

## **Volatile compounds in crumb of whole-meal wheat bread fermented with different yeast levels and fermentation temperatures**

### **Abstract**

The influence of fermentation temperatures (8, 16, and 32°C) and yeast levels (2, 4, and 6%) on the formation of volatile compounds in the crumb of whole-meal wheat bread was investigated. Volatile compounds were extracted by dynamic headspace extraction and analyzed by gas chromatography–mass spectrometry. Results were evaluated with multivariate data analysis and ANOVA. Bread fermented at a high temperature (32°C) had higher peak areas of the Maillard reaction products 2-furancarboxaldehyde, 2-acetylfuran, 2-methylpyrazine, and phenylacetaldehyde compared with bread fermented at lower fermentation temperatures. Bread fermented at low temperatures (8 and 16°C) was characterized by having higher peak areas of the fermentation products 3-methylbutanal, 2-methylbutanal, ethyl acetate, ethyl hexanoate, ethyl propanoate, and 3-methylbutanol. Fermentation of bread with 6% yeast resulted in a higher peak area of the important fermentation product 2-phenylethanol. It also reduced the peak areas of important lipid oxidation products. The peak area of 2,3-butanedione was also relatively higher in bread fermented with 6% yeast compared with lower yeast levels; however, an interaction was seen between the high yeast level and all three fermentation temperatures. In contrast, fermentation with a low yeast level (2%) resulted in bread with relatively higher peak areas of 2- and 3-methylbutanal, as well as (*E*)-2-nonenal and (*E,E*)-2,4-decadienal, which are important lipid oxidation compounds in bread.