

## **Numerical modeling, simulation and parameter estimation for wine fermentation**

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In the literature, many models based on ordinary differential equations already exist to describe the process of wine fermentation. However, the dynamics due to yeast cell growth plays an important role in this fermentation process. This is why we take a closer look at the mass structure of yeast cells by introducing a nonlinear integro-partial differential equation for the population balance of yeast and integro-ordinary differential equations for the other substrates such as sugar and nitrogen and the product, i.e. ethanol.

The derived model is solved numerically using Orthogonal Collocation on Finite Elements for the discretization of the mass domain and BDF methods for the resulting system of time dependent ordinary differential equations.

Moreover, in this fermentation process, a lot of parameters occur whose values are unknown and have to be estimated. In this context, an approach that takes the whole model into account is applied to the specific model describing the wine fermentation process and considering also the mass structure of yeast cells. In this way unknown parameters are identified and estimated numerically.