



Application Note AN N526

Online Quality Control of Mineral Fertilizers using FT-NIR Spectroscopy

In 2018, nearly 200 million tons of fertilizers were used worldwide to adapt agriculture to the ever-growing demand. Already 50% of the world's agricultural harvest can be realized only by fertilization. In order to achieve those harvests also in the future, specialized fertilizers are needed for the different demands and with varying compositions.

Fertilizers can be differentiated according to their effect (fast-acting, long-term, depot), their composition (mineral or organic) or, more generally, its form (solid or liquid).

Depending on the soil status and the plant needs, special combinations of minerals and other nutrients are required. To ensure uniform distribution and reproducible fertilization as well as ease of handling, solid fertilizers are often produced in granulated form.

Online measurements of solids in motion

Several measurement points are advisable for a production of granulated fertilizer. To test the composition of the raw material before it enters the process as well as the final product after mixing or granulation ensures optimum product control.

However, the spectrometer must be able to measure moving goods without contact. Bruker developed the Q412/A sensor head to measure moving solids in diffuse reflection. The two built-in tungsten light sources illuminate

the sample. The scattered light is collected by a collimator and guided to the process spectrometer via a fiber optic cable. The sensor head can either be installed over a conveyor belt, on a chute or flanged to a reactor. Up to six sensor heads can be installed per spectrometer.

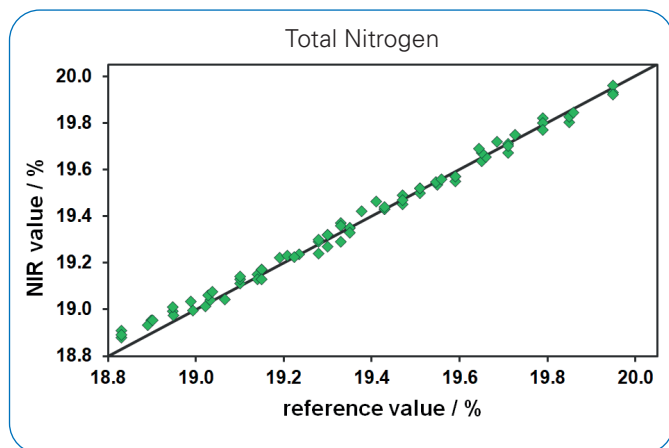
Measuring minerals by FT-NIR

Although NIR spectroscopy is mainly used for the analysis of organic substances, it can also be utilized to determine the concentration of minerals, since they have an influence on the shape of the water absorption band. Thus, in e.g. a granulated NPK fertilizer total nitrogen, total phosphorus and water-soluble potassium content can be determined.

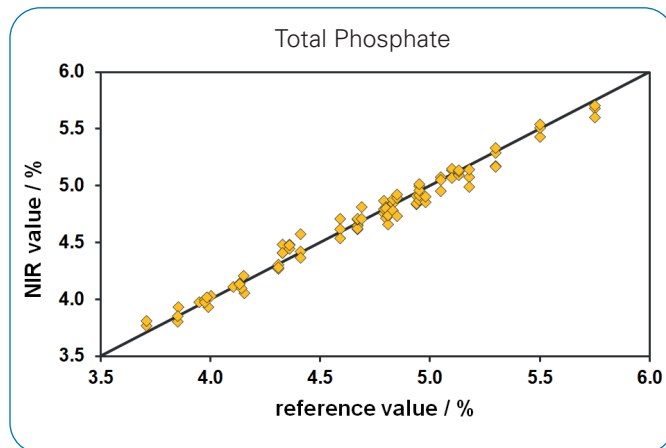
In addition to the sum parameters (e.g. total nitrogen), the individual components such as ammonium nitrogen or nitrate nitrogen, etc. can also be determined. Moreover, the determination of added minerals or elements such as calcium or magnesium may be possible, depending on the matrix and concentration.

Process control even in hazardous areas

The process spectrometer MATRIX-F as well as the sensor head Q412/A are designed for the use in hazardous or Ex areas and meet the high international standards such as ATEX, IECEx and NEC 505/506.



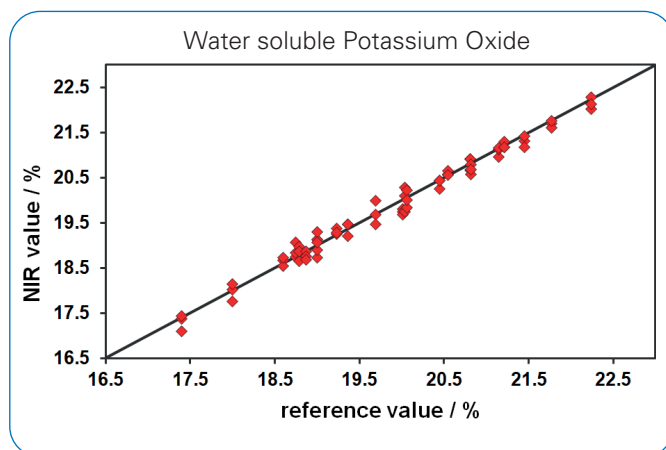
Cross validation results of a PLS based model for the prediction of total nitrogen in fertilizer granules.



Cross validation results of a PLS based model for the prediction of total phosphate in fertilizer granules.

Further Parameters:

- Urea
- Moisture
- Total sulfur
- Total magnesium
- Nitrogen as nitrate, ammonium
- ...and more



Cross validation results of a PLS based model for the prediction of water soluble potassium oxide in fertilizer granules.

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

TANGO



Touch-screen operated FT-NIR analyzer for routine use in the lab and atline.

MPA II



Multi Purpose Analyzer for maximum flexibility with ease-of-use.

MATRIX-F



Process monitoring with probes and contact-less sensor heads.

● Bruker Scientific LLC

Billerica, MA · USA
Phone +1 (978) 439-9899
info.bopt.us@bruker.com

www.bruker.com/optics

Bruker Optics is continually improving its products and reserves the right to change specifications without notice.
© 2021 Bruker Optics BOPT-01

Bruker Optics GmbH & Co. KG

Ettlingen · Germany
Phone +49 (7243) 504-2000
info.bopt.de@bruker.com

Bruker Shanghai Ltd.

Shanghai · China
Tel.: +86 21 51720-890
info.bopt.cn@bruker.com