

Inline quality control



Inline quality control of olive oil and by-products

Application note

Inline quality control of olive oil and by-products



Olives and the products made from them are a valuable and highly priced agricultural commodity, therefore the quality control of olives and the monitoring of the process conditions in the production of olive oil is a decisive criterion for the quality of the food produced.

Wet chemical methods, such as Soxhlet analysis, are time consuming and cannot permanently monitor the production process. Since even small changes in production affect the quality of the olive oil produced, laboratory analyses are increasingly insufficient because they do not provide representative results for the entire process.

Polytec's near-infrared (NIR) spectrometers enable olive oil producers to monitor processes at every step of production and adjust them in an automated and cost-effective manner. The entire batch of olives delivered can be analyzed in real time, helping to optimize production and maintain a consistent level of product quality.

With NIR technology, olives are analysed in a fraction of a second, using no harmful chemicals or solvents. With just one measurement, various parameters such as the fat and moisture content of the olives can be measured. The acidity of the delivered olives can also be deter-

mined, as it is a decisive criterion for the storage and processing of olives. The acid number is an indicator of how many positive properties are still present in the oil and whether it is still edible. Polytec has developed ready-to-use calibrations for a quick and efficient start for process monitoring in olive oil production.

Distance sensor head

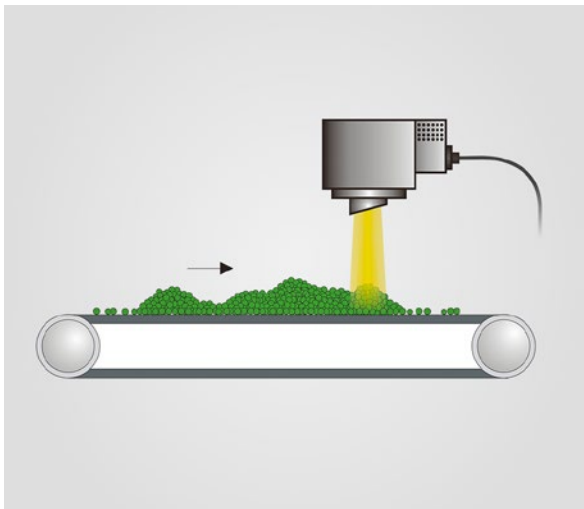
Polytec's distance sensor head is a specially designed reflectance probe that allows you to take measurements at distances from the sample between 150 and 600 mm. The distance sensor head is the perfect tool for the analysis of goods on conveyor belts, for railroad goods and similar applications. The measuring head has a combined illumination and light collecting unit and an integrated reference.

- Fully automated system calibration
- Adjustable measurement spot size
- Integrated 20 W tungsten-halogen light source for sample illumination
- Stainless steel housing



Measurement of the whole olives:

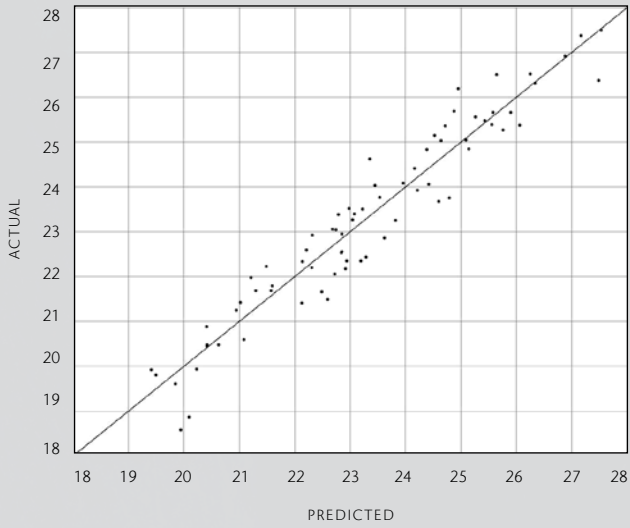
The value of an olive harvest is mainly determined by the oil content. The oil content varies greatly depending on the time of harvest and the olive variety and can range from 10% to 30%. The exact determination of the oil content is essential for the industry to estimate the value of a harvest and to ensure a fair payment to the farmers. Two measurement scenarios have been used, avoiding grinding of the olives.



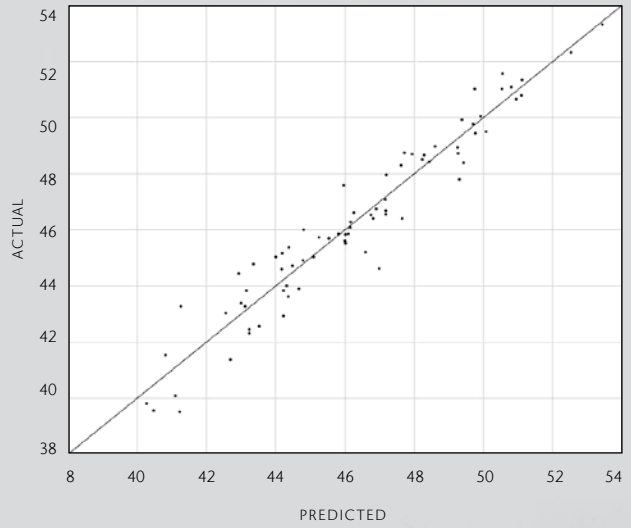
In the first measurement setup, samples are measured with the Polytec NIR spectrometer system and a laboratory-specific adapter using a rotary stage. For the reference analysis, samples were analyzed by one of the leading agricultural institutes in Spain using official techniques. Soxhlet extraction method for the composition of fat concentration and a gravimetric method for the moisture content.

Additionally to laboratory setup, measurements are performed under real process conditions in olive oil mills. In this case, the Polytec NIR system was installed in the processing area by usage of a sensor head, placed above the olive conveyor belt at the exit of the washing plant. With this installation a fully automated sampling, without grinding and human intervention can be carried out.

Calibration for fat



Calibration for moisture



Olive Calibration Ranges:

Fat and moisture content in olives can be measured non-destructively directly on the conveyor belt.

| Parameter | Min (%) | Max (%) | RMSECV |
|-----------|---------|---------|--------|
| Fat | 18.06 | 28.13 | 1.39 |
| Moisture | 37.91 | 53.34 | 1.18 |

Min: Minimum references value in calibration data sets
Max: Maximum references value in calibration data sets.
RMSECV: Root mean square error of cross validation for the calibration data set



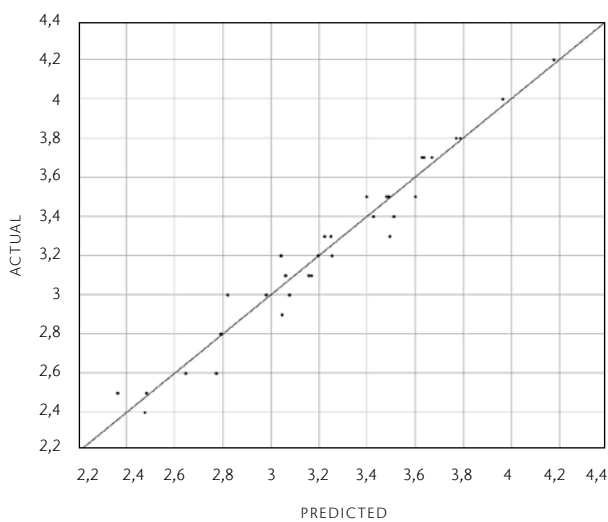


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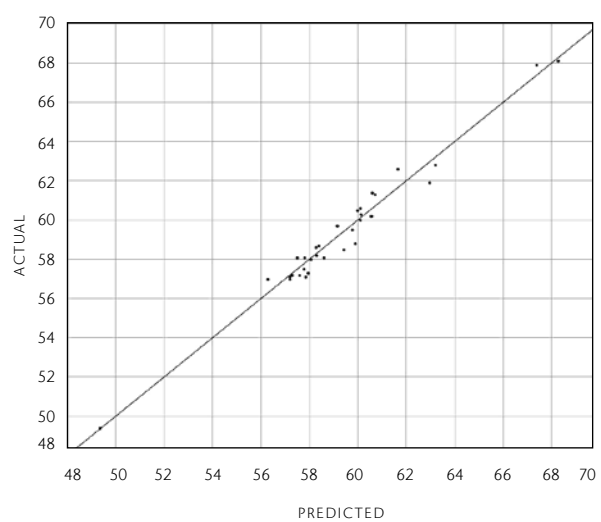
Palacin

Measurement of pomace:

Fat in press cake



Moisture in press cake



| Parameter | Min (%) | Max (%) | RMSECV |
|-----------|---------|---------|--------|
| Fat | 2.40 | 5.20 | 0.30 |
| Moisture | 49.40 | 68.10 | 0.91 |

After the first pressing, which is used for production of the highest quality olive oil (extra virgin), the resulting press cake (pomace) can be analysed for the residual oil content, which should not exceed 2%. If the pomace contains more than 2% residual oil, it is possible to conclude that the first pressing failed which leads to a loss of profit.

With this measurement, the oil producer can decide whether a further pressing process is worthwhile for a lower quality or whether the initial pressing needs to be adjusted. Thus, NIR process technology enables comprehen-

sive monitoring of this process. The technology provides time-saving results and a large number of samples are examined in real-time. Equipped with robust and vibration-insensitive heads that comply with food hygiene regulations, the whole oil extraction process can be controlled. This enables an increase in yield and improves the production margins due to the following factors:

- Optimisation of oil losses in the pomace
- Immediate detection of possible process disturbances
- Increase of the oil quantity at the first extraction

Measurement of the pressed oil:



The olive oil obtained can be analysed for quality and purity before further processing and bottling. The acid content of less than 0.8% is the main criterion for classifying olive oil as "extra virgin". Other quality parameters are the peroxide value, as well as the K-value (UV absorption).

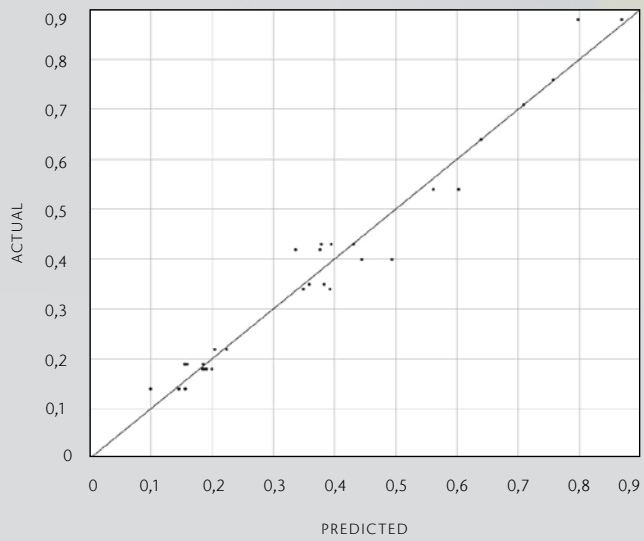
Olive oil is a temperature and light-sensitive product. If it is exposed to high temperatures or UV radiation, it will sooner or later become rancid, therefore the fatty acid profile is an important parameter for the quality of olive oil.

Oleic acid (C18:1) is found chemically bound in triglycerides in almost all natural oils and is particularly present in olive oil in high concentrations. Oleic acid is highly desirable from a nutritional point of view, for example, but it has a decisive influence on the shelf life of the oil because the chemical compound slowly oxidizes in the air, turning yellow.

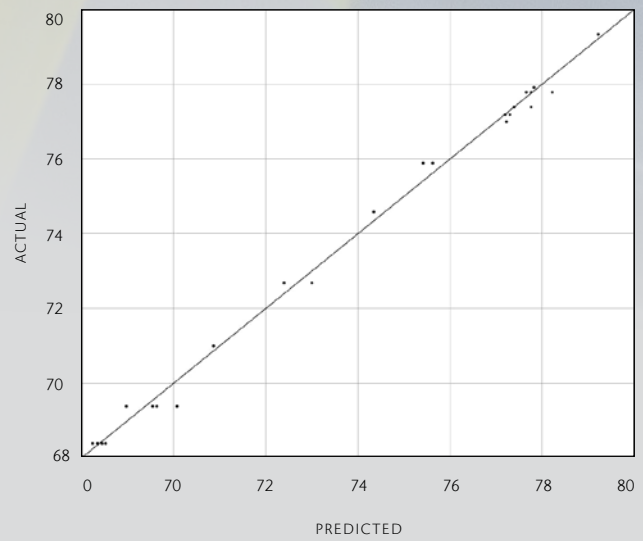
As a result of these oxidation processes, the oil becomes rancid and unpalatable to the consumer. It is therefore obvious that the content of oleic acid in freshly produced olive oil should be as low as possible to ensure stability and usability for the consumer for as long as possible.



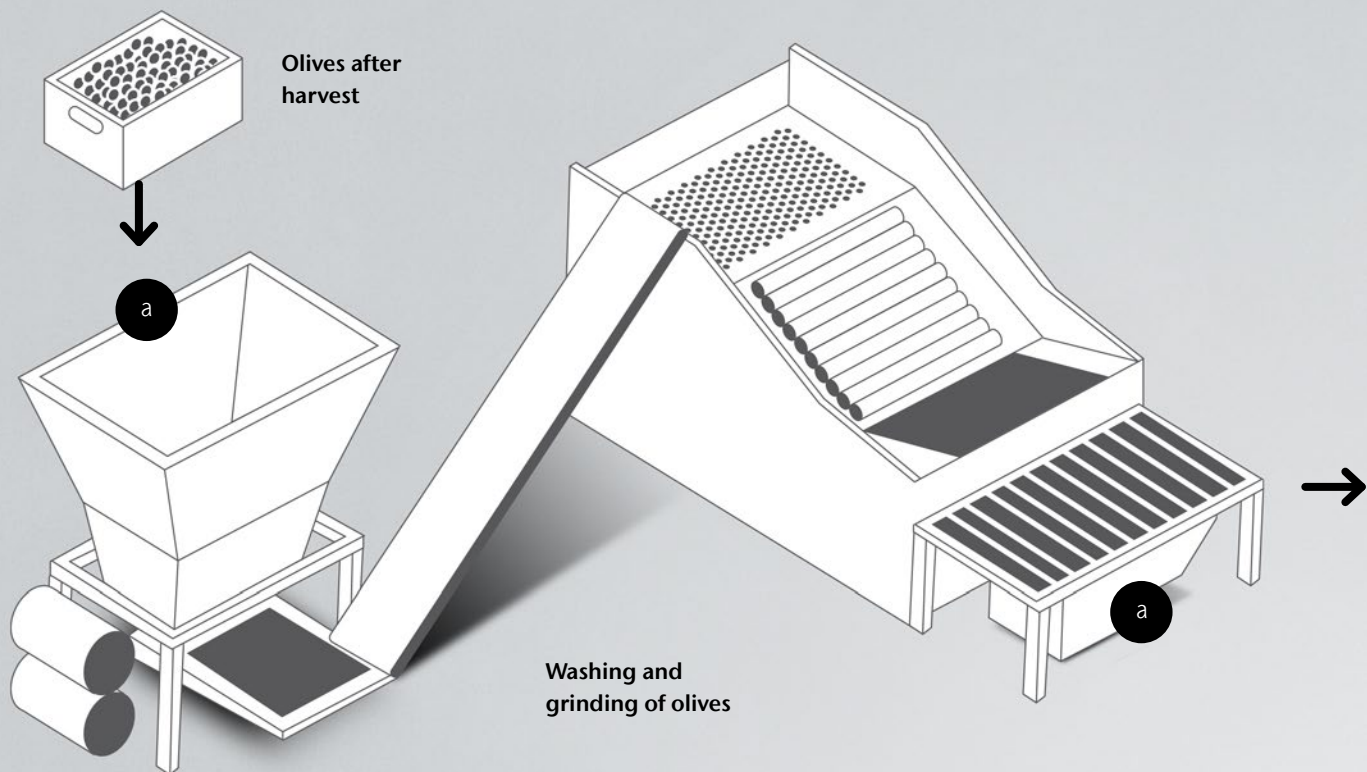
Free Fatty Acid



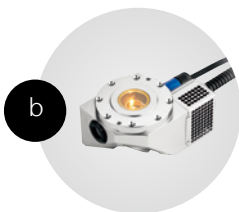
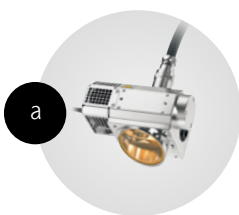
C18:1 Oleic acid



| Parameter | Min (%) | Max (%) | RMSECV |
|------------------|---------|---------|--------|
| Free Fatty Acid | 0.12 | 0.88 | 0.070 |
| C18:1 Oleic acid | 68.4 | 79.3 | 0.363 |

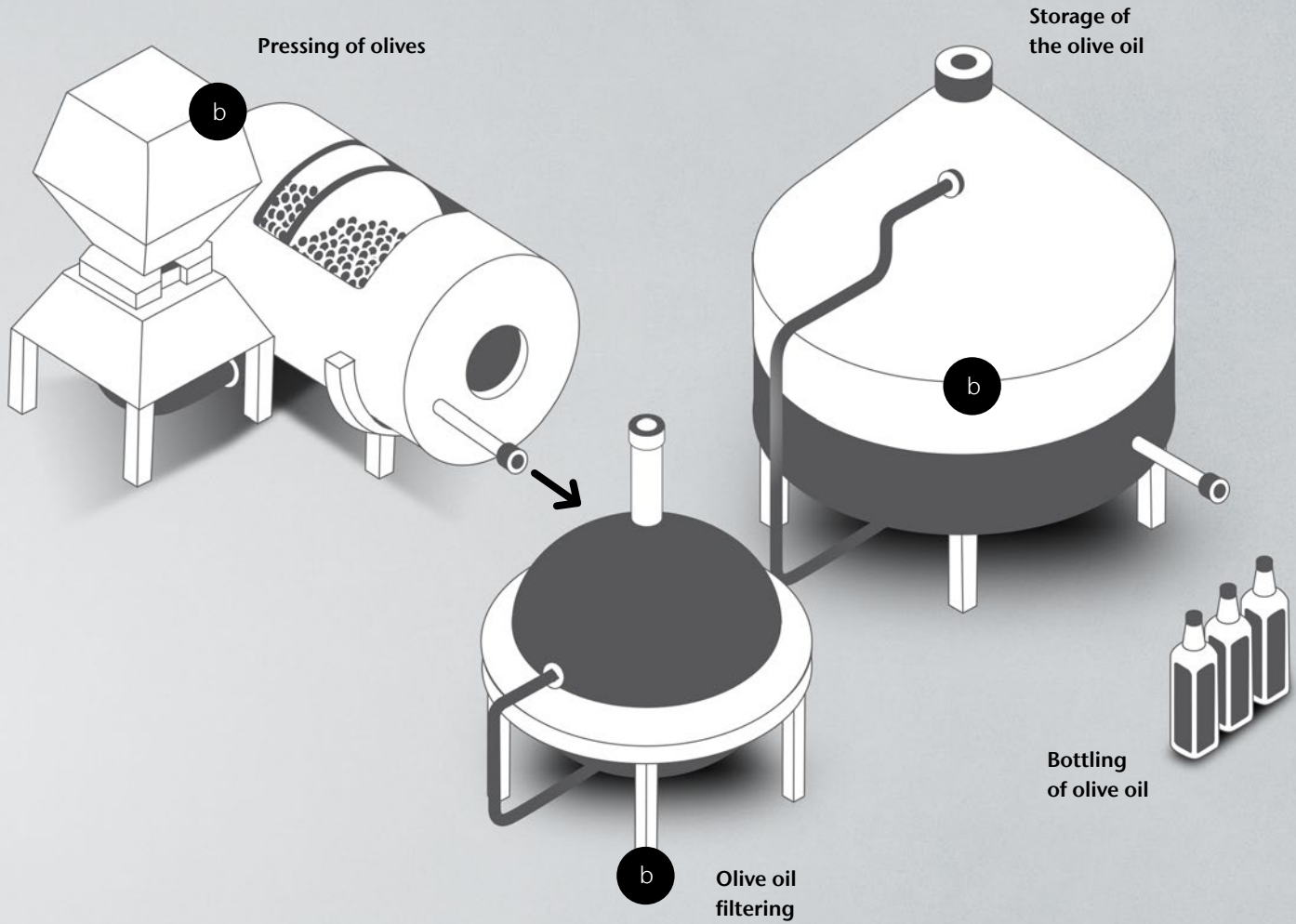


Summary



Polytec's NIR spectrometers can be equipped with up to 6 probes thanks to the multiplexer technology. This allows the producer to use only one spectrometer to monitor multiple production steps from harvesting the olives into the process of pressing and bottling the olive oil.

With the probes for non-contact measurements and integration into process lines via contact probes, every step of olive oil production can be monitored. The most important parameters, decisive for the subsequent quality of the olive oil, are determined in real time. Analysis results are displayed graphically on a screen in the production area. This allows the user to make quick adjustments to the processes and react to deviations in the production flow.



Service and maintenance:

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

Application and calibration support:

Polytec's applications team has extensive knowledge of measurement equipment and applications. Our specialists are available to assist you with method development, either remotely or in your production area.



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