Application Note AN-T-173

pHe value of denatured ethanol fuel

Fast and accurate measurement according to ASTM D6423

The pHe is a measure of acid strength in alcohol fuels and in ethanol. It can be used as predictor of the corrosion potential of an ethanol-based fuel. The determination of the pHe is preferred over the total acidity, because total acidity overestimates the contribution of weak acids (e.g., carbonic acid) and underestimates the contribution of strong acids (e.g., sulfuric acid). Furthermore, the acid strength is an important parameter to determine in order to reduce the risk of failing motors.

The pHe is not to be confused with the pH value. The pH value is only applicable for aqueous solutions, whereas the pHe value is a measure for alcoholic solutions.

The pHe value is highly dependent on the sample itself, but also on the stirring rate and the time the electrode is immersed into solution. Therefore, both the stirring rate and measuring time need to be fixed.

This Application Note describes the determination of the pHe value using the 913 pH Meter and the EtOH Trode according to ASTM D6423, which covers denatured fuel ethanol and ethanol fuel blends.

SAMPLE AND SAMPLE PREPARATION

The method is demonstrated for denatured ethanol fuel.

Temperature has a strong influence on the obtained results. Therefore, sample temperatures are first adjusted to be at the same value in order to be able to compare results.

EXPERIMENTAL

This application is performed on a 913 pH Meter equipped with an EtOH Trode, a temperature sensor, and an external stirring plate. The EtOH Trode is conditioned and calibrated prior to use.

A defined amount of sample is poured into a 100 mL beaker and placed on an external stirring plate. The EtOH Trode and the temperature sensor are immersed, and the measurement is started immediately. The value after 30 seconds is considered to be the acid strength of the sample.

Figure 1. 913 pH Meter equipped with a pH electrode. Example setup for the determination of the pHe value.

RESULTS

The analysis demonstrates acceptable and reproducible pHe values. For the tested denatured ethanol fuel, a pHe value of 8.08 (n = 10, SD(rel) = 0.45%) is obtained. An example measurement curve is displayed in Figure 2.

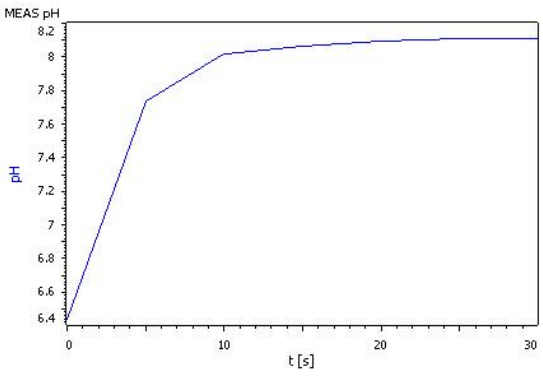

Figure 2. Example curve of a pHe measurement in denatured ethanol fuel.

CONCLUSION

With a 913 pH Meter it is possible to assess quick and easily the pHe of an ethanol fuel according to ASTM D6423. The used EtOH Trode is specifically mentioned in the standard, and is therefore fully compliant.

By using a 913 pH/DO meter or a 914 pH/Conductometer, it is also possible to assess the dissolved oxygen concentration or the conductivity in parallel, if necessary.

Internal reference: AW TI CH1-1232-102016

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CONFIGURATION

913 pH Meter

Portable two-channel pH measuring instrument for measuring pH/mV and temperature. You will be optimally equipped for measurements in the field with this battery-operated measuring instrument.

- Portable pH meter with built-in battery pack and two galvanically isolated pH measuring inputs
- Analog pH measuring input for Metrohm standard pH electrodes
- Digital pH measuring input for the intelligent pH electrodes from Metrohm
- Robust, water-tight and dust-tight housing (IP67) for hard outdoor and laboratory use
- LCD color display with background illumination for simple legibility of the results
- USB interface for simple data export to PC or printer
- Large internal memory (10,000 data sets)
- Pin-protected User and Expert modes, prevents unwanted parameter changes
- GLP-compliant printout and data export with User ID and timestamp

EtOH-Trode

Combined pH electrode with double-junction system for pH measurements in nonaqueous media (e.g., for pHe in ethanol).

The electrode is equipped with a fixed ground-joint diaphragm which is insensitive to contamination, and the bridge electrolyte can be freely chosen (aqueous or nonaqueous).

When c(KCl) = 3 mol/L is used as bridge electrolyte, storage in storage solution is recommended. When a different bridge electrolyte is used, storage in the respectively used bridge electrolyte solution is recommended.

The two chambers for reference electrolyte ("INNER FILLING") and bridge electrolyte ("OUTER FILLING") are each filled with c(KCl) = 3 mol/l at the time of delivery.