Application Note AN-T-202

Reserve alkalinity of engine coolants

Straightforward determination according to ASTM D1121

Corrosion of metallic components is an inherent problem for engines, because metals naturally tend to oxidize in the presence of water and/or low pH value. The reserve alkalinity of engine coolants and antirusts is a measure of the buffering ability to absorb acidity. Such acids might by introduced by exhaust gas leakage, by residual acid cleaner, or by the oxidation of ethylene glycol or propylene glycol. The reserve alkalinity is frequently used for quality control during production and often listed in the specifications of the coolants. A fast and accurate determination is therefore important.

This Application Note describes the straightforward determination of reserve alkalinity according to ASTM D1121. Engine coolants or antirusts are dissolved in water. After a pH measurement, the determination is carried out by potentiometric titration.

Using a fully automated system allows an accurate and reliable determination due to the reduction of human errors. Furthermore, the operator is free to carry out other tasks increasing the efficiency of the laboratory.

SAMPLE AND SAMPLE PREPARATION

The method is demonstrated on engine coolant. No sample preparation is necessary.

EXPERIMENTAL

The analysis is performed on an OMNIS system consisting of an OMNIS Sample Robot S and an OMNIS Advanced Titrator equipped with a Profitrode. The Profitrode has to be calibrated before use.

Engine coolant is pipetted into the sample beaker. While stirring, deionized water is added using the integrated pumps. The pH value is measured until a stable drift is reached, then the solution is titrated with standardized hydrochloric acid to the endpoint at pH 5.5.

Afterwards, the solution is aspirated and the buret tips as well as the electrode are rinsed with deionized water. The glass membrane of the electrode alone is then conditioned for 2 minutes in deionized water.

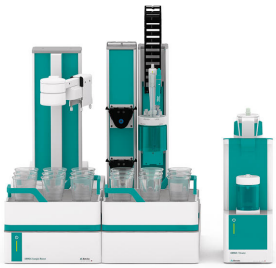

Figure 1. OMNIS system consisting of an OMNIS Sample Robot S and an OMNIS Advanced Titrator equipped with a Profitrode for the determination of the reserve alkalinity in engine coolant.

RESULTS

The obtained results lay within the limits given by ASTM D1121 and are therefore acceptable. An example titration curve can be seen in Figure 2 and the results are summarized in Table 1.

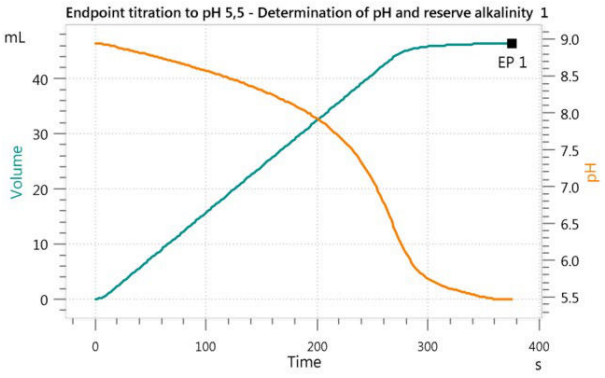

Figure 2. Titration curve of the reserve alkalinity of engine coolant.

Table 1. Results of the determination of the reserve alkalinity in engine coolant (n = 6).

	Mean	SD(abs)	SD(rel) / %
Initial pH	8.94	0.02	0.2
Reserve alkalinity / mL	46.56	0.12	0.3

CONCLUSION

The reserve alkalinity can precisely be determined according to ASTM D1121 by using the Profitrode for indication and a reliable titration system from Metrohm. By choosing an automated OMNIS system, the accuracy can be enhanced and the throughput maximized by the determination of samples in parallel.

Internal reference: AW TI CH1-1251-112018

CONTACT

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CONFIGURATION

OMNIS Advanced Titrator with magnetic stirrer

Innovative, modular potentiometric OMNIS Titrator for stand-alone operation or as the core of an OMNIS titration system for endpoint titration and equivalence point titration (monotonic/dynamic). Thanks to 3S Liquid Adapter technology, handling chemicals is more secure than ever before. The titrator can be freely configured with measuring modules and cylinder units and can have a rod stirrer added as needed. If required, the OMNIS Advanced Titrator can be equipped for parallel titration via a corresponding software function license.

- Control via PC or local network
- Connection option for up to four additional titration or dosing modules for additional applications or auxiliary solutions
- Connection option for one rod stirrer
- Various cylinder sizes available: 5, 10, 20 or 50 mL
- Liquid Adapter with 3S technology: Secure handling of chemicals, automatic transfer of the original reagent data from the manufacturer

Measuring modes and software options:

- Endpoint titration: "Basic" function license
- Endpoint and equivalence point titration (monotonic/dynamic): "Advanced" function license
- Endpoint and equivalence point titration (monotonic/dynamic) with parallel titration: "Professional" function license

Profitrode (length 12.5 cm)

Combined pH electrode with double-junction construction, installation length 11.3 cm. This electrode is suitable for pH measurements/titrations of samples:

- that contaminate the reference system of the electrode (e.g., galvanic baths, samples containing sulfides)
- for which potassium chloride c(KCl) = 3 mol/L cannot be used as reference electrolyte (e.g., reaction of potassium or chloride with sample)

The electrode is equipped with a flexible ground-joint diaphragm which is insensitive to contamination and which can be replaced when needed.

When c(KCl) = 3 mol/L is used as bridge electrolyte, storage in storage solution is recommended.
The bridge electrolyte can be easily replaced with a suitable electrolyte (e.g., potassium nitrate c(KNO_3) = 1 mol/L (6.2310.010)), storage in the used bridge electrolyte.
The Profitrode is available in other lengths under the following article numbers:
- 6.0255.110: Length 17.8 cm
- 6.0255.120: Length 31.0 cm