Metabolic changes during humid storage of rapeseed and influences on the volatile profile and sensory quality of virgin rapeseed oil

Anja Bonte[1], Rabea Schweiger[2], Claudia Wagner[1,3], Caroline Pons[2], Ludger Brühl[1], Bertrand Matthäus[1], Caroline Müller[2]

[1] Max Rubner-Institut, Federal Research Institute of Nutrition and Food, Department of Safety and Quality of Cereals, Schützenberg 12, 32756 Detmold, Germany
[2] Bielefeld University, Faculty of Biology, Department of Chemical Ecology, Universitätsstraße 25, 33615 Bielefeld, Germany
3 Wilhelms-University Münster, Department of Food Chemistry, Corrensstr. 45, 48149 Münster, Gemany

Rapeseed is the most important source for the production of vegetable oils after palm fruits and soybeans. The main part is pressed by a screw press and extracted by a solvent and the resulting oil has to be refined to make it edible and stable. In some countries also virgin rapeseed oil is produced as product with high added value, because the oil is obtained only by screw pressing and purification by filtration or sedimentation. This type of oil is more and more favoured by the consumers due to the less intensive processing, the higher amount of valuable bioactive compounds and the typical rapeseed-like, nutty smell and taste.

Some virgin rapeseed oils have a fusty and musty smell and taste resulting from inappropriate storage conditions of the rapeseed. It is assumed that metabolic processes within the rapeseed accelerated by higher moisture content lead to the degradation of storage compounds like proteins, starch or lipids. These metabolic changes probably affect the composition of volatile aroma-active compounds in the resulting oil.

To investigate the effects of storage under high moisture on the rapeseed metabolome and the profile of volatile compounds in virgin rapeseed oil, seeds were held moistly over four days at room temperature. Seed metabolite profiles were determined daily by measuring several primary metabolites (*via* GC-MS and UHPLC-FLD) and glucosinolates (HPLC-DAD). Further seed samples were pressed after each day and the volatile compounds of the oils analyzed *via* dynamic headspace GC-MS. In addition, the sensory quality of the resulting oils was evaluated by a panel of 3-5 trained persons.

Already after the first day, seeds started to germinate. In the seeds, carbohydrates slowly and amino acids rapidly increased over storage time indicating the stepwise provision of primary metabolites for plant growth. Indole glucosinolates only increased from the third day of storage while aliphatic glucosinolates partially decreased during storage under humid conditions. There was also a clear correlation between rising indole glucosinolates in the stored rapeseeds and volatile glucosinolate degradation products as well as the “germinated” sensory impression in the resulting rapeseed oils from the third day of storage. Several volatile compounds in the oil had lower concentrations after one day of humid storage of the seeds, whereas many others increased from the third day of seed storage. These results show to our knowledge for the first time a link between the metabolism of constituents of rapeseed and the change of the profile of volatile compounds responsible for the sensory impression of virgin rapeseed oil during storage of rapeseed under unfavorable conditions.