MultiScan MS 20

Stability Analysis of Whey Based Beverages

dataphysics
Understanding Interfaces

Whey drinks area popular ready-to-drink protein beverages, owing to their excellent nutritional qualitiest and good flavor. To have a fresh and neutral taste, whey based beverages are usually prepared with fruits or vegetables. Stability issues are one of the major problems which are commonly encountered in this kind of beverages, such as, crystallization of lactose stored in the fridge, coagulation of whey proteins amongst others. It is of great importance to study the stability of whey beverage formulations and modify them towards a better performance. With the ***MultiScan 20 (MS 20)*** *(Fig. 2) dispersion* ***stability analysis*** *system from 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 four whey beverage formulations is presented throughout this application note.*

Fig. 1. Whey beverages with different fruit additives.

Keywords: MultiScan 20 (MS 20) ▪ Stability Analysis ▪ Whey Based Beverage ▪ Coagulation ▪ Crystallization

Technique and Method

The MultiScan MS 20 (Fig. 2) from DataPhysics Instruments is the measuring device for 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 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.

20 ml of each whey drink formulation (cassis, peach, blood orange, multifruit) were poured in a transparent glass vial and measured every 5 min for 5 h 45 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.

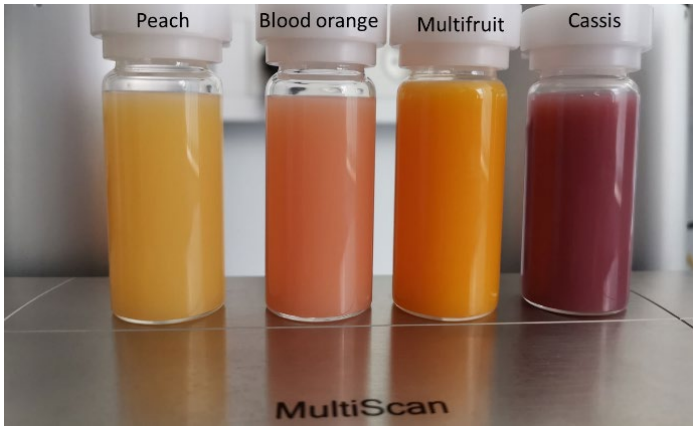

Fig. 3. Samples of whey beverages with different fruit additives after measurement.

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 whey drinks.

The four samples showed similar change of backscattering intensities over time. Figure 4 shows the plot of the backscattering intensities against the position for the whey beverage with cassis. It shows a clearly time-dependent as well as position-dependent change of the signal, which decreased at top between 50 mm and 55 mm, indicating a typical sedimentation process.

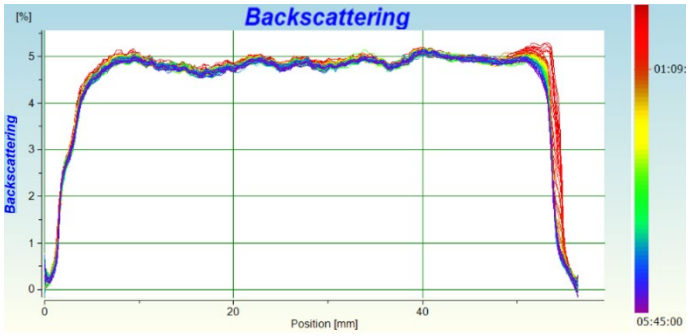

Fig. 4. Backscattering intensity diagram of whey drink with cassis.

Calculated with the respective function of the MSC software, the change in migration front can be analyzed, resulting in an average sedimentation rate of 1.038 mm/h in the first 1 h and 0.02576 mm/h in the last 4 h 45 min for cassis whey beverage (Fig. 5). The reason is that most of the particles have already sedimented during the first 1 h.

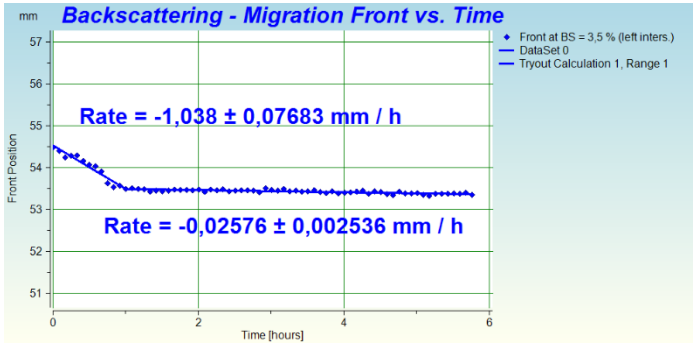

Fig. 5. Changes in migration front of cassis contained whey drink over time.

Accordingly, the other 3 samples were analyzed leading to the sedimentation rates as displayed in Fig. 6. The whey begerages with peach, cassis or blood orange were also very unstable in the first 1 h, while the multifruit containing whey beverage showed a constant sedimentation rate of only 0.1029 mm/h during the test, indicating its stabillity is highest. Besides, the whey beverage with peach was found

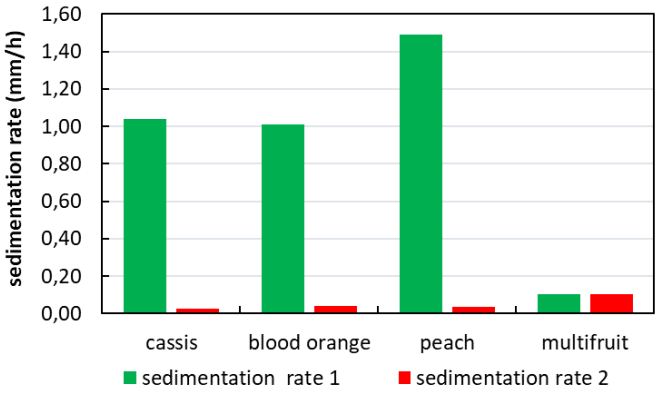

Fig. 6. Changes in migration front (position range 50 – 55 mm) of the four samples (*change rate 1: 0 – 1 h; change rate 2: 1 h – 5 h 45 min*).

to be the most unstable formulation with a sedimentation rate of 1.491 mm/h, while the drinks with cassis and blood orange showed similar stability.

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. 7). In consistency with the results from before also the stability index analysis supports that the beverage with multifruit is the most stable formulation, while the whey beverages with peach was the most unstable. This results underlines **the excellent applicability** of MS 20 to analyze and quantify stability issues of different formulations **locally and globally with high reliability**.

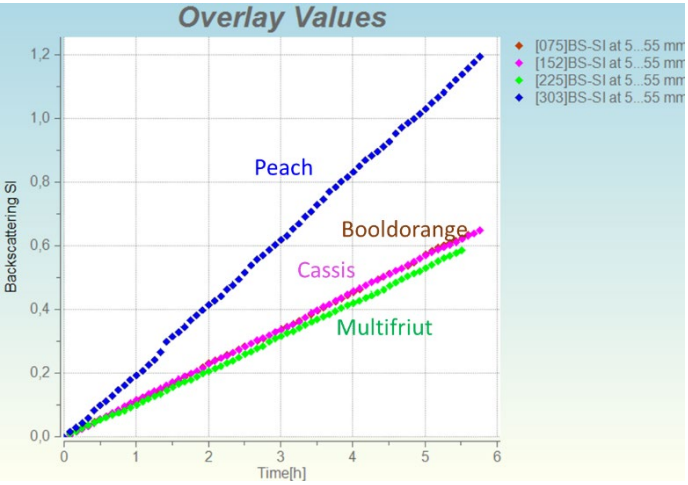

Fig. 7. Overlay of the backscattering stability index change of three samples vs. time.

Summary

Using the MS 20 stability analysis system and its corresponding MSC software, an **easy and fast way** to study the stability of whey beverage formulations could be demonstrated. **Changes can be detected senstively, 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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