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This project aims to develop a new expertise within regional research teams to take into account environmental issues during research and innovation processes. Thus, introducing life cycle thinking from the research and process design phases, in order to acquire concepts of sustainability and environmental impact. The goal is to provide a simplified LCA methodology adapted to the stage of process development (laboratory scale), adding the scaling up issue to understand the environmental impacts of process in large-scale (pilot and industrial scale). The target zone for this project is agroindustry and biotechnology.

Studying LCA as a tool to include environmental impacts in multicriteria optimization of processes

Case study : ultrasound assisted extraction of polyphenols from a food industrial by-product (chicory ground)

Assays at varied operating conditions :

- Temperature (20-60°C)
- Solvent composition (0-60% ethanol)
- Ultrasonic power (0-100 Watts)
- Extraction time (0-120 min)

Comparative LCA :

Examples with the same target for all assays : obtaining 0.55 L of extract exhibiting 250 μM Trolox antioxidant capacity.

Next steps and perspectives :

- Analysis of LCA results for the whole set of experimental assays
- Analysis of operating parameters impact taking into account both LCA results and process efficiency (extraction yield, productivity...)
- Studying the possibility of proposing a tool for processes multi-criteria optimization including environmental impact (LCA results) in addition to classical yield and energy consumption criteria


Study the impact of process scaling up on LCA results

Case study : production of carrot soup

Small scale : 1 bottle Industrial scale : n bottles

Impact on LCA results ?

LCA results for a large scale production (100 bottles) :

Hotpoints : - Production - Packaging - Raw materials

- Paths of potential improvements in the frame of an eco design approach

Next steps and perspectives :

- Small scale production (15 bottles) and data inventory
- Small scale LCA
- Comparative study of LCA results at both scales
- Studying the potentialities of estimating LCA results at large scale on the base of LCA results at small scale

1 bottle of carrot soup from a small scale production

1 bottle of carrot soup from a large scale production

Impact on LCA results?

Possibility of estimating LCA results at higher scale? (like processes performances at higher scale can be estimated thanks to process engineering tools)