

Highlights of Analytical Sciences in Switzerland

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Enlightening the Lactate Degradation Processes in Cheese and Bacterial Cultures Using Phenylboronic Esterification and GC-MS

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In food production, fermentation plays a key role for preserving food. At the same time, the process can be used to achieve the desired qualities of aroma, taste and texture. For example, for various cheeses, the eye formation is important, which is caused by the release of carbon dioxide during the ripening process. The bacteria used for this have a multitude of metabolic activities that can also release other gases. Some of the degradation pathways lead to the formation of diols. *Lactobacillus parabuchneri* is an interesting example for such a pathway, because it can metabolize lactate to propane-1,2-diol with simultaneous release of acetate and carbon dioxide. *Lactobacillus buchneri*, on the other hand, produces propane-1,3-diol during the co-fermentation of

carbohydrates and glycerine. The 2,3-butanediol fermentation is a way of breaking down carbohydrates to produce energy under anoxic conditions. The pathways that convert lactate into acetate under anaerobic conditions are not well understood at the molecular level. A sensitive method was therefore developed and validated for the simultaneous quantitative measurement of the metabolites propane-1,2-diol, butane-2,3-diol, and propane-1,3-diol in cheese and bacterial cultures. In a first step, the diols are extracted in water and esterified directly in the extract with the aid of phenylboronic acid. After extraction with toluene, the resulting phenylboronic esters are measured directly using GC-MS in selected-ion monitoring (SIM) mode with an external calibration using butane-1,2-diol as the internal standard. **The method is simple, fast, robust, allows precise measurements in the mg/kg range and can be used in complex matrices due to selective double extraction and is therefore also of interest for plant and non-dairy food fermentation.**

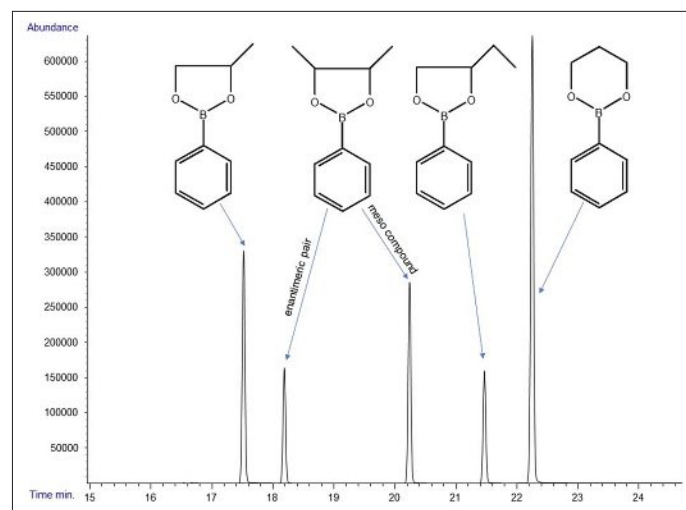
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Eye formation in cheese, a quality feature.



Selected-ion mode chromatogram of a standard diol calibration sample. From left to right: Phenylboronic esters of propane-1,2-diol, butane-2,3-diols, butane-1,2-diol (internal standard), and propane-1,3-diol.

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