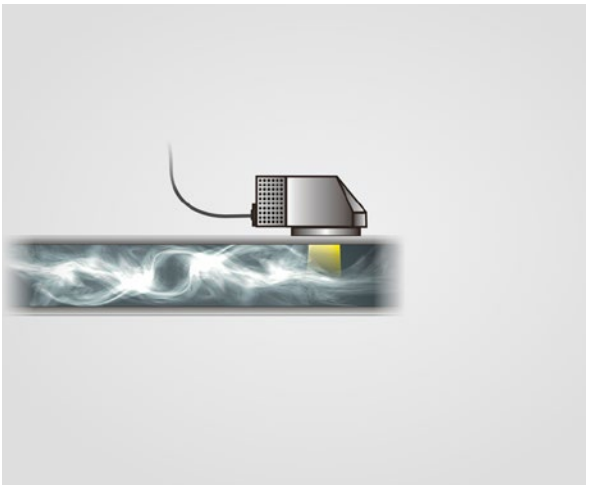
Polytec

Inline quality control
of edible oils
Application note

Inline-Quality control of edible oils

Domestic edible oils such as sunflower oil and rapeseed oil are produced in Central Europe for centuries. They are part of our daily food intake in form of frying fat or margarine.



Domestic edible oils such as sunflower oil and rapeseed oil have been produced in Central Europe for many centuries. They are a part of our daily food intake in form of frying fat or margarine.

Olive oil from European production is in Central Europe, the most commonly used oil at home and is highly valued for its health-providing ingredients and wholesomeness. Today, we can choose from a wide variety of edible oils of all price ranges. What they all have in common is the consumer´s demand for consistency and high quality. These demands and increasing requirements from the field of food inspection require edible oil producers around the world to invest more and more in process-optimised measuring technologies.

Process analysis with Polytec near-infrared (NIR) spectrometers enables high-quality, cost-effective and convenient solutions that achieve a rapid return on investment. The method is applied at several levels of the production chain: incoming goods inspection, process control and the final product classification. Many parameters relevant to product quality, can be derived from a single measurement.

The advantages of modern NIR technology are versatile.

In contrast to classical wet-chemical and chromatographic analyses, the integrated process-optimised near-infrared spectroscopy provides a fast, reliable and safe analysis technique without the use of hazardous, environmentally harmful chemicals and does not involve time-consuming sample preparation for laboratory analyses. Furthermore, Polytec's NIR technology enables the analysis of multiple components in less than one second.

The ability to measure more samples in less time helps the manufacturer to rapidly the quality of the goods along the production chain - from the inspection of incoming raw materials (oilseeds) to the quality testing of the of the finished edible oils.

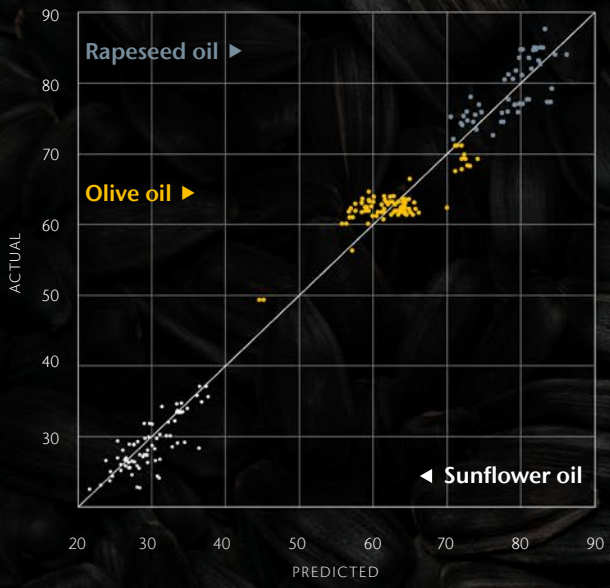
Thanks to the distance measuring head from Polytec, oilseeds such as unhulled sunflower seeds or rapeseed, can be analysed directly after harvesting to verify their oil content. The quality of edible oils can be determined through various parameters such as the iodine value (IV), free fatty acids (FFA) and oleic acid content (C18:1).

Traditional wet chemistry analyses are usually performed according to standardised chemical and physical methods which are approved by the American Oil Chemist Society (AOCS) or the German Society for Fat Science (DGF). However, these methods are usually designed for the analysis of one specific parameter and are unsuitable for "real-time" process control.

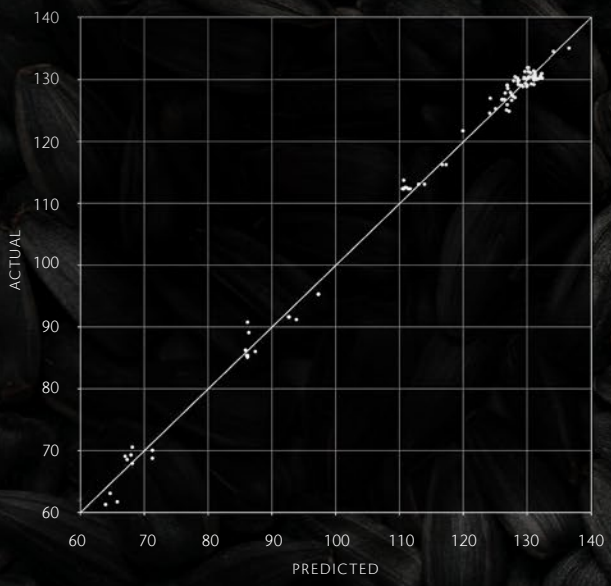
For this reason, manufacturers are now turning to NIR technology as it provides fast results and allows the manufacturing process to be controlled with pinpoint accuracy.

IDENTIFICATION:

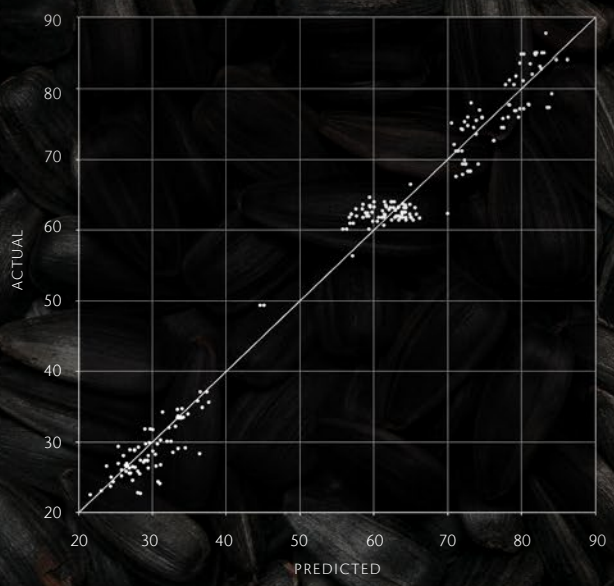
Different types of oil based on of the oleic acid content.



IODIN VALUE(IV)



OLEIC ACID (C18:1)



Parameter	Min (%)	Max (%)	RMSECV
Iodin value (IV)	41.12	135.11	1.5231
Free Fatty Acid (FFA)	0.007	0.950	0.1528
Oleic acid (C18:1)	22.62	87.79	2.5536

Min: Minimum reference value in the calibration data sets.
Max: : Maximum reference value in the calibration data sets.
RMSECV: Root Mean Square Error (mean error) of the cross-validation for the calibration data set.

Determination of the Fatty Acid composition / Oleic Acid content.

An important quality parameter of edible oils is the fatty acid profile. The fatty acid composition serves as a measure of the individual fatty acids in oil or fat. Oleic acid, chemically bound in triglycerides, occurs in almost all natural oils and fats. A particularly high proportion of such esterified oleic acid can be found in olive oil.

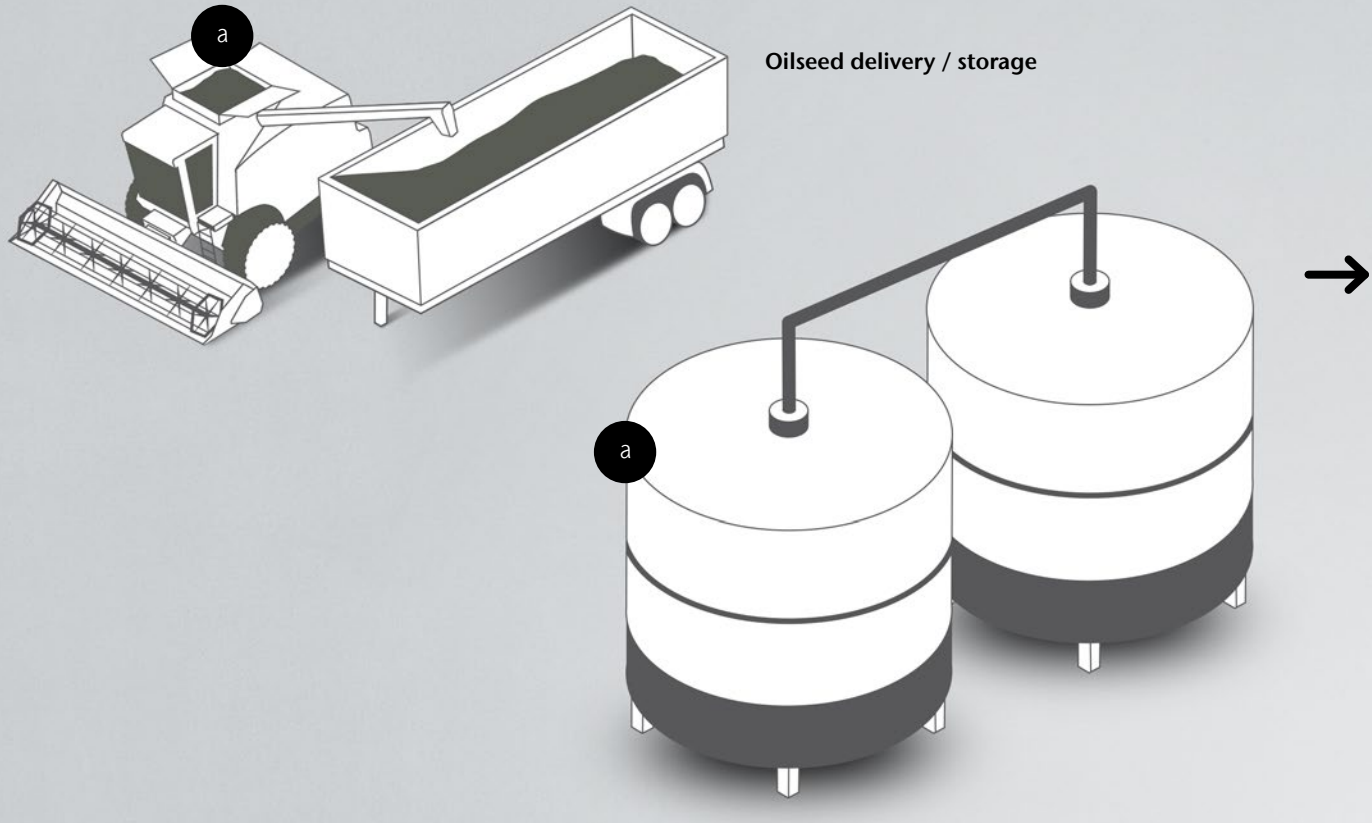
The ratio of the different fatty acids determines not only the type of oil and its nutritional value, but also its influences of the physical properties and its stability. For example, oleic acid (C18:1) is very desirable from a nutritional point of view, but decisively affects the shelf life of the oil. Oleic acid oxidises slowly in the air with yellowing, due to the formation of decomposition products. As a result of these oxidation processes, the oil becomes rancid and unfit for consumption. Therefore, it is obvious that the content of oleic acid in freshly produced edible oil should be as low as possible to order to maintain the stability and usability of the oil for a long period.

Using the oleic acid content, the classification of different edible oils can be established. This is used, for example, as an identification parameter for unknown oils. Due to the different C18:1 ratios in the edible oil groups with low, medium and high C18:1 concentration can be identified. This characteristic allows conclusions about the oil grade.

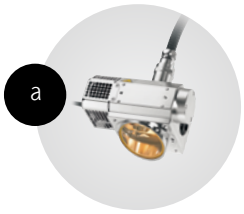
Determination of the iodine value

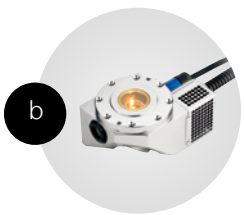
The iodine value (IV) is a fat index for characterising fats and oils. It is a measure of the content of unsaturated compounds of an oil, or more precisely, unsaturated fatty acid residues in the glycerides. The iodine value is the amount in grams of halogen, calculated as iodine, that can be formally added to 100 g of fat. The more olefinic double bonds (C=C bonds) are in an oil, the more iodine can be formally added and the higher the iodine value.

The method can be used for identification and quality control. Lipids are classified according to their degree of saturation, as this is decisive for aging during storage. Fats and oils with a higher iodine value therefore spoil more quickly. While heating unsaturated fats (e.g. during deep-frying), the iodine number decreases and their viscosity increases due to polymerisation. The iodine value is therefore a decisive parameter for the production and service life of frying oils.



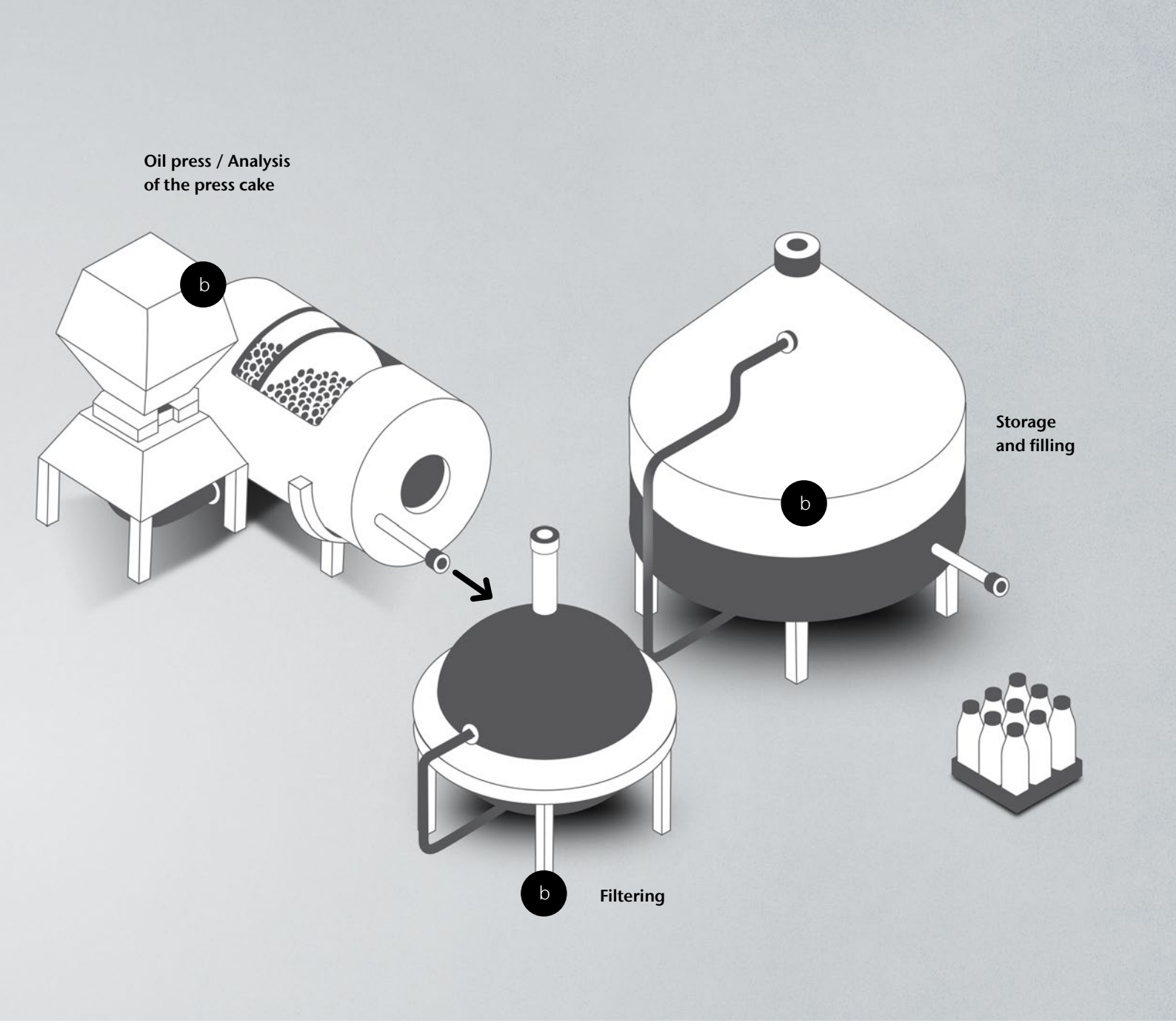
Summary





Thanks to Polytec's inline NIR spectrometers for direct use in the corresponding production steps of the edible oil production, it´s possible to perform fast, cost effective and efficient quality control. Due to the multiplexer technology up to 6 measuring probes at different production points can be controlled cost-efficiently with only one spectrometer.

Process-optimised measuring probes for liquid as well as solid samples and user-specific adaptations for edible oil production are an ideal tool for the non-destructive and fast analysis of oils and enables manufacturers of edible oils the monitoring of all production steps from delivery of the oil seed, through the pressing process and storage in real time and control constantly essential parameters for oil production.

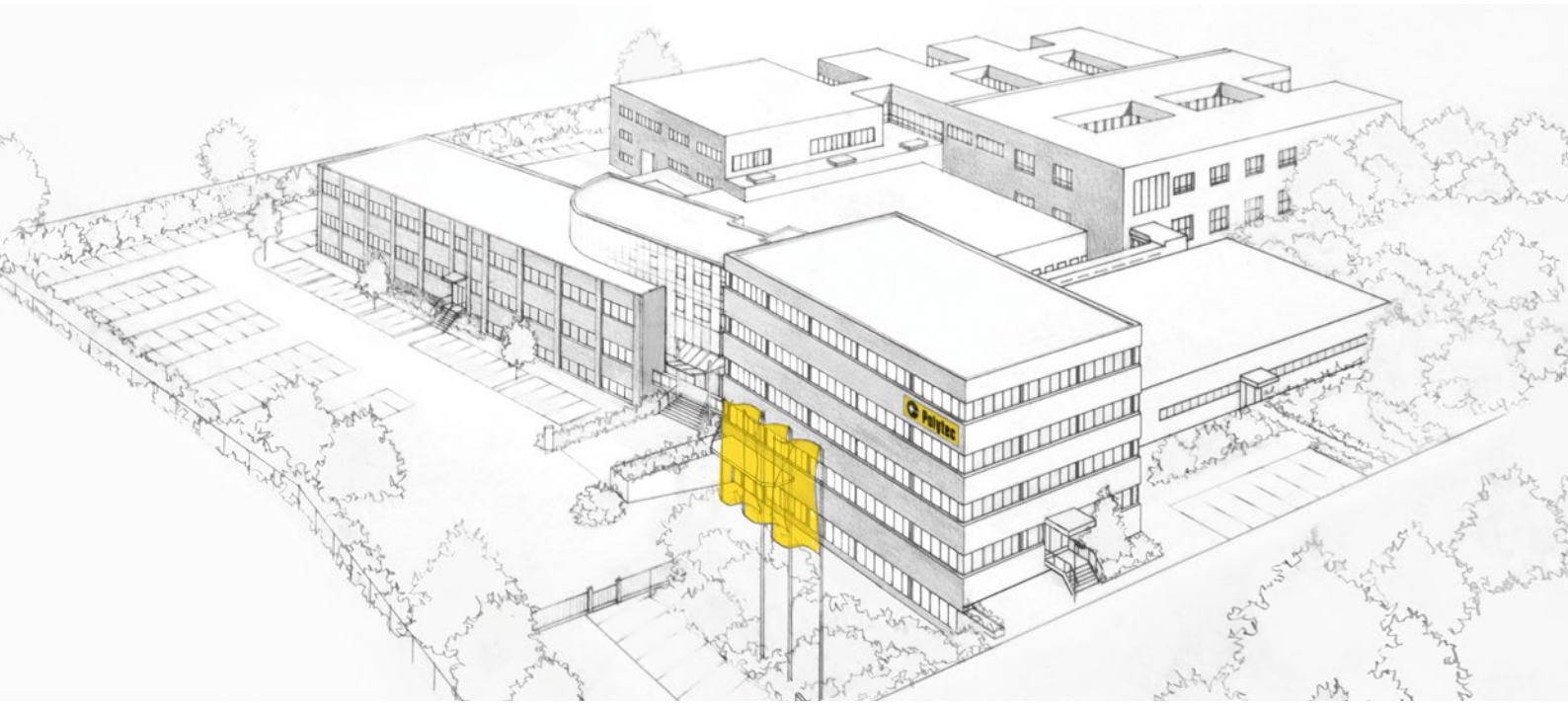


Service and Maintenance

With many years of experience in NIR spectroscopy, Polytec's online spectrometer series is designed for years of trouble-free operation. Should a problem occur, a worldwide network of Polytec companies and representatives is available to address your needs. Professional installations and a high standard of service after delivery are commitments that Polytec makes to all customers.

Application and calibration support

Polytecs' applications team has a comprehensive knowledge of measurement devices and applications. Our specialists are available for method development, either remotely or in your production area.



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