Biotransformation in production of fermented beverages

P. Satora[1]

[1]*University of Agriculture in Krakow, Department of Fermentation Technology and Microbiology, Balicka 122, 30-149, Krakow, Poland*
pawel.satora@urk.edu.pl

The production of fermented alcoholic beverages involves numerous processes in which microorganisms and enzymes convert components derived from the raw material into a wide range of compounds that affect the sensory characteristics of the resulting product. It is estimated that there may be as many as 800 to 1,000 such compounds in wine and about 800 in beer. These compounds belong to different chemical groups such as esters, alcohols, carboxylic acids, carbonyl compounds, polyphenols, sugars and many others. Some of them are primary metabolites (whose formation is linked to the growth of microorganisms), others are secondary - often requiring the formation of specific precursors [1,2].

Among these, terpenes and thiols, which are formed by plants and occur in a bound form, are an interesting group. Terpenes occur as glycosides bond to a glucose or disaccharide molecule, while thiols form disulfide bonds with amino acids, peptides and proteins. In this form, due to their low volatility, they do not significantly affect the sensory characteristics of beer/wine. To change this, it is necessary to use enzymes with β-glucosidase or lyase activity, which can be introduced in the form of enzyme preparations or as microorganisms with the appropriate activity [3,4].

The aim of our research was to determine the quantitative and qualitative changes in terpenes during enzymatic maceration using different commercial enzyme preparations with beta-glucosidase activity, as well as during the subsequent winemaking stage - fermentation. Three varieties of Polish grapes - Solaris, Seyval Blanc and Johanniter - were used in the experiments. Three Polish grape varieties - Solaris, Seyval Blanc and Johanniter - were used in the experiments; prob analyses (HS-SPME-GC-MS) were carried out during maceration, after sedimentation and in finished young wines. Enzymatic maceration increased the content of most terpenes analysed, with Solaris grapes being the richest in bound forms of terpenes. The greatest increase in terpenes was found after the clarification stage, in the must to be fermented. The fermentation process had the greatest effect on the terpene content of the finished wine. Some of these terpenes were degraded by the yeast (such as α-terpineol, rose oxide, etc.), while at the same time terpenes not present in the grape (such as α-terpinene, limonene, γ-terpinene, p-cymene-8-ol, etc.) were formed as a result of yeast metabolism. To maintain a high level of terpenes in the finished wine, *S. cerevisiae* strains should be used for fermentation, preserving the varietal characteristics of the grapes.

In the second experiment, the aim was to increase the amount of terpenes in beer obtained by so-called dry-hopping. Lager beer was hopped with Marynka hops and at the same time enzyme preparations with beta-glucosidase activity and pectinolytic agents were added.

The obtained results showed that the addition of enzyme preparations significantly influenced the content of aroma compounds in the tested beer. On the basis of the obtained results, it

was noted that the addition of hops to beer (dry hopping) increased the concentration of some terpenes and terpenoids, such as β-myrcene, humulene and caryophyllene. In the samples with addition of hops and Pectopol T-400 enzyme. Higher levels of humulene and β-myrcene were detected. Beer with hops and the enzyme complex (aromazyme and rapidase) was characterised by a higher content of nerol and geraniol. On the other hand, the application of two enzymes, Aromazyme and Pectopol T-400, increased the content of linalool. The complex of all three enzymes increased the amount of caryophyllene oxide, humulene and β-myrcene. The beer with the addition of hops was characterised by the lowest amount of aromas, with mainly floral and slightly fruity notes detected. In all the samples with the addition of enzymes, more intense floral, fruity and hop-derived aromas appeared. The results obtained prove that the use of enzyme preparations during dry hopping can contribute to the creation of a unique and distinct beer aroma profile.

References

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