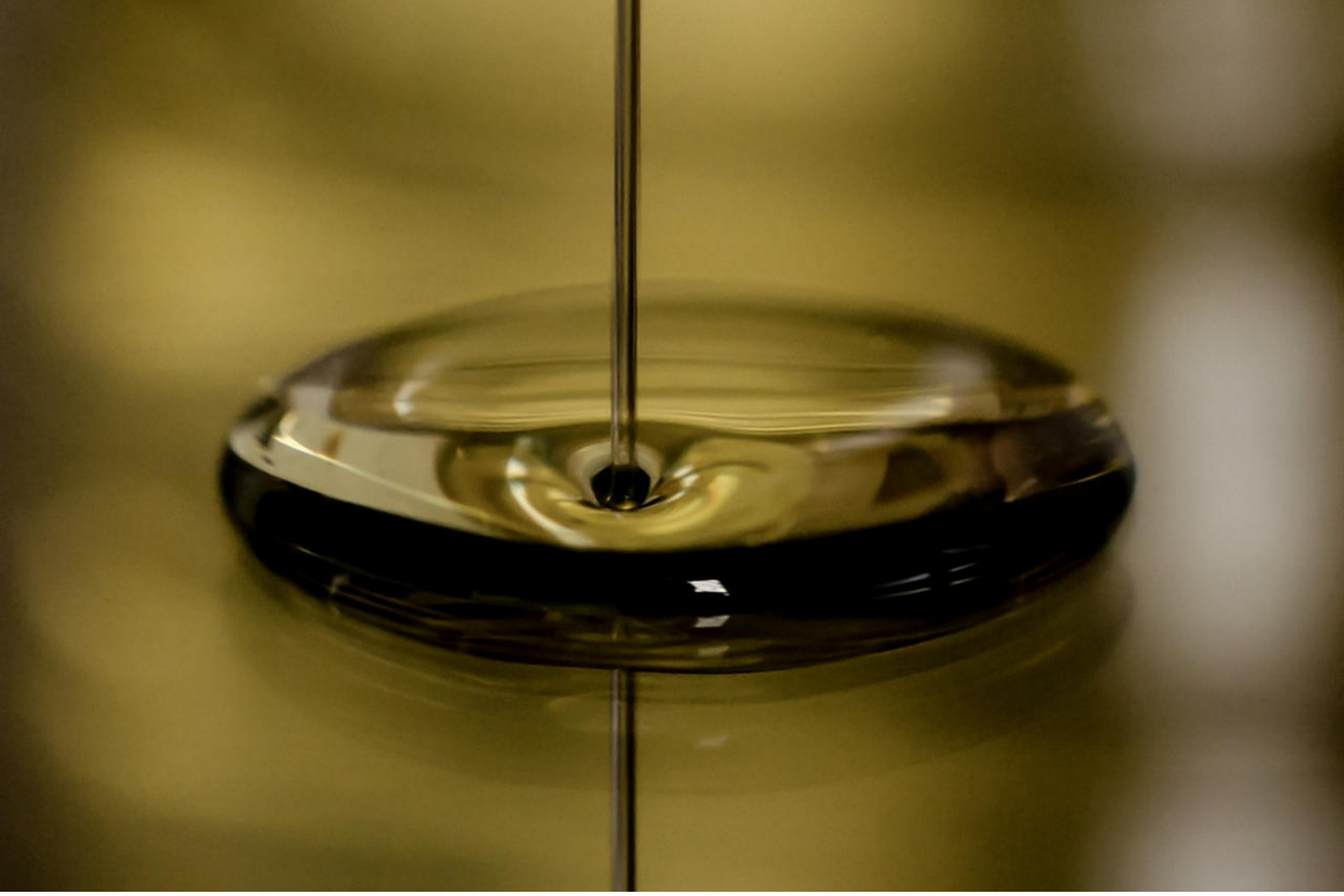

Application Note AN-T-187

Bromine number in petroleum distillate

Ecological determination according to ASTM D1159 with toluene as solvent

The bromine number indicates the degree of unsaturation and relies on the simple addition of bromine to the double bond of alkenes. One mole of bromine is consumed for each mole of carbon-carbon double (C=C) bond present in a substance. In petroleum products, the bromine number corresponds to the olefin content.

Normally, chlorinated solvents are used for the determination of the bromine number. In this Application Note they have been replaced by toluene. This makes the determination more ecological. The titration is performed automatically on an OMNIS system in combination with a double Pt-wire electrode. With this setup, a fast and accurate determination by potentiometric titration can be realized.

SAMPLE AND SAMPLE PREPARATION

The analysis is demonstrated on petroleum distillate. According to the expected bromine number, an appropriate amount of sample is dissolved in toluene.

EXPERIMENTAL

The analysis is carried out on an OMNIS system consisting of an OMNIS Advanced Titrator, an OMNIS Dosing Module, and a double Pt-wire electrode.
Sample and titration solvent (consisting of toluene, methanol, sulfuric acid, and glacial acetic acid) are pipetted into a thermostated vessel. While stirring, the solution is cooled to between 0–5 °C. After reaching this temperature, the solution is titrated with standardized bromine until after the equivalence point is reached.

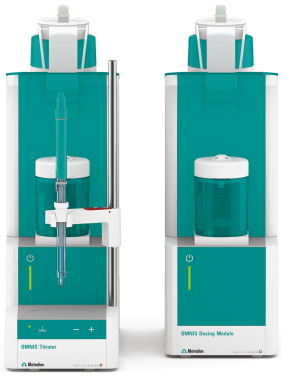

Figure 1. OMNIS system consisting of an OMNIS Advanced Titrator and an OMNIS Dosing Module equipped with a double Pt-wire electrode for indication.

RESULTS

Steep and smooth curves are achieved with this setup. The results are very reproducible with relative standard deviations < 0.2 %.

With the presented analysis, a bromine number of 10.80 g bromine/100 g petroleum distillate (n = 5; SD(rel) = 0.19%) is obtained.

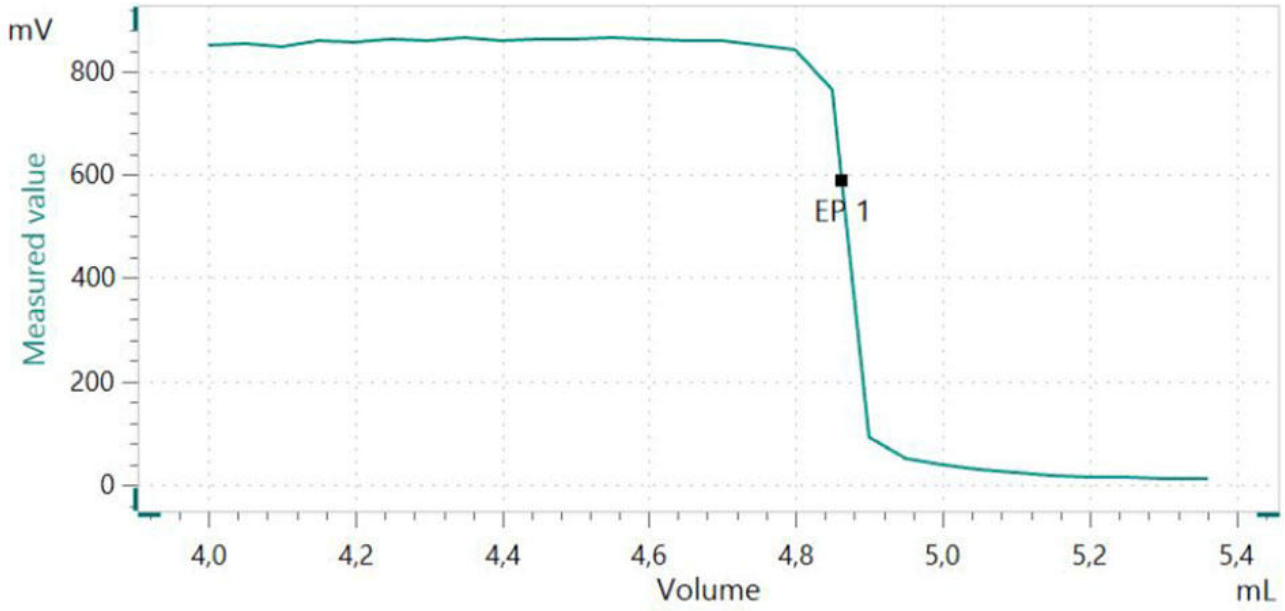

Figure 2. Titration curve of the determination of the bromine number of a petroleum distillate sample.

CONCLUSION

After reaching the temperature of 0–5 °C, the titration is automatically started. There is therefore no further need to observe the temperature. The titration curves are steep and easy to evaluate. Due to this point, the reproducibility is very good and the criteria of ASTM D1159 regarding reproducibility is fulfilled. Additionally, the exchange of chlorinated solvents by toluene leads to a more environmentally friendly application with a comparable precision.

Internal reference: AW TI CH1 1245-122017

CONTACT

Metrohm Slovensko, s.r.o.
Galvaniho 12
82104 Bratislava
office@metrohm.sk

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

OMNIS Dosing Module without stirrer

Dosing module for connection to an OMNIS Titrator for extending the system to include an additional buret for titration/dosing. Can be supplemented with one magnetic stirrer or rod stirrer for use as separate titration stand. Freely selectable cylinder unit with 5, 10, 20 or 50 mL.

Double Pt-wire electrode for coulometry

Indicator electrode used for coulometric Karl Fischer titration.

Pt1000 temperature sensor (installation length 12.5 cm)

Pt1000 temperature sensor (class B) made of glass. This PT1000 temperature sensor is also available under the article number 6.1110.110 with an installation length of 17.8 cm.