Application Note AN-T-098

# Total base number according to IP test method 400

## Base number of petroleum products determined following IP 400

Acids are formed in engines during the combustion process through oxidation of hydrocarbons and sulfur compounds. These acids can attack the engine surfaces, causing corrosion. The alkaline reserve of engine oil serves to neutralize these acids and thus protect the engine from damage. The alkaline reserve is the amount of alkaline additives in the oil that serve to neutralize harmful acids. The total base number (TBN) value determines the alkaline reserve of oil.

The TBN value is expressed in milligrams of potassium hydroxide (mg KOH) per gram of oil. A high TBN value means that the oil has a high alkaline reserve and therefore offers good protection against acids. It is recommended to have TBN values of at least 8 mg KOH/g for modern engines.

Some benefits of using conductometric titration for this analysis according to IP test method 400 include accuracy, speed, simplicity, sensitivity, and flexibility.

## SAMPLE

A new commercially available motor oil was used for the analysis.

## EXPERIMENTAL

Hydrochloric acid in a 2-propanol solution was used to titrate the sample up to the first equivalence point. The conductivity was measured after each titrant addition.

A 5-ring conductivity cell was used as the measuring cell. Figure 1 shows the system that could be used for this analysis.

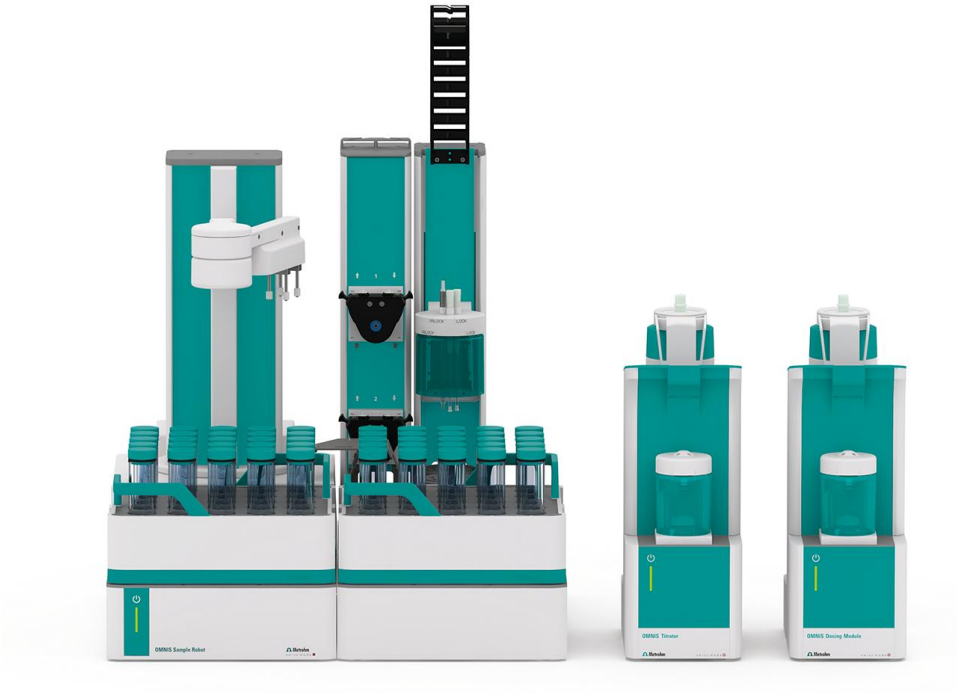

**Figure 1.** OMNIS Titrator with an OMNIS Dosing Module and OMNIS Sample Robot.

## RESULTS

The determination of the TBN value in motor oil gave accurate results (Table 1). An example determination is shown in Figure 2.

**Table 1.** Results of the motor oil determination by conductometric titration according to IP 400.

| Sample | Result TBN | RSD in % |
|---|---|---|
| Motor oil (n=6) | 7.85 mg KOH/g | 0.4 |

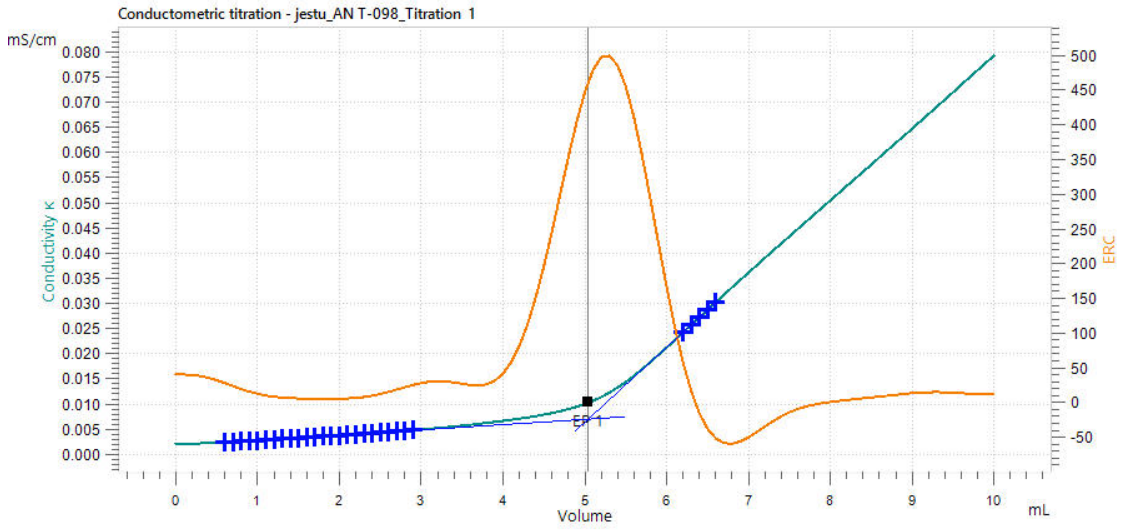


**Figure 2.** Example titration curve to determine the total base number in motor oil according to IP test method 400.

## CONCLUSION

This analysis method does not require indicators or complicated instruments. Compared to other titration methods, it is highly sensitive, giving users precise results.

The measurement is easy to perform and is applicable to a variety of sample types. Measuring suspensions, slurries, and cloudy or colored solutions (e.g., diesel fuels or oil samples) is straightforward.

The robust design of the conductivity measuring cell makes it easy to clean. Unlike a potentiometric sensor, the cell does not require any rehydration time between measurements.

It is possible to use conductivity titration to titrate highly diluted solutions, nonaqueous solutions, strong acids, and weak acids or bases. The endpoint of this titration method is sharp and precise compared to other titration methods.

## CONTACT

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