CFD ANALYSIS OF NUTRIENT MIXING DURING WINE FERMENTATION

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Wine fermentations benefit from homogeneous substrate and nutrient distribution during the entire process. While most bioreactors are equipped with mechanical mixing devices to assure homogeneity, winemakers often refuse their application out of tradition and quality concerns. It is assumed that the flow induced by the formed CO_2 bubbles already provides sufficient agitation inside the tank. To analyze the mixing efficiency of this two fluid flow we performed CFD simulations in a bubble-column like set-up for a $10\,m^3$ wine fermentation vessel. Using an Eulerian multiphase model with consideration of drag and lift force effects the overall flow pattern could be simulated [1, 2]. Transient mixing analysis were based on a passive scalar transport approach representing yeast nutrient additions at three different dosage locations during two stages of fermentation. First results of early and peak fermentation scenarios indicate mixing times between $(83 \pm 11)\,s$ and $(205 \pm 32)\,s$. Considering the total time scale of wine fermentations the results support the general assumption that adequate bubble formation ensures homogeneous fermentation conditions.

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