

## Summary for the final report

### Application of infrared spectroscopy for fast and non-destructive detection of free fatty acids in nuts for quality assurance (FreshNut)

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The research project was aimed for evaluation of the application of infrared spectroscopy (NIR, FTIR) for fast, non-destructive and cost effective quality assessment of single nuts by their amount of free fatty acids. As part of the project, the free fatty acids of various nuts (hazelnuts, peanuts, almonds) were localized and calibration models for determination of free fatty acids and thus the presence of mold by infrared spectroscopy were created.

For localization of free fatty acids in nuts, the nuts were stored under dry and humid conditions. All varieties of nuts showed a mold infestation after a few weeks. The occurred mold infestation was easily removable without trace. The molded hazelnuts and almonds did show a significant increase of free fatty acid on the surface. Peanuts instead showed no significant change in free fatty acid content even with visible mold infestation. During storage under dry conditions, just the hazelnuts did show an increase of free fatty acids. The increase of the free fatty acids under dry conditions was way much lower compared to the presence of mold.

The nuts were measured individually and non-destructively by NIR and FTIR spectrometers. Afterwards the applied spectra were correlated with the free fatty acid content evaluated in the chemical laboratory. NIR spectroscopy (near infrared) was not able to differentiate between molded and non-molded nuts. FTIR spectroscopy instead did differ between molded and non-molded nuts. For discrimination, preliminary spectral features linked to the mold mycelium were observed. Those observations were same for all evaluated varieties of nuts. The different calibration models of the different nut varieties were successfully applied to each other. The rate of correct classification was between 80 and 91 %.

In general, an inhomogeneous distribution of free fatty acids in nuts could be demonstrated in two ways. On the one hand, the different nut varieties showed a different sensitivity according to the formation of free fatty acids. On the other hand, the free fatty acids were found in higher concentrations on the surface of the nuts. For this reason, only FTIR spectroscopy was able to successfully distinguish molded from non-molded nuts, since the surface is almost exclusively measured due to the low penetration depth. The penetration depth of NIR spectroscopy is many times greater than that of FTIR spectroscopy.

IVLV members can download the complete final project report in German from our homepage. All you need is to register in the section "[My IVLV](#)". Non-members can request the final report from the IVLV office at [office@ivlv.org](mailto:office@ivlv.org).

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on the basis of a decision  
by the German Bundestag



The IGF project no. 20715 N presented here by the Research Association of the Industrial Association for Food Technology and Packaging (IVLV e.V.) is funded by the Federal Ministry for Economic Affairs and Climate Action via the AiF as part of the program for the promotion of industrial community research (IGF) based on a decision of the German Bundestag.