Application Note AN N301

FT-NIR Spectroscopy for the Palm Oil Industry

The oil palm is the most efficient oil-bearing crop compared to e.g. soybean, sunflower or rapeseed. Moreover, the palm fruit is unique in producing two different types of oil. Palm oil is obtained from the fleshy orange mesocarp and palm kernel oil from the seed, in a ratio of around ten to one.

About 90 percent of palm oil products currently go into food applications. Crude Palm Oil is usually refined, bleached and deodorized (RBD). It is often fractionated into a liquid Olein and solid Stearin to increase its versatility in food applications. Olein is mostly used as a cooking and frying oil, whereas Stearin is used in food processing, e.g. in margarine and shortening industries.

Palm Fruit & Kernel Analysis

The farmers are paid based on the actual percentage of oil content in the palm fruits. Therefore it is essential to test the oil content of the crop on the spot to ensure a fair payment of the fruit owners. Moreover, parameters like moisture content enable the oil miller to optimize the process for maximum yield. The expellers can also be tested on the amount of protein, fiber and ash since they are a valuable raw material for the animal feed industry.

Palm Oil Analysis

Crude Palm Oil (CPO) is a raw material used in many vegetable oil based food products. The content of FFA as well as Moisture & Impurities and color are criteria, which affect the value of the oil. Moreover, manufacturers need to assess the Deterioration of Bleachability Index (DOBI), since refining into RBD oil is the most common processing step. Only an oil with a high DOBI will enable the producer to work with milder processing conditions during deodorization, leading to a more natural, healthier product.

FT-NIR Analysis along the Production Chain

The FT-NIR technology offers many advantages over classical wet-chemical and chromatographic analyses. It is quick, cost-effective and safe, since no hazardous chemicals are used. It can help the producer to constantly monitor the quality of the goods along the production chain - from checking the incoming raw materials up to quality testing the finished product. Bruker Optics offers ready-to-use calibrations for the palm oil industry to enable a quick and efficient start.

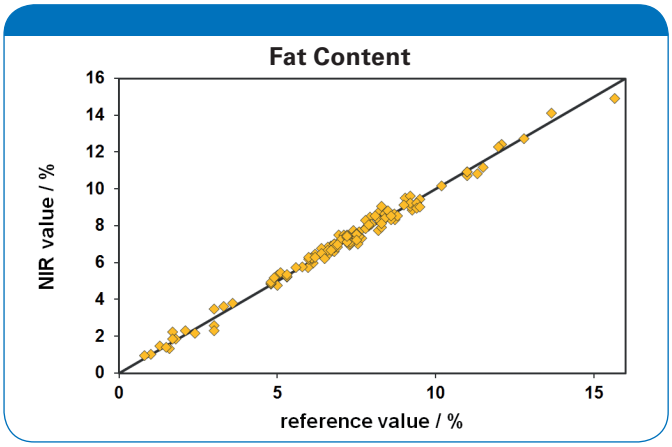
Parameters commonly analyzed with FT-NIR

Palm Kernel

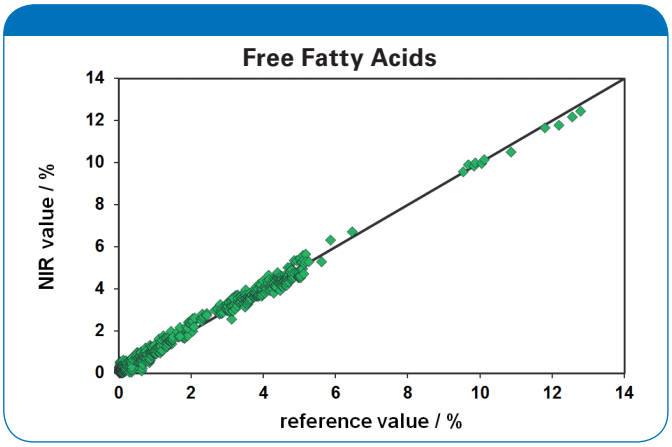
- Oil
- Moisture
- Protein
- Fiber
- Ash

Palm Oil and Fractions

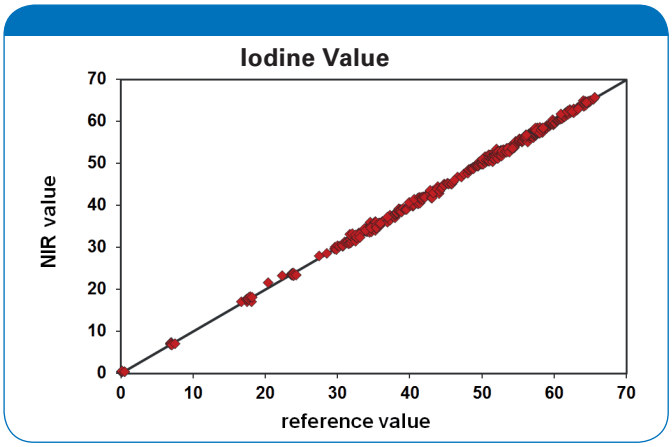
- Free Fatty Acids (FFA)
- Iodine Value (IV)
- Moisture
- Moisture & Impurities
- Slip Melt Point (SMP)
- DOBI
- Color



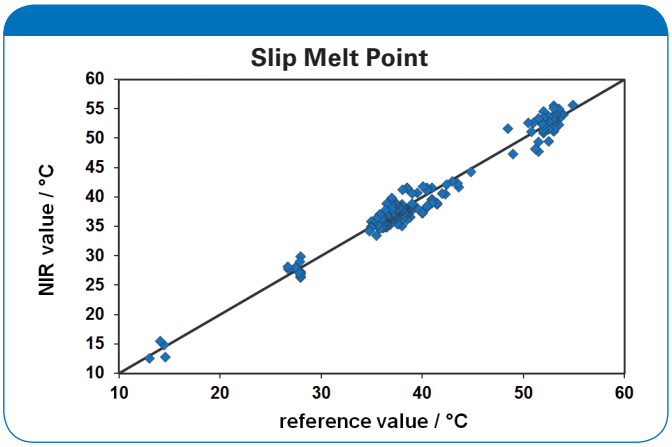
Validation results of Fat Content in Palm Kernels with a standard error of 0.28% over a range from 0.7 - 22.2%.



Validation results of FFA with a standard error of 0.18% over a range from 0 - 12.8% (error of 0.05% achievable for dedicated calibrations).



Validation results of Iodine Value (IV) with a standard error of 0.45 over a range from 0.1 - 65.7.



Validation results of Slip Melt Point (SMP) with a standard error of 1.3°C over a range from 12 - 56°C.

FT-NIR Spectrometers: Bruker Optics offers various FT-NIR spectrometer models for lab, at-line and on-line applications:

TANGO

FT-NIR analyzer for routine use in the lab.

MPA II

Multi Purpose Analyzer for maximum flexibility.

MATRIX-I

At-line analysis with optional NEMA4/IP66 protection.

MATRIX-F

Process monitoring with probes and measurement heads.

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