

# Trappist Beers Analysis, Exploring the Secrets of Monks

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## Abstract

Trappist beers are famous amongst connoisseurs for their typical taste and flavor. Most of these beers are rated in the top 100 of the most appreciated beers. Only ten monasteries provide Trappist beers in the world: 6 in Belgium, 2 in the Netherlands, 1 in Austria, and 1 in the USA. All together, they produce 29 different beers. Nowadays, Trappist monks still brew their beer within the walls of their monastery, in the respect of the ancestral tradition, and exclusively to cover monastic-like living expenses.

In order to better understand the specificity of Trappist beer aroma, we investigated the volatile organic compound (VOC) profile of this family of beers. For sampling, different techniques were compared: solid phase micro-extraction (SPME), stir bar sorptive extraction (SBSE), dynamic headspace (DHS)... All these methods were followed by thermal desorption (TD). DHS was selected as the technique of choice for beer VOC sampling. The volatile mixture was further injected on a two-dimensional gas chromatography system coupled to a time-of-flight mass spectrometer (GC×GC-TOFMS). The 2D space occupation was optimized using an experimental design approach. Resulting VOC profiles were further processed using different statistical approaches such as Fisher discrimination ratio and principal component analysis (PCA).

TD-GC×GC-TOFMS appeared to be an efficient tool for beer aroma profiling. It allowed obtaining an exhaustive description of the headspace composition. The statistically optimized separation provided clear chromatograms that were requested for proper multiple sample comparison. Finally, multivariate techniques provided useful information to increase our understanding of Trappist beers aroma.