Application Note AN-T-206

Bromine index of petroleum-based hydrocarbons

Environmentally beneficial determination based on ASTM D2710 and IP 299

The bromine index is an important parameter for the determination of aliphatic C=C double bonds in petroleum hydrocarbons. Bromine is generated in-situ from a solution of bromide and bromate, and the bromine index is determined by an electrochemical titration at 5 °C. For the titration, a solvent mixture of glacial acetic acid, methanol, and dichloromethane is usually used.

In this Application Note, the chlorinated solvent in the solvent mixture was replaced with toluene, resulting in a more environmentally beneficial method in comparison to ASTM D2710 and IP 299.

SAMPLE AND SAMPLE PREPARATION

This application is demonstrated on heptane and cyclohexene, respectively.

EXPERIMENTAL

The analysis is carried out on an OMNIS Advanced Titrator equipped with a double Pt wire electrode. Before the sample is determination is determined, a blank determination is performed.

An appropriate amount of sample and solvent mixture consisting of glacial acetic acid, methanol, and toluene are added into the titration vessel. While stirring, the solution is cooled below 5 °C. The solution is then titrated with a solution of potassium bromide and potassium bromate until after the equivalent point is reached.

Figure 1. OMNIS Advanced Titrator equipped with a double Pt wire electrode for the determination of the bromine index.

RESULTS

Well-defined, steep titration curves are obtained for both samples. In addition, low relative standard deviations below 1% are achieved. The results are displayed in Table 1.

Table 1. Results of the bromine index determination in heptane and cyclohexene.

Bromine index (n = 6)	Heptane in mg/100 g sample	Cyclohexene in mg/100 g sample
Mean	0.66	90.61
SD(abs) / (mg/ 100 g sample)	0.003	0.63
SD(rel) / (%)	0.4	0.7

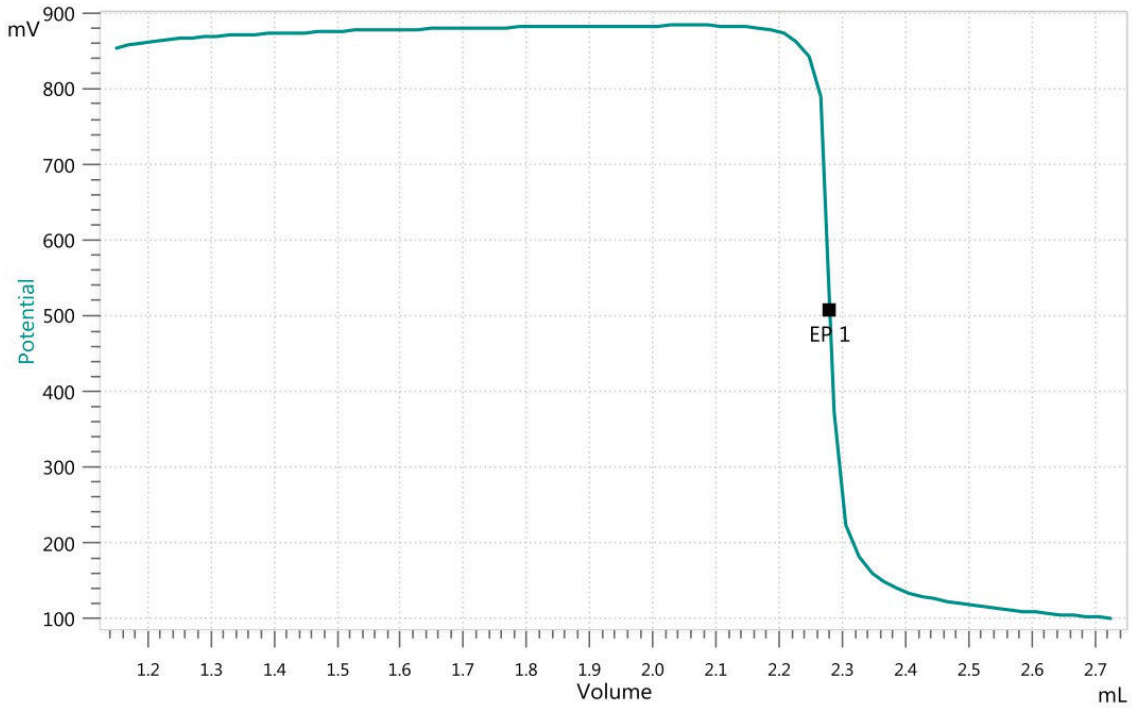

Figure 2. Example titration curve of the bromine index determination in cyclohexene.

CONCLUSION

Titration is an inexpensive method, allowing precise and reliable determinations of the bromine index of petroleum hydrocarbons based on ASTM D2710 and IP 299. The replacement of dichloromethane with toluene provides an environmentally friendly alternative for the analysis.

Using an OMNIS Titrator allows you to customize the system according to your needs and expand it for other titration applications.

Internal reference: AW TI CH1-1263-122018

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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

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.