

Application Note AN-R-035

Oxidation stability of spices and seasonings with the PEG method

Fast and reliable determination without sample preparation due to polyethylene glycol as carrier material

Herbs, spices, spice blends, flavor enhancers, and other seasonings are integral to modern cuisine. A wide variety of plant parts can be used (e.g., leaves, flowers, bark, seeds, roots, fruits, or sap) which contain flavoring and aromatic compounds as well as essential oils. Thanks to their antioxidant content, spices are also used to preserve foods, beverages, and spice mixtures. This is also known as spices' antioxidant activity.

The presence of antioxidants may be natural or added artificially. Rosemary, for example, contains high levels of carnosolic acid and has potent antioxidant, antimicrobial, and anti-inflammatory properties. Furthermore, the oxygen radical absorbance capacity of rosemary helps to scavenge free radicals, lending health benefits and possible protection against heart disease. Rosemary powder or extract is therefore used as a natural favorite antioxidant and is of economic importance in the food industry.

However, processing spices (especially drying and

storage) reduces the total antioxidant content over time and can lead to a loss in quality. It is therefore important to monitor and analyze the antioxidant compounds in spices as a quality parameter.
The 892 Professional Rancimat is an analytical system to easily and safely determine the oxidation stability of fresh and dried herbs as well as spices and seasonings with the PEG method according to AOCS Cd 12b-92 and ISO 6886.

INTRODUCTION

When measuring stability with the Rancimat, the PEG (polyethylene glycol) method has proven to be the most effective analytical technique aside from direct measurement. It is particularly suitable for products with a complex matrix, samples with low fat or high water content, or if time-consuming sample preparation should be avoided.
Because the PEG method requires no sample preparation, the entire sample (including the matrix) is analyzed. As many spices and seasonings naturally contain high antioxidant levels or have added stabilizers (depending on the use in the final product), the PEG method can be used to determine the sample's antioxidant content and antioxidant capacity.

SAMPLE AND SAMPLE PREPARATION

This application is demonstrated on ground black and white pepper, sliced rosemary, ground caraway, granulated garlic, curry powder, as well as a common seasoning (powdered) with salt and glutamate, as displayed in Table 1.
No sample preparation is required.

EXPERIMENTAL

The determinations are carried out using an 892 Professional Rancimat (Figure 1).
An appropriate amount of sample and PEG are weighed into the reaction vessel, and then the analysis is started.
With the Rancimat method, the sample is exposed to an airflow at a constant temperature of 100–180 °C. Highly volatile secondary oxidation products are transferred into the measuring vessel along with the airflow where they are absorbed in the measuring solution.

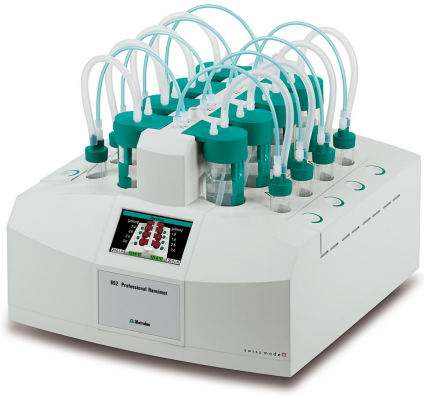


Figure 1. 892 Professional Rancimat equipped with measuring and reaction vessels for the determination of oxidation stability.

The conductivity of the measuring solution is continuously registered. The formation of secondary oxidation products leads to an increase in the conductivity. The time until occurrence of this marked conductivity increase is referred to as the «induction time», which is a good indicator for the oxidation stability (Figure 2 and Figure 3).

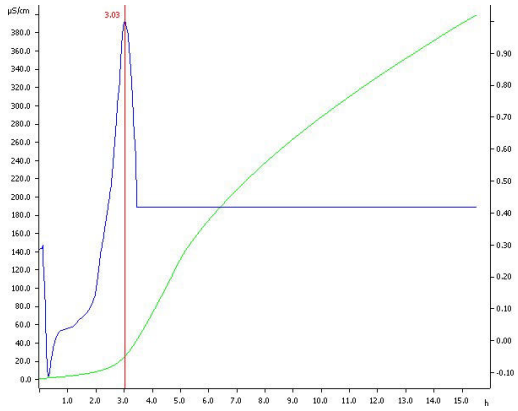


Figure 2. Determination of the oxidation stability of ground black pepper. Induction time is determined at 3.03 h.

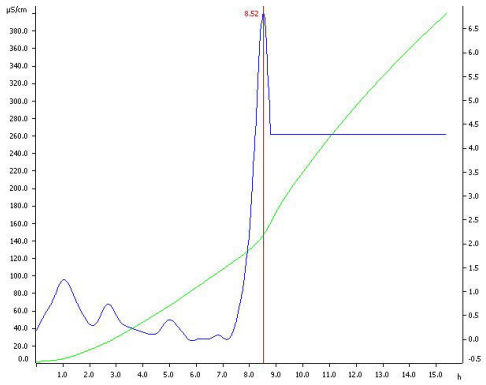


Figure 3. Determination of the oxidation stability of sliced rosemary. Induction time is determined at 8.52 h.

Table 1. Summary of results for the oxidation stability of various spices and seasonings with the 892 Professional Rancimat as measured at 120 °C.

Sample (n = 4)	Mean value in h	SD(abs) in h	SD(rel) in %
Black pepper (ground)	2.92	0.18	6.0
White pepper (ground)	1.45	0.03	2.1
Rosemary (sliced)	8.70	0.75	8.6
Caraway (ground)	1.87	0.13	7.1
Garlic (granulated)	0.47	0.01	2.0
Curry (powdered)	1.97	0.03	1.4
Seasoning (powdered)	0.66	0.02	3.2

CONCLUSION

Thanks to the PEG method, a reproducible and accurate determination of the oxidation stability of spices and seasonings is possible. Since no sample preparation is required, the direct influence of the complete matrix of the sample is seen—not just the individual components. Using the Rancimat with PEG is therefore a well-suited antioxidant measurement method.

The results show clear differences between different spices according to their amounts of antioxidants. The induction time for black pepper is nearly twice that of white pepper, while rosemary has the highest induction time of the samples tested in this study.

With the Rancimat, this quality parameter can easily and simultaneously be determined for eight different samples at a time, increasing quality control laboratory throughput. This is possible due to the eight measuring positions in two heating blocks. The built-in display shows the status of the instrument and each individual measuring position. Start buttons for every measuring position enable the measurement start on the instrument.

The use of practical disposable reaction vessels and dishwasher-safe accessories reduces cleaning to a minimum. This saves time and money and significantly improves accuracy and reproducibility.

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CONFIGURATION



892 Professional Rancimat

The 892 Professional Rancimat is an analysis system for the simple and safe determination of the oxidation stability of natural fats and oils with the well-established Rancimat method. With eight measuring positions in two heating blocks. The built-in display shows the status of the instrument and each individual measuring position. Start buttons for every measuring position enable the measurement start on the instrument. Cleaning effort can be reduced to a minimum through the use of practical disposable reaction vessels and dishwasher-safe accessories. This saves time and costs and significantly improves accuracy and reproducibility.

All accessories necessary for carrying out determinations are included in the scope of delivery. The StabNet software is required for instrument control, data recording and evaluation and for data storage.