Saponification value of edible oils

Fully automated saponification value titration according to EN ISO, ASTM, AOAC, USP, and Ph.Eur. standards

The saponification number or saponification value is an important parameter used for the characterization and assessment of the quality of edible fats and oils. Furthermore, the saponification value provides information about the average molecular weight of all bound and free fatty acids present in a sample. The higher the saponification value of an oil or fat sample, the lower the molecular weight of all medium chain fatty acids.

In simple terms, the saponification value indicates how many grams of sodium hydroxide (NaOH) or potassium hydroxide (KOH) are required to neutralize the fatty acids contained in one gram of fat.

This Application Note describes the titrimetric determination of the saponification value in canola oil (rapeseed oil) and olive oil. The analysis is performed according to the standard EN ISO 3657 and is based on a modification of the norms AOAC 920.160, ASTM D5558, USP<401>, and Ph.Eur. 2.5.6. Using potentiometric indication, very precise results can be achieved for a wide range of edible oils and animal fats as well as for waxes and other products with high saponification values.

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SAMPLE AND SAMPLE PREPARATION

The analysis is demonstrated on canola oil (rapeseed oil) and olive oil.

An appropriate amount of sample is weighed into a conical flask and refluxed with ethanolic potassium hydroxide solution for 60 minutes – this is required to saponify the sample. For the blank determination, the same procedure is applied, but the sample is omitted.

EXPERIMENTAL

This method is carried out on an OMNIS system consisting of an OMNIS Advanced Titrator, an OMNIS Dosing Module, and a dSolvotrode (**Figure 1**).

The prepared sample solution is first allowed to cool down to room temperature. Next, the buret tips as well as the electrode are inserted into the conical flask. Ethanol is added, and then the solution is titrated with standardized hydrochloric acid until after the equivalence point is reached. Afterwards, the electrode is cleaned with ethanol and deionized water. The electrode is then conditioned by immersing the bulb (glass membrane) alone in deionized water for one minute.

Figure 1. OMNIS Advanced Titrator and OMNIS Dosing module equipped with dSolvotrode for the determination of saponification value.

RESULTS

This method offers very precise results for saponification value determination. Steep and smooth titration curves are generated from the analysis (**Figure 2**), with SD(rel) <0.5% as displayed in **Table 1**.
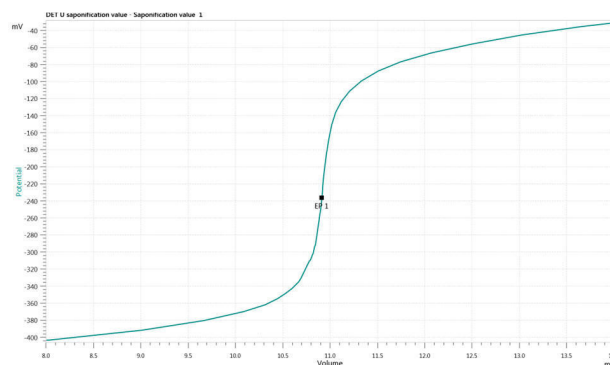

Figure 2. Titration curve from the determination of the saponification value of canola (rapeseed) oil.

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Table 1. Results for the saponification value for canola oil (rapeseed oil) and olive oil.

Sample (n = 5)	Mean saponification value in (mg KOH/g)	SD(rel) / %
Canola oil	190.75	0.3
Olive oil	193.52	0.2

CONCLUSION

The saponification value in a variety of edible oils is easily determined using automated potentiometric titration according to the standard EN ISO 3657. The dSolvotrode used in this application was designed especially for nonaqueous titrations and leads, together with the OMNIS system (which offers users flexibility combined with high-end software), to unmatched precision.

In addition to improving the accuracy and speed of determinations, OMNIS delivers results equal to or better than other established titration systems. OMNIS can be customized according to your needs and expanded for other titration applications required for your quality control purposes.

Furthermore, the OMNIS system is easily expandable and leaves all options open for further analysis of key fat quality parameters like iodine value or free fatty acids.

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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.

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dSolvotrode

Digital, combined pH electrode for OMNIS for all non-aqueous acid/base titrations. The glass membrane is optimized for poorly conducting solutions and thanks to the flexible ground-joint diaphragm, the electrode is suitable for contaminated samples.

This electrode can be used with non-aqueous reference electrolytes (lithium chloride or tetraethylammonium bromide).

Storage in corresponding reference electrolyte.

dTrodes can be used on OMNIS Titrators.

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