Practice abstract 4

Upcycling of plant-based food side streams using mild processing

Problem

Food side streams have the potential for use in food products but can quickly become non-food grade due to handling, storage, quality deterioration, and microbial spoilage. Upcycling these side streams enhances the sustainability of the food chain. One way to prevent this transition is by processing them directly into sustainable applications like ingredients, food products, or feed. However, the feasibility and economic viability of this approach are not always guaranteed. A major obstacle is the limited stability of fruit and vegetable side streams, in such cases, using stabilizing pre-processing techniques can be a practical alternative.

Solution

The use of mild processing technologies for further processing can result in ingredients with good quality and functionality. Mild processing methods and research on upcycling plant-based side streams aim to preserve natural ingredients, produce high-quality products, and reduce food waste. Understanding upcycling is essential for companies making decisions about food loss and waste. This includes estimating costs, examining material properties, and considering the impact of processing choices, material variations, and uncertainties. The *Processtimator* software tool assists in designing and analyzing upcycling pathways, considering various factors influencing costs and material properties.

Benefits

- o Determine and design potential process routes for converting a side stream into valuable ingredients.
- o Perform mass balance calculations to determine the composition of the end products and estimate their value as feed.
- o Estimate the necessary process resources, costs, and carbon dioxide equivalent footprint.
- o Conduct variation analysis to facilitate optimization and comparison of different scenarios.
- o Provide feasibility analyses and propose process solutions in a report.

Practical recommendation Improving resource use efficiency by upcycling food side streams may improve the sustainability of food chains. The Processtimator aids in selecting the upcycling options that are economic of interest and result in a net positive contribution to sustainability. Furthermore, it provides insight into the factors which influence the potential of upcycling the most. These results and insights are essential to encourage side-stream owners and potential users to stimulate resource use efficiency by total use of valuable food materials. The tool can be employed by food processing specialists in short-term advice studies with specific food chain

stakeholders, as well as in longer-term research looking into the potential of total use from a broader perspective.

The *Processtimator* is implemented with careful consideration of the necessary factors for sustainable and reliable process knowledge and data sourcing, as shown in Figure 3.
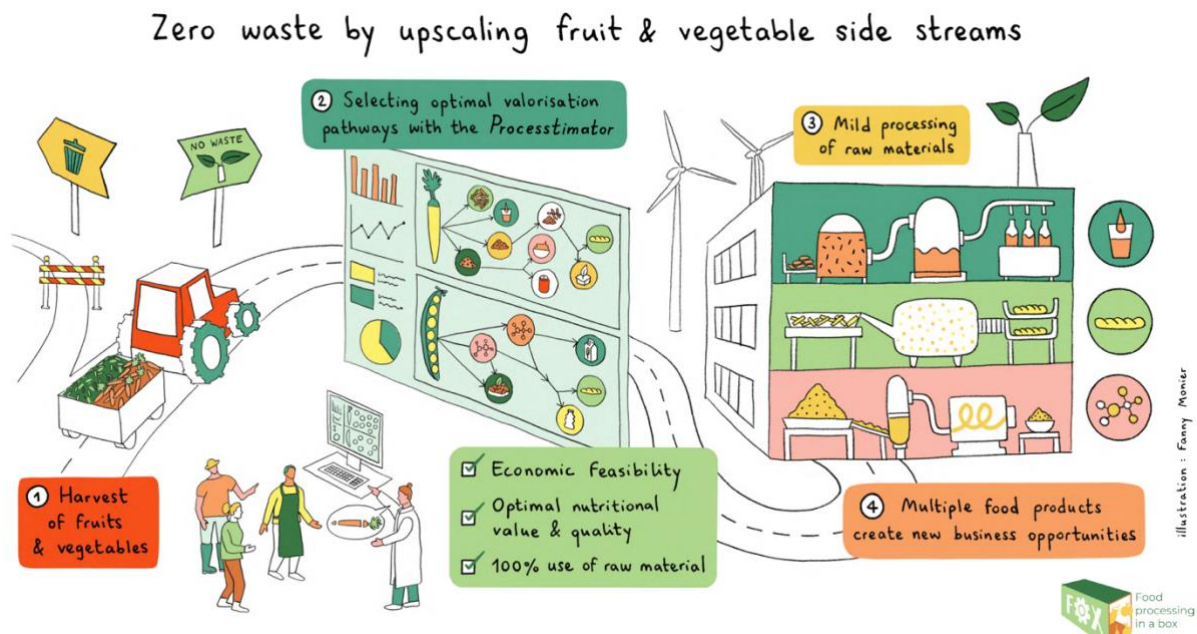

Figure 3. Key aspects that are part of the implementation of the *Processtimator*

The key components of the *Processtimator* are:

- o Upcycling of side streams: The tool considers further processing or assigning a use to fractions of materials that are not intended to be the final product, taking into account associated costs and benefits.

- o Modular process design: Each process step has inputs and outputs, allowing for interchangeability and automatic generation of outputs.

- o Process selection advice: The tool incorporates knowledge of suitable processes for food materials, providing advice based on material characteristics.

- o Emphasis on mild processing: The tool includes a range of processing technologies, with a focus on milder methods such as dry separation and use of pulsed electrical fields.

- o Integration with databases: Relevant information on food side stream composition, economic value, and processing costs is obtained from external databases.

- o Multiple outputs: The tool provides information on production costs, energy and water use, auxiliary materials, fraction quality, and CO_2-equivalent footprint.

- Scenario analyses: Different types of scenario analyses can be conducted, exploring the effects of input volumes, starting material composition, and process yields.
- Expert tool: The *Processtimator* is designed for food technologists with sufficient knowledge in food processing, allowing them to modify process settings and override default values.

Environment impact

A key aspect to consider in upcycling side streams is the environmental impact. The process pathways obtained with the *Processtimator* are therefore analysed on environmental impact expressed in a kilogram of CO_2 equivalents. This impact is compared with the impact of the current use of the side streams, such as composting, anaerobic digestions, and use as feedstock to be able to determine if the upcycling results in a net positive contribution to the important aspect of sustainability.

Further Information

Further readings

Home - FOX (fox-foodprocessinginabox.eu)

Link to VMT article (Dutch): https://www.vmt.nl/59588/zijstromen-hergebruiken-intelligente-tool-schat-de-processingkosten?giftCode=G4mOtcNYupdLvDLVdTkqqrTFT9dS8EPasMveniRIaSdUtAbpHEWBepMO5LICa-Nn&social=copy

Weblinks

https://foxlink.app/

About this practice abstract

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