Environmental performances of the production of dried lactic acid bacteria concentrates protected by fructo-oligosaccharides

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Objective
H2020 PREMIUM project aims at eco-designing new strategies for preserving lactic acid bacteria concentrates using oligosaccharides, taking into account protective ability, process conditions and environmental impact. The first part of the project led to selecting three fructo-oligosaccharides as promising protective agents, and two processes (freeze-drying and spray-drying) as stabilization alternatives. The objective of this work was to compare these different options from an environmental point of view.
Methods
The environmental performance of six production scenarios has been assessed by Life Cycle Assessment, for two bacteria (L. bulgaricus and L. plantarum). Pilot experimentations were performed in duplicate, including all production steps of stabilized lactic acid bacteria: growth medium preparation, cell culture by fermentation, cell harvesting and concentration, protection, stabilization and storage at 4 °C, 25 °C and 37 °C. The biological activity of bacteria concentrates was assessed by the measurement of culturability and acidifying activity. The mass and energy flows during the process were collected either by sensors or manual measurement. The mainly used background database was Ecoinvent 3.6, completed by Agribalyse 3.0 for ingredients of growth medium. Impact characterization was performed using SimaPro 9.1.0.11 software and the EF3.0 method. Environmental indicators were weighted by the biological activity of the bacteria to take into account jointly environment and bacteria quality.
Results
The spray drying process resulted in more degradation of the bacteria activity than freeze-drying. However, depending on the storage temperature considered, it can be considered as an interesting alternative process from an environmental point of view. Even if the effect was not decisive, the choice of oligosaccharide could help to reduce environmental impacts by 10-20%.
Conclusion
Considering the large set of data generated, an in-depth analysis is underway to validate these preliminary trends. The stabilization process used as well as the choice of the protective molecules changed the environmental impact of the lactic acid bacteria production system. This study will provide valuable information concerning the identification of environmental hotspots of the manufacturing of dehydrated lactic acid bacteria concentrates.

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