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BBI JU

Bio Barr

NEW BIO-BASED FOOD PACKAGING MATERIALS WITH ENHANCED BARRIER PROPERTIES

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1. Value Chain Analysis

Main objective:

Understanding how each company along the SC creates value and looking for ways to add more value are critical elements in developing a competitive strategy for the new SC here proposed.

Value chain analysis is a means of evaluating each of the activities in a company's value chain to understand where opportunities for improvement lie.

Conducting a value chain analysis prompts to consider **how each step adds or subtracts value from the product** (in our case, respectively, from feedstock to packaging solution, passing through PHA granules, PHA-based flexible films and functionalised flexible films). This, in turn, can help SC players to realize some form of competitive advantage, such as:

- Cost reduction, by making each activity in the value chain more efficient and, therefore, less expensive;
- Investing more time and resources into activities like research and development, design, or marketing that can help the product stand out

1. Value Chain Analysis

Method: The applied Value Chain Analysis analytical framework is based on the structure of the innovative FAO method (Bellù, 2013)

The Value Chain Analysis methodology

1. Mapping the Biobarr Value Chain

Four steps: setting the boundaries, identifying the activities, identifying the agents and quantifying the physical flows.

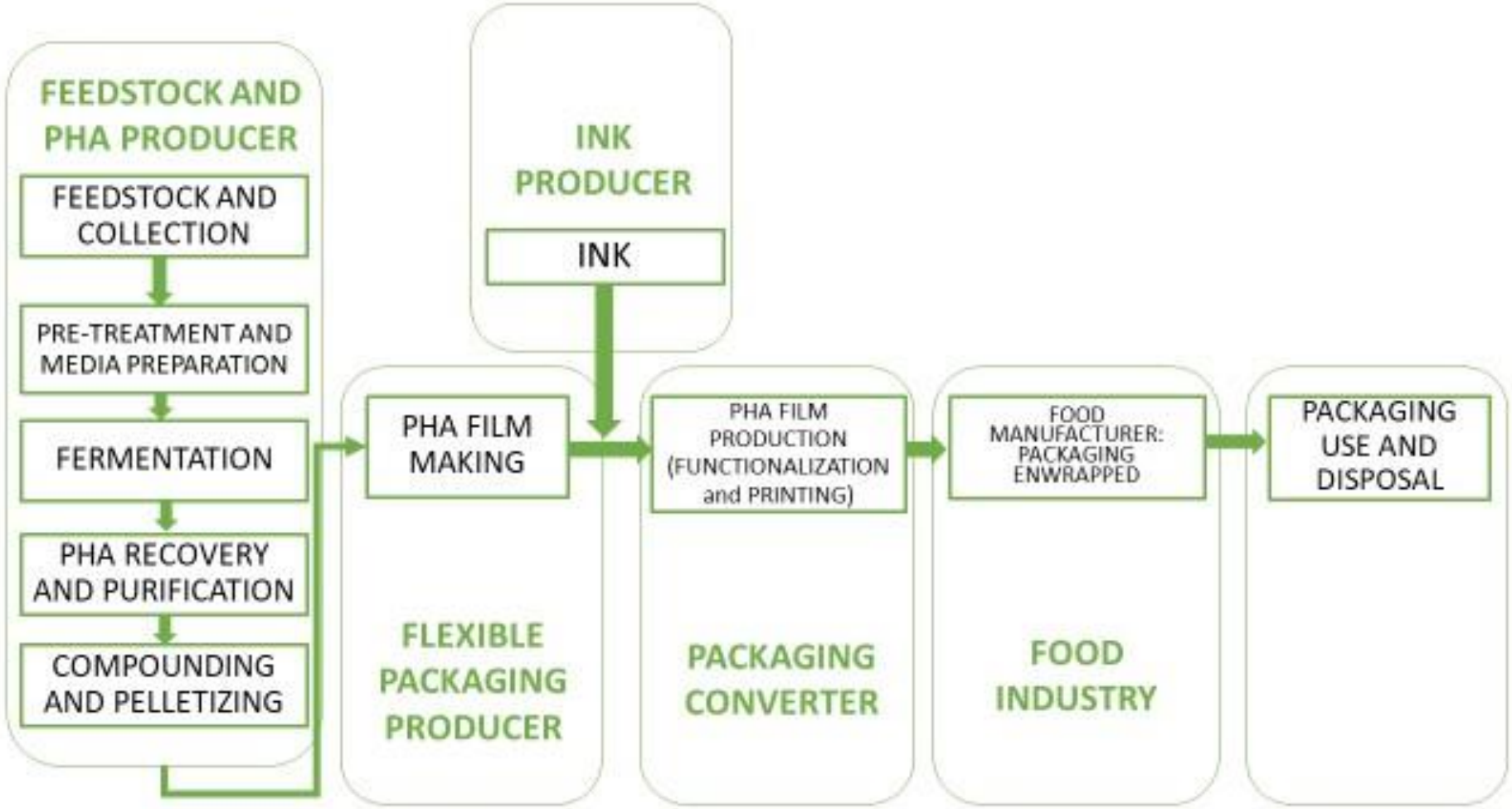
2. Determine the Cost and Value of Activities (Net Value Added, NVA)

Price must, on average, cover costs of inputs purchased from third parties, wages and salaries of employees, and provide an adequate return to company.

3. Identify Opportunities for Competitive Advantage

Once compiled the value chain and understood the cost and value associated with each step, it is possible to analyze it through the lens of whatever competitive advantage the SC is trying to achieve.

1. Value Chain Analysis



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1. Value Chain Analysis

Main findings:

The PHA producer is the actor who generates the higher value in the BioBarr Value Chain. Despite investments in equipment, processes optimisation, on its side it has exclusivity: being there few producers on the market, it can still dictate the price. Obviously the price is related to the production quantity: major demand for production (e.g. tons), lowest price per kg.

The food industry discloses an NVA which is the second largest value, originated by a high value of the output and the possibility to maintain a higher price on the shelf the green characteristics of packaging.

Understood how much feedstock's choice influences the generation of value, which steps could be more efficient (e.g. energy consumption results to be one of the main cost drivers for all agents), how much important are future investments in R&I.

Need to carry out in the future comparative studies changing some parameters (e.g. feedstock) and optimizing processes.

2. Final Conclusions

Very finalised project, with **delimited boundaries.**

MAIN FOCUS on

- ❑ PHA production
- ❑ Investigation of PHA-based (PHB, PHBV) granules processability in flexible films for food packaging applications
- ❑ Investigation of PHA-based films functionalisation

Proof-of-concept (TRL 5)

What was out:

- In depth study on different feedstocks (not the main focus)
- Injection moulding & rigid-semirigid trays – only FLEXIBLE FOOD PACKAGING SOLUTIONS
- Study of End-of-life (EoL) and related waste management (e.g. recyclability) - out of scope in the technical activities, performed some analyses in CBA and LCA
- Investigations on Storage conditions (e.g. in warehouse)

2. Final Conclusions

Challenges:

- Study the right formulation (>yield, optimise processes of fermentation, recovery, purification, compounding)
- Understanding more on PHA granules (mechanical, barrier, choice of additives) and how this step impacts along the SC
- Study the extrusion phase (screw, speed, parameters, film thickness)
- Test processability through existing equipments
- Study new coextrusion, lamination and surface treatments (including corona treatment)
- Study adhesion & printing conditions, sealing and packing

2. Final Conclusions

Recommendations*:

- Feedstock: Pay attention to choose a real ‘waste’ (which has ti be disposed – no alternatives) → this can impact on LCA, CBA, VCA

- Pay attention to additives’ choice (may involve: fragility, bad runnability, migration on the surface, problems in multilayers’ adhesion and/or printability)

2. Final Conclusions

Evidences/Lessons learned*:

- The use of wastes from agri-food sector as feedstock can influence the costs and the added value along the SC
- A strict collaboration among players can optimise the final product
- PHB (PHBV) can be produced, intervening also in costs reduction (e.g. optimisation of energy consumption in the last step of the recovery phase, the drying phase; reduction of chemical consumption in production process)
- PHB (PHBV) can be processed through the typical technologies of thermoplastics

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* According to our studies and conditions: limitations in some studies need to be taken into consideration when some project's results are assessed

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2. Final Conclusions

Evidences/Lessons learned:

- Coextrusion or blending are the best technological solutions for PHB (need to investigate more on the best co-polymer); coextruded films can be then oriented, laminated, or processed in other ways, as is done for single-layer materials
- Lamination is feasible; need to investigate more on the best co-polymer for multilayers
- Suitable for printing, both with traditional inks and with compostable/bio-based ones
- Suitable for food contact
- Compostable and biodegradable (not certified)

2. Final Conclusions

Evidences/Lessons learned:

- LCA is a relevant tool at support of R&I projects and guide product optimization; current LCA on the relatively immature PHA technology showed where to focus to make PHA-based polymers perform better than existing alternatives, but limitations and data gaps need to be considered, as well as that i) process is not optimised yet; ii) there are a lot of margins of improvements for changing the result
- PHB-based films treated with Aluminum or Aluminum oxide are fine for packing fresh fruits/vegetables and potentially also for bakery/dairy products evidencing them a plastic behaviour
- New compostable and bio-based inks are reaching the mkt

2. Final Conclusions

However, what remains to do:

- Need to increase PHA production capacity and related PHA yield (also when scaled up)
- Test also other feedstocks (both under the technical as well as LCA, CBA and VCA point of view)
- Reduce PHA thickness to ~30 μm
- Some more investigations are needed to move towards TRL 7-8 (e.g. improvement of material's fragility; extrusion trials and following steps should be conducted all at industrial scale; coextrusion or blending solutions to be investigated)
- Biodegradability: repeating tests using Standard for obtaining certification
- Bio-based ink to be certified Ok Compost!

Thanks for participating!

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