

Volatile Compound Profiling in Commercial Lager Regular Beers and Derived Alcohol-Free Beers After Dealcoholization by Vacuum Distillation

Cristina Andrés-Iglesias¹ · Carlos A. Blanco¹ · Juan García-Serna² · Valentín Pando³ · Olimpio Montero⁴

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Abstract Alcohol-free beers are characterized by less aroma and body than regular ones. Seven flavor compounds were chosen as indicators in dealcoholization experiments at 102 and 200 mbar. Compounds were analyzed by headspace (HS)-solid phase microextraction (SPME)-gas chromatography–mass spectrometry (GC-MS). Also, contents of aroma-related compounds were compared between commercial regular and alcohol-free beers. In dealcoholization experiments by vacuum distillation, most of the compounds were shown to be evaporated in the first vapor fraction. The compounds that mainly remained in alcohol-free beers were amyl alcohols and 2-phenylethanol; this might explain their characteristic sweet and, to a lesser extent, fruity and flowery flavors. Regular beers were mainly characterized by 1-butanol, amyl alcohols, and ethyl acetate. Beers dealcoholized at 102 mbar are characterized by a high

concentration of 2-phenylethanol. Beers dealcoholized at 200 mbar and commercial non-alcoholic beers had a similar flavor profile, which is characterized by low concentrations of the compounds used as indicators.

Keywords Flavor compounds · Dealcoholization · Aroma · GC-MS · Alcohol-free beers · HS-SPME · Non-alcoholic beer · Volatile compounds

Introduction

Beer is one of the most widespread and popular drinks consumed worldwide (Lehnert et al. 2008; Rossi et al. 2014). Beer popularity arises from its pleasant organoleptic and favorable nutritional characteristics for moderate consumption (Blanco et al. 2014; Sohrabvandi et al. 2010).

The increasing worldwide production of alcohol-free beers reflects the global trend towards a healthier lifestyle (Lehnert et al. 2008). Low-alcohol beers are a good source of nutrients such as vitamins, minerals, soluble fiber, and antioxidants (Brányik et al. 2012; Liguori et al. 2015) and, therefore, recommended for specific groups of people (pregnant women, sports professionals, people with cardiovascular and hepatic pathologies, and people on medication) (Blanco et al. 2014; Sohrabvandi et al. 2010). Also, restrictive drink/driving rules and religious concerns have contributed to increase the market of this beverage (Catarino and Mendes 2011; Sohrabvandi et al. 2010).

Low-alcohol beer is a beer with very low or no alcohol content. In most of the EU countries, beers with low-alcohol content are divided into alcohol-free beers, with less than or equal to 0.5 % alcohol by volume (ABV), and low-alcohol beers, with no more than 1.2 % ABV (Blanco et al. 2014; Brányik et al. 2012).

Flavor compounds are very important in beer as they make a major contribution to the quality of the final product. A large

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