BeerAMA: new advanced tool for beer aroma in-depth comprehension
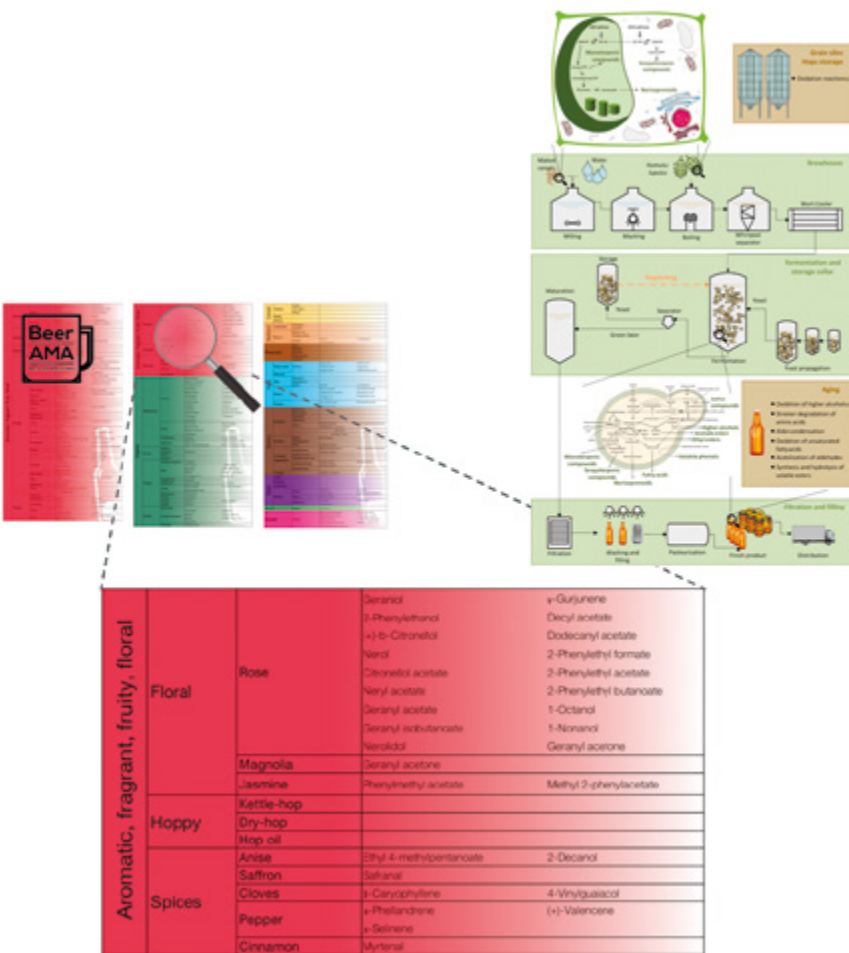
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Beer represents a widespread alcoholic beverage, being the first most consumed beverage per capita in Europe. Beer volatile composition has been studied based on gas chromatographic analysis, and seldom complemented by sensorial assays. Specific tools have been used for sensorial analysis, such as Beer Flavour Wheel, and more recently Beer Flavour Map, and despite their utility, scarce information about the related molecules is included. Thus, this work intended to in-depth comprehend beer aroma by mapping its volatile molecules. For this purpose, an advanced multidimensional chromatographic methodology based on headspace solid-phase microextraction (HS-SPME) combined with comprehensive two-dimensional gas chromatography with time-of-flight mass spectrometry (GC×GC-ToFMS) was developed and applied to a set of lager beers, the main produced and consumed type. This methodology allowed the detection of hundreds of compounds, from which was selected 8 chemical families: acids, alcohols, esters, monoterpenic compounds, norisoprenoids, sesquiterpenic compounds, sulfur compounds, and volatile phenols, mainly associated to raw materials' (i.e. cereals and hops) and yeasts' metabolism (Fig. 1).

Using the Beer Flavor Wheel (including 3 information levels, with exiguous chemical information) as a starting point, information about beer volatile molecules, respective aroma descriptors and origins were combined to create BeerAMA – Beer Aroma Molecular Atlas (Fig. 1). The 4th level of information, containing only data about volatile molecules, represents the most in-depth study about beer volatile composition.

BeerAMA, an easy and user-friendly tool, can be further used in industrial context, namely by brewers as a complement of sensorial analysis, to control the brewing process and product, and to evaluate the impact of the raw materials, including the new ones to produce distinctive beer styles, a recent market trend.