Application Note AN N291

Analysis of Fish Oil with FT-NIR Spectroscopy

Marine oils are the main source of polyunsaturated Omega-3 fatty acids. Especially EPA (Eicosapentaenoic Acid) and DHA (Docosahexaenoic Acid) are known to be highly beneficial to human health. Since the body is not able to produce Omega-3 fatty acids on its own, it is essential to supplement our diet with DHA, EPA and other valuable unsaturated fatty acids.

Omega-3 fatty acids are mostly found in oily fish such as salmon, mackerel, sardines and anchovies. To efficiently separate the Omega-3 fatty acids from the remaining lipids is the most important step in producing high quality fish oil for use in dietary supplements and food products. Here a close control of the process by analyzing the fractions at different stages is important. Moreover, pharma-grade Omega-3 oils need to meet a number of strict purity parameters before being released.

Advantages of FT-NIR for Fish Oil Analysis
The traditional analyses are generally carried out using standardized chemical and physical methods. However, these methods are often designed for the analysis of only one specific parameter and tend to be tedious, time consuming, expensive and often require hazardous solvents and reagents.

Near infrared (NIR) spectroscopy, on the other hand, is fast (analysis time of the order of less than 1 minute) and can analysis multi-components with only one measurement.

In addition, it is a non-destructive method without any sample preparation, and does not require the use of any solvents or reagents. FT-NIR easily allows performing precise real time analysis resulting in huge time and cost savings.

Bruker Optics rugged FT-NIR analyzers for quality control in the lab or production area are easy to use, rugged and reliable. Our portfolio ranges from the TANGO, a small footprint, touch screen operated analyzer and the MPA Multi Purpose Analyzer to the fully automated in-process system MATRIX-F for closed loop control.

FT-NIR has the potential to substitute a wide range of classical analysis methods in the edible oil industry. Bruker Optics offers ready-to-use calibrations for fish oils as well as plant-based edible oils to enable a quick and efficient start.

Dedicated parameters for Fish Oil commonly analyzed with FT-NIR:

- EPA (Eicosapentaenoic Acid)
- DHA (Docosahexaenoic Acid)
- DPA (Docosapentaenoic acid)
- SDA (Stearidonic acid)
- Total Omega-3 Content
- Free Fatty Acids
- Oxidation Status (Anisidine Value, Peroxide Value)
- Polymer Content

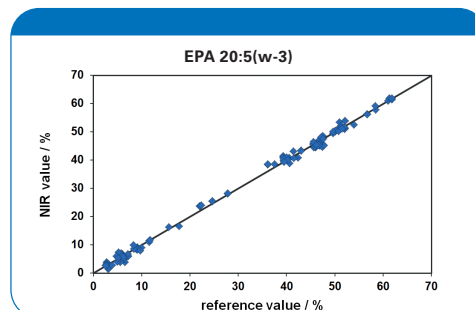## Benefits of FT-NIR Spectroscopy

- No sample preparation
- Sample simply filled in a vial
- Simple to operate user interface
- Fast, non-destructive analysis in less than a minute
- Simultaneous determination of multiple components per measurement
- No waste, no use of solvents, reagents or gases
- Highly precise and accurate
- Direct calibration transfer between instruments
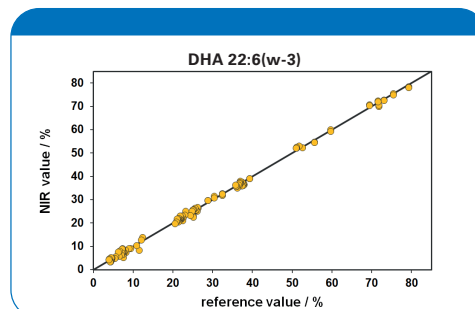
Quality Assurance in a Validated Environment

To ensure that pharma-grade fish oils and Omega-3 fatty acids meet the strict quality parameters before their release, it is essential to carry out a completely traceable analysis according to GLP.

Bruker Optics spectrometers can be fully validated according to US Pharmacopeia and PhEur. The operating software supports Operational Qualification (OQ) and Performance Qualification (PQ) as well as full traceability according to 21 CFR Part 11. Dedicated validation manuals containing a complete documentation of the hard -and software performance are available on request.
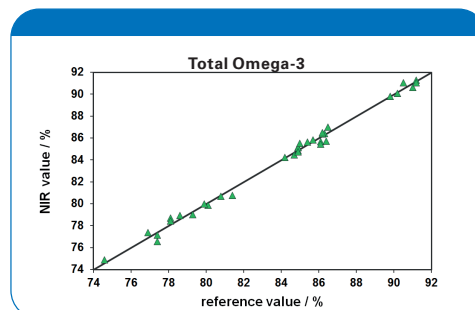
- OPUS Validation Program for OQ/PQ qualification
- Qualification according to USP<1119> and PhEur 2.2.40 with certified standards
- Internal Validation Unit for automatic PQ tests
- Validation manual with complete qualification documentation for hard- and software
- Compliance with 21 CFR Part 11
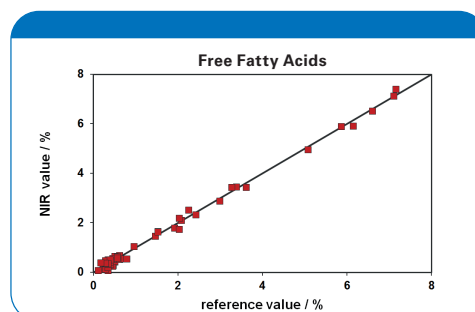- Secure, time-stamped audit trails

Validation results of EPA with a standard error of 1.1% over a range from 2 - 62%.

Validation results of DHA with a standard error of 0.9% over a range from 3 - 79%.

Validation results of total Omega-3 with a standard error of 0.3% over a range from 75 - 91%.

Validation results of FFA with a standard error of 0.1% over a range from 0.1 - 7.2%.