



NIR spectroscopy

Screening of deep-frying oils, quality assurance and process optimisation

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FT-NIR screening of deep-frying oil samples

NIR screening of deep-frying oil samples is a quick, reliable and low-cost method to check the thermal stress level of vegetable deep-frying oil samples. Since only one measurement is needed to cover various parameters, several parameters can be checked simultaneously to make more precise prediction regarding the further usability of a deep-frying fat or oil. The measurement takes no more than 2 minutes and requires only a few millilitres of sample material. NIR screening is a validated standard method approved by DGF(C-III 21a (13)).

Parameters measured and their significance

Parameter	Significance
Acid Value (FFA=AV/2)	Strong emission of smoke from a deep frying oil normally induces a rapid increase of the acid value. The acid value is a quantitative parameter for the content of titratable acid groups in the fat. If coconut oil, animal fats or silicone antifoam agents such as E900 are used, fats are subject to quick hydrolytic cleavage. Also, strong bubble formation due to an overload of deep-fried food induces a quick increase of the acid value based on oxidative alterations.
Anisidine Value	Despite the fact that the anisidine value is highly dependent on the type of deep-frying fat, it is a very helpful analytical parameter to optimise the quality of boiling and deep-frying products. The anisidine value describes the content of oxidation products which are often responsible for a bad taste such as rancidity of filled doughnuts. In many cases reduction of the anisidine value improves the digestibility of deep-fried pastries (no belching) or the long-term storage stability (e.g. crisps).

Parameter	Significance
Polymers Triglycerides	Dark, poorly soluble residues on the walls of deep fryers are often caused by strong polymerisation of the fats due to extended use or excessive deep-frying temperatures. The rate of these altered products can be determined by analysis of di- and polymer triglycerides (DTPG). Their portion correlates well with the polar components.
Polar Compounds	Polar compounds cover the overall alterations in a fat caused by polymerisation and oxidation as well as hydrolysis. However, the result is not completely objectively reliable as all natural polar fat compounds are also detected, e.g. mono- and diglycerides (especially for palm oil). Truly oxidatively altered and naturally present polar fat compounds can be differentiated by analysis of the oxidised fatty acid monomers.
Monox TG	Truly oxidatively altered and naturally present polar fat components can be differentiated by analysis of the oxidised fatty acid monomers.
Trans fatty acids	The influence of foods on the fat composition cannot be underestimated. Heating under deep-frying conditions (< 200°C) does not generate considerable amounts (< 2%) of trans fatty acids which are globally held responsible for cardiac diseases and arteriosclerosis. Exchange of matter with pre-fried products can rapidly increase the content of trans fatty acids to 10% and more if the products have been pre-fried with partially hydrogenated fats.
Iodine value	Alterations of the deep-frying fat caused by the fat of the food to be deep-fried (98% of the fat in a fried food is identical with the deep-frying fat) can be tracked by the change of the iodine value. This value characterises the content of unsaturated fatty acids in a fat and it is a simple criterion to differentiate oils and fatty acids.

The changes in this analytical parameter allow for a comprehensive description of the alterations in deep-frying oil used in food production. Extensive laboratory analyses would be necessary to determine these values, which is not only time consuming but cost-intensive as well. The NIR technique facilitates the determination of all parameters at the same time in less than 2 minutes at minimal cost. Since the formation of acrylamide correlates with the polar compounds level, the control of the thermal stress level of deep-frying fats/oils is of particular importance.

NIR screening for process optimisation in food production

By way of NIR spectroscopy of deep-frying oil samples, error sources and technical deviations/defects in production processes can be identified quickly and at low cost.

From the key figures collected in combination with general information about the basic technical conditions of the production process, the causes of abnormally rapid oil/fat degradation can be identified and eliminated. Maxfry® GmbH offers this method of process optimisation. Our customers receive a detailed questionnaire to document the basic technical conditions of the deep-frying process under review. The information requested relates to:

- type of equipment: oil volume, heating system, filter systems, automatic regulation of the oil level, etc.
- process details: temperature control system, production quantities, type of fried food, deep-frying oil etc.

Moreover, sample containers will be provided to the customer if desired, together with a timing recommendation for taking samples. By means of the oil samples taken at different times during the production process, the actual condition of the oil throughout its life cycle can be ascertained. Moreover, recommendations for optimisation can be derived, which may cover technical aspects as well as process-related aspects.

NIR spectroscopy in other areas

Apart from process optimisation and internal quality monitoring during deep-frying, NIR spectroscopy is also used successfully for the assessment and quality testing of olive oils. Our customers in this area in particular are distributors of high-quality olive oils, which use our service for quick, low-cost incoming goods inspection.

By means of NIR spectroscopy, the identity, quality and even the provenance of the olive oil can be established/verified. Together with the results of the final sensory test and assessment of the sample, our customers will receive a detailed test report about the samples they have submitted.



More knowledge means added value!

Sounds interesting? Then please do not hesitate to contact us. We will be glad to present you with an offer of consultation or products tailored to fit your individual needs: info@maxfry.de.

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