

# i-pH value of oil in biogas engines

## Summary Information

- i-pH value of oil samples correlates to ASTM D7496
- i-pH value in range from 1 to 14
- Mid-Infrared Spectroscopy

## Product Description

The IR Sphinx spectrometer measure the mid-infrared spectrum of a sample and extract relevant parameters. The spectrometers do not contain any moving parts but use a solid state dispersion element in combination with black body infrared emitters to measure the infrared spectrum of a sample. This results in a unique product which is robust, battery operated and weighs less than 0.5 kg. The spectrometer can be configured to measure from 2.5  $\mu\text{m}$ -5.0  $\mu\text{m}$  or from 5.5  $\mu\text{m}$ -11.0  $\mu\text{m}$ . The IR Sphinx spectrometer come with a sophisticated but user friendly software called Sphinx Suite. The software is modular and the user can choose from a number of different software modules. The software is compatible with many common operating systems.

## Application

A classical pH value cannot be determined in oil. Instead titration is used to provide an initial value for the pH value of the oil. The i-pH value is used together with the Total Base Number (TBN) to provide information about the oil condition. Especially in engines where biogases are burned the TBN measurement alone can result in misleading information as the bases in the oil might not be able to neutralise all acids present. The change in i-pH provides an additional parameter to monitor the accumulation of acidic components in the oil.

The results obtained using infrared spectrometry correlate well with the ASTM standard D7946. However the customer has to assure himself that any reference analysis based on titration provides sensible results.

## How to use

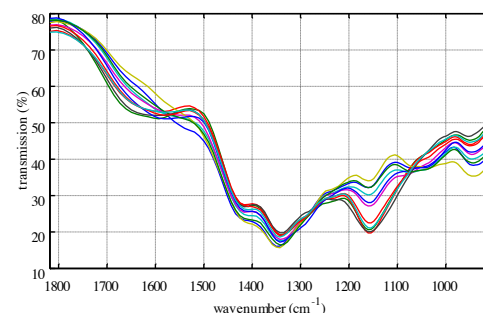
The IR Sphinx spectrometer enable the user to quickly measure the i-pH value of an oil sample. Depending on the product range the measurement is carried out in a slightly different way. For the IR Sphinx ATR products the oil sample placed on top of the ATR crystal making sure that the entire crystal is covered by the oil.

For the IR Sphinx transmission products the oil sample has to be present in the sample chamber. The transmission systems are best suited for inline measurement where the oil sample is delivered to the sample holder via a pumping system. Alternatively a syringe can be used to deliver the sample to the sample holder.

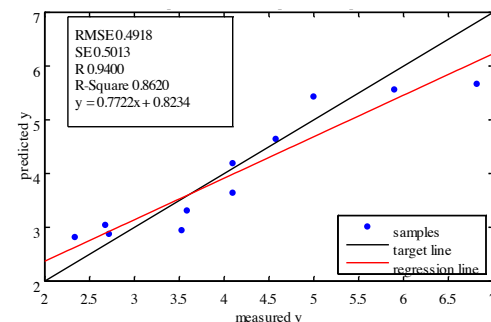
Once the sample is in place the measurement is started from the software. After about 30s the analysis of the sample is available.



## Results & Performance



Mid-infrared absorption spectra of a typical biogas engine oil at different points during the lifetime of the oil. Note the visible changes in the spectra which are related to specific oil degradation effects.



The i-pH value has been calculated from the measured absorption spectra using the SphinxSuite software module. The plot compares the i-pH values obtained from analysing the mid-infrared absorption spectra to the i-pH values obtained from the same oil samples in an accredited oil analysis laboratory. The data indicate that the oil reference data obtained from the oil laboratory should be checked as they indicate a saturation effect (systematic error of titration technique for i-pH value).