An overall system perspective on food (processing) residues in life cycle assessment

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Introduction

Food waste and food residues are a possibility for reducing the environmental impacts of food consumption. Thus, they have become an issue in the political debate. Several initiatives and ideas have been developed on how to reduce the amount of food residues or make best use of them.

Most LCA (Life Cycle Assessment) assume that using waste is free from environmental burdens of the upstream life cycle. Approaches just focusing on the system using the residues miss the interlinks to many other sectors, such as energy or material provision. In turn, increasing competition changes the LCA results due to economic allocation.

Methods

This poster highlights the experiences from LCA studies on different issues in the context of disposal, use, and valorisation for food processing residues such as:

- Couple products:
  - Whey from cheese making
  - Soybean meal from oil pressing
  - Apple peels from making dried apples
- Food waste:
  - Unsold bread from supermarket
  - Used cooking oil sold by McDonalds

It is important to consider the implication of cut-off approaches and the polluter-pays-principle in the allocation of residues used to provide new products outside the food system. An example is the market for used cooking oil and the several types of substrates used in biogas plants [1].

Different process routes for residues in different sectors and pathways for the usage of food processing residues can be found:

- Food (maybe upgraded)
- Fodder for animals and insects
- Fertilizer (compost)
- Biomaterials (e.g. leather from apple peels)
- Biochemicals (glycerine, oils, ethanol)
- Processed materials (bioplastics)
- Energy carrier (biodiesel, biogas, ethanol)
- Energy (heat, electricity)
- Waste management with energy and substance recovery (municipal waste incineration (MSWI) or wastewater treatment plant (WWTP) with sludge digestion, direct incineration, partly recovery e.g. of phosphorus)

Results and discussion

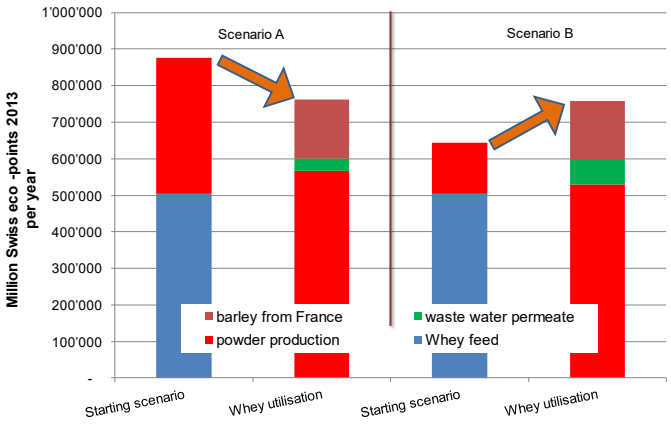
The analysis shows that ideas for the use of food processing residues are not always environmentally friendly if considering the markets and price developments for certain substrates classified as waste [1].

The following example should illustrate such a problem setting [2, 3]. We investigated the use of whey as pig feed and assumed that milk powder is used for human consumption in the base case. This is compared with two alternative scenarios for upgrading the food processing waste:

A: Production of whey protein powder (WPC 35) and whey powder, import of cereals for pigs

B: Production of whey protein powder (WPC 65), import of cereals for pigs.

The comparison shows that the first scenario results in a more ecologically favourable situation. The second scenario involves a higher level of processing into WPC 65, but due to increased energy consumption and large amounts of whey serum to be disposed, it performs ecologically worse than the current use in pig fattening.



Conclusions

Conducting LCAs of food residues and its use involves allocation questions. We propose and conclude to apply the polluter-pays-principle to all types of food processing residues [4, 5]. It should be consistently applied both to the process where the residue is provided and the process where it is used or treated further. Applying cut-off approaches to one side or the other, as e.g. prescribed by mono-sectorial product category rules, might lead to incomplete assessments of environmental impacts and, thus, wrong incentives. We highlight that it is always relevant to see both sides of the coin.

Furthermore, the efforts (and impacts) of upgrading and valorisation need to be considered. Not every idea proves to be suitable if these impacts are included. For the functional unit it is important to clearly define the scenarios being compared. This often limits the possibilities for generalization, as not all possible pathways are considered.

It should also be noted that LCA results influence the market. For instance, increasing prices (due to good environmental performance of the product) of used substrates lead to higher impacts. This, in turn, leads to less attractive pathways from an environmental point of view.

References

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