MultiScan MS 20

Stability Analysis of Seasoning Oil Mixtures with DataPhysics Instruments MS 20

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Understanding Interfaces

Seasoning oil (Fig. 1) is popular worldwide and plays an essential role in cooking, due to its enhancement of flavour in various foods. These oils are often dispersions with multiple components for which a homogeneous distribution needs to be assured in order to accieve a good taste and cooking quality. To study the stability of seasoning oil formulations and modify them towards a better processability and performace is therefore of high importnace. With the MultiScan 20 (MS 20) (Fig. 2) dispersion stability analysis system form DataPhysics Instruments stability changes can be detected and evalauted in a quantitative way much faster than any traditional shelflife test would permit. The stability study of three seasoning oil formulations will be presented throughout this application note .

Fig. 1. One example of seasoning oil.

Keywords: MultiScan 20 (MS 20) ▪ Stability Analysis ▪ Seasoning Oil ▪ Food Product

Technique and Method

The MultiScan MS 20 (Fig. 2) from DataPhysics Instruments is the measuring device for the automatic optical stability and aging analysis of liquid dispersions and the comprehensive characterisation of time- and temperature-dependent destabilisation mechanisms. It consists of a base unit and up to six connected ScanTowers with temperature-controlled sample chambers. The ScanTowers of the MS 20 can be individually controlled and operated at different temperatures (4 °C to 80 °C).

With its matching software MSC, MS 20 is an ideal partner for the stability analysis since even the slightest changes within dispersions can be detected and evaluated. The MS 20 enables a fast and objective analysis of the dispersion stability as well as conclusions on possible destabilisation mechanisms.

Fig. 2. DataPhysics Instruments stability analysis system MultiScan MS 20 with six independent Scan Towers.

Experiment

A small vial filled with the desired dispersion is placed in one of the “Scan Towers” of the MS 20. The scanning system is composed of a transmission and backscattering LED along with a detector. This system moves along the vertical side of the vial (z-axis).

The obtained transmission and backscattering intensity is represented in an intensity-position diagram. The sample was scanned at regular time intervals. Changes in the detected measuring signal can provide explanations on the stability properties of the sample.

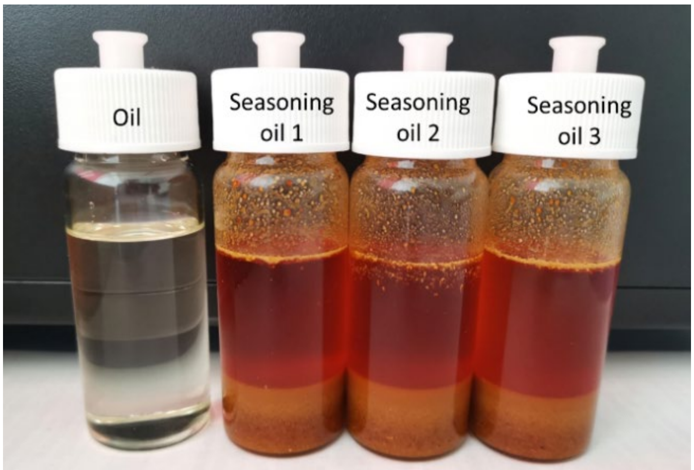

Fig. 3. Seasoning oil samples show an inhomogeneous particle distribution after 2 h 50 min measurement time

20 ml of each seasoning oil formulation (seasoning oil 1, seasoning oil 2, seasoning oil 3) were poured in a transparent glass vial and measured at T = 40 °C every 5 s for 2 h 50 min. The measured zone is between 0 mm (bottom of the glass) and 57 mm (fill level of the vial). Fig.3 shows the samples' vials at the end of the measurement.

Results

As the samples have a significant volume concentration, the transmission signal was too weak and exhibited very little information throughout the measurment. Therefore the backscattering signal was analysed to study the stability of seasoning oil.

The three samples showed similar change of backscattering intensities over time. Figure 4 shows the plot of the relative backscattering intensities against the position for seasoning oil 1. The colour-coding of the curves indicates the time at which they were recorded, from red (start of the experiment, t = 0 s) to purple (end of experiment, t = 2 h 50 min). Every curve represents one individual measurement. The backscattering diagram shows a clearly time-dependent as well as position-dependent change of the signal, which increased between 4 mm and 15 mm while decreasing between 18 mm and 40 mm, indicating a typical sedimentation process.

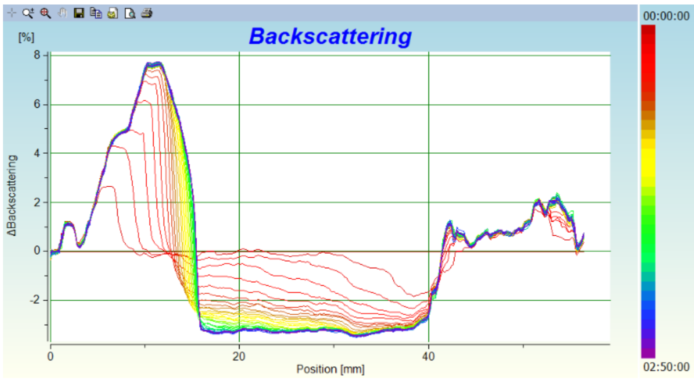

Fig. 4. Backscattering intensity diagram of seasoning oil 1

Fig .4 shows a strong increase of backscattering intensities leading to a peak formation between 4 to 15.5 mm that can be evaluated by peak area method. Calculated with the respective function of the MSC software, the change in peak

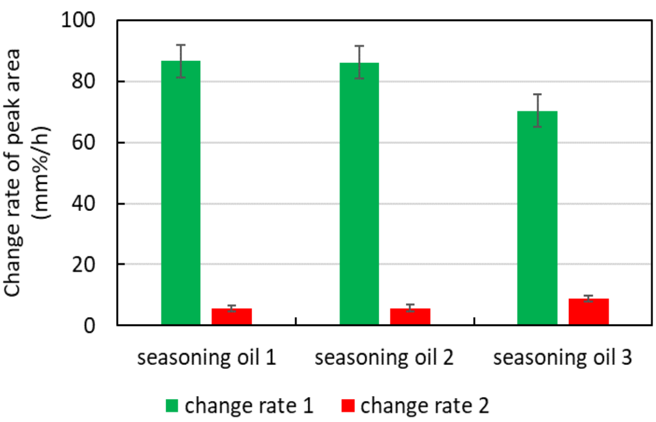

Fig. 5 Changes in peak area (position range 4 – 15.5 mm) of the three samples (*change rate 1: 0 - 30 min; change rate 2: 30 min-2 h 50 min*).

area can be analyzed resulting in an average peak area change rate of 86.61 mm%/h and 5.56 mm%/h in the first 30 min and the last 2 h 20 min for seasoning oil 1, respectively.

Accordingly, the other 2 samples were analyzed leading to the change rates as displayed in Fig. 5. All the samples were very unstable in the first 30 min. The reason is that most of the particles have already precipitated in the first 30 min. Seasoning oil 3 was found to be the most stable formulation with a peak area change rate of 70.37 mm%/h, while seasoning oil 1 and 2 showed similar stability with value of the peak area change rate around 86 mm%/h.

Most notably, the MSC software can also provide an overall analysis by the **stabilty index** function. To **directly and simply** get the stability difference, the rsults of all samples can be displayed in an **overlay** window (Fig. 6). In consitency with the results from before also the stability index analysis supports that seasoning oil 3 is the most stable formulation, while seasoning oil 1 and 2 were both less stable. This results underlines **the excellent applicability** of MS 20 to analyze and quantify stability issues of different formulations **locally and globally with high reliability**.

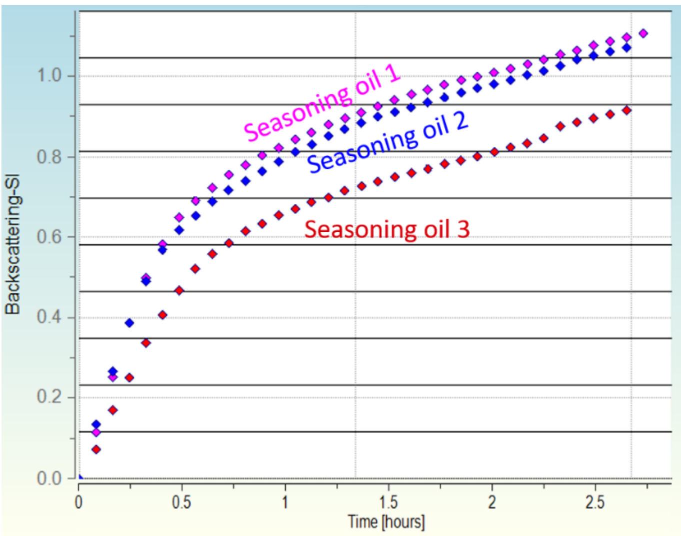

Fig. 6. Overlay of the backscattering stability index change of three samples vs. time

Summary

Using the MS 20 stability analysis system and its corresponding MSC software, an **easy and fast way** to study the stability of seasoning oil formulations could be demonstrated. **Changes can be detected easily and reliably** which enables the producer to anticipate and quantify **stability issues** and thus guarantee time and cost optimal product development.

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