

BEER DEALCOHOLIZATION BY LYOPHILIZATION: STUDY ON THE ETHANOL CONTENT AND AROMA COMPOUNDS

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Lyophilization process has been successfully applied in food industry for food preservation, creation of new products or additives. In this case we have applied this technique to dealcoholize beer, studying the evolution of ethanol content and the main aroma and flavor compounds. To our concern this process has not been tested as a possible dealcoholization process in beer yet.

It is well known that dealcoholization processes have drawbacks related to the decrease in the flavor quality of the final product, by losing crucial volatile aroma compounds as well as the ethanol and, evidently as ethanol itself contributes to the beverage flavor.

Six different commercial *lager* beers from Spain and other European countries were lyophilized at -55°C and 0.2 mbar during 3, 8 and 16 hours analyzing the regular beer and lyophilizates produced by HS-SPME-GC-MS. Comparison in the aroma profile was carried out using standard calibration curves of 11 characteristic volatile compounds: esters, acids and high alcohols.

A targeted principal component analysis (PCA) (depicted in **Figure 1**) shows how regular and lyophilized beers can be clearly classified in two different groups, mainly based in the comparison of esters remaining (contribution of 48%). Furthermore, it shows no differences among the lyophilized samples.

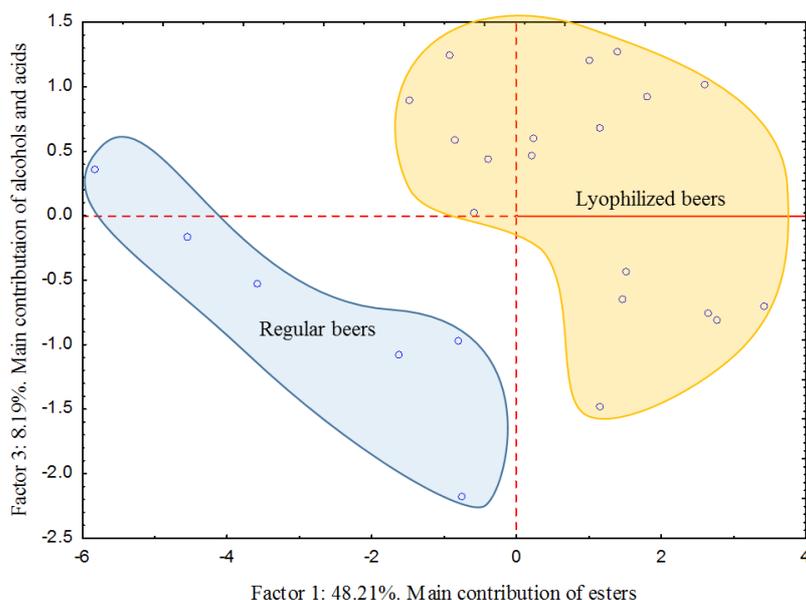


Figure 1. lager beers VS lyophilized according to the volatile compound profile

Ethanol content decrease from 6.5-5.0 %vol to 1.22-0.92 %vol at 3 hours of experiment and then down to 0.33-0.20 %vol at 16 hours as plotted in **Figure 2** together with some volatile compounds. The content of volatile compounds was preserved in more than 60% during this process. Thus, after 3 hours of lyophilization the volatile compounds were evaporated together with the ethanol but there were no considerable differences within the longer lyophilization times 8 and 16 hours in most cases.

In all cases, the least concentration of the ethanol and volatile compounds was obtained after 16 hours, as expected.

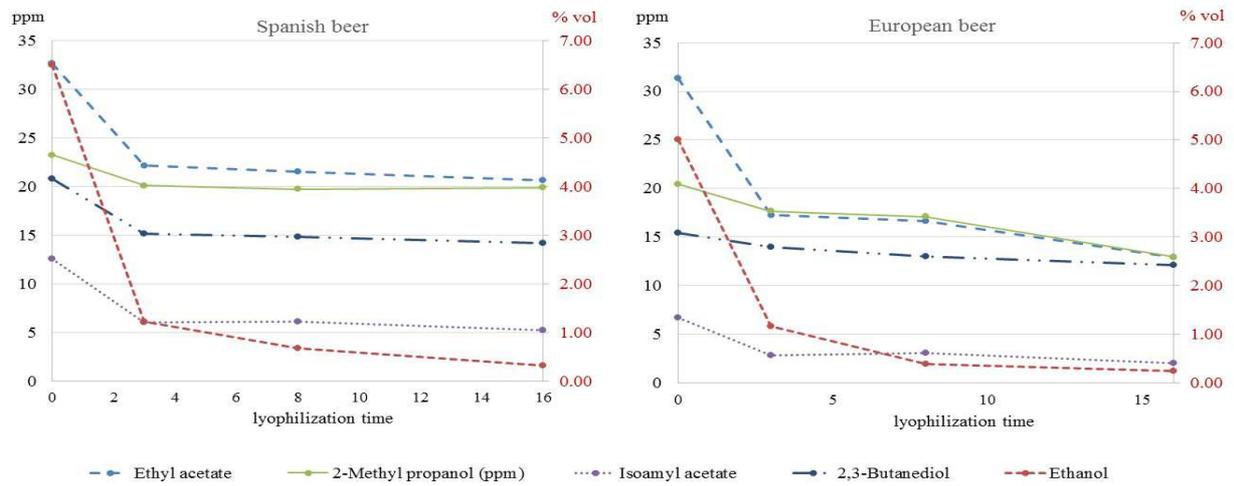


Figure 2. Decrease of ethanol (% vol) and some volatile compounds (ppm) concentration at the different lyophilization times.

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