Drying is one of the most widely used food preservation methods. Its influence on the quality of final products (herbs, fruits, vegetables, etc.) in the context of shaping the aroma profile, including the change (loss) of volatile organic compounds (VOCs), is very well proven in the literature as well as through actual experiences of producers. Since 2010, the Department of Food Chemistry and Biocatalysis at the University of Life Sciences (UPWr) has been conducting research on the optimisation of drying processes in the context of shaping sensory characteristics and aroma. The loss of low-molecular-weight (usually up to C-15) volatile compounds, e.g. essential oils, is a typically physical characteristic. During the drying process, evaporation occurs due to temperature effects. The losses usually range from a dozen to several dozen percent of the initial content and are non-linearly dependent on the temperatures used. Higher temperature shortens the time but also causes faster evaporation of compounds. The influence of e.g. residual biosynthesis, enzymatic degradation especially of terpenoid glycosides or chemical interaction with biological plant matrix is also known, but according to our and literature experience, it is negligible in quantitative changes of VOCs during drying. Although quantitative prediction of the actual loss of VOCs is currently impossible (no suitable model is available) the effect of their loss seems to be quite understandable from a physical point of view. The drying process usually uses freeze-drying techniques, but also convection techniques, with temperatures usually in the range of 40 to 70 °C, often assisted by microwaves or infrared. In contrast to VOCs, the behaviour of temperature-stable molecules, e.g. phytosterols, alkaloids, lignans, saponins, di- and triterpenoids as well as polyphenols at drying temperatures should result in no change in their quantitative content in the plant material. Our experience clearly shows that a relatively low temperature, as well as the time of the process, does not cause their thermal degradation, evaporation or chemical transformations. In contrast to the above observation, several publications appear annually, where the authors show statistically significant losses or increases of compounds from the above mentioned non-volatile groups. And so, for example, for *Centella asiatica* at drying in the range of 50-70 °C, the authors [1] described even a 20-fold decrease (in terms of d.m.) in the content of stable triterpene acids. For *Ganoderma lucidum* both an increase and a decrease in triterpenoid content in the range of 30% have been published. For *Phylantum amarus*, drying at 30 °C degraded saponins. The loss of phytosterols in rapeseed dried by the low-temperature method was 17% [2]. On the other hand, for ginger a more than 3-fold quantitative increase in 6-shogaol content was observed. For Urtica dioica, the authors described even 40-fold changes (increase) in phenolic derivatives of caffeoylquinic acids [3]. To our knowledge, none of the above publications fully validated the analytical methods in the determination of bioactive compounds, the authors also did not take into account the completely different extractivities of active compounds from fresh and dried plant material.

The project will aim to demonstrate, by validating (using LC-MS, GC-MS or NMR techniques) fully analytical methods, the actual quantitative and qualitative changes in compounds from the "non-volatile" group. The research will be conducted for 3 plant organs of different textures (i.e. flower, leaf, root or rhizome) for 12 different plant species (listed in the detailed project description) of high practical importance in the herbal and food industry. For each plant, non-volatile bioactive fractions will be selected and individual compounds that shape their functional characteristics will be isolated or purchased. I plan to carry out at least 4 drying methods (so-called traditional, in the shade and the air, convectional (at extreme temperatures up to 70 °C), convectional assisted by microwaves as well as freeze-drying). Isolated/pure bioactive compounds suspended on prepared matrices will also undergo this process to determine their actual thermal stability. This will be a study to determine, in a fully validated manner, the effect of these drying methods on the behaviour of selected non-volatile bioactive fractions in plant material.

References:

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