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Environmental assessment of strategies for production of stabilized yeast

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Yeast are widely used for producing fermented (bread, beer...) and health benefit (probiotics) products. The production of stable and active yeast involves fermentation, concentration, protection, drying (stabilization) and storage. During the stabilization and storage steps, the cells face numerous stress which may deteriorate functional properties and cause cell death. Different strategies can be used to preserve cell survival, such as changing growth medium for fermentation or adapting process conditions (time, temperature).

This work aims at i) performing environmental analysis of production process of stabilized yeast and identifying hotspots; ii) comparing different scenarios of varying conditions of fermentation (growth medium with vs without cysteine) and of drying (45 °C during 90 min vs 60 °C during 60 min). SimaPro (PRé consultant) has been used for the Life Cycle Assessment modeling with ILCD 2011 method. With the purpose of meaningful comparisons, the impact scores were weighted by the final yeast survival, quantified by cell cultivability.

Fermentation appeared as the main hotspot due to its energy and water consumptions. The addition of cysteine improved the yeast survival leading to less yeast necessary to produce, and consequently decreased the total environmental impact of the system. Drying at 45 °C during 90 min had a higher environmental impact than drying at 60 °C during 60 min because drying temperature did not impact energy consumption as much as drying duration.

The comparison between microorganisms' stabilization scenarios highlighted the relevance of a life cycle approach to identify hotspots and suggested options for decreasing the environmental impact.