Prediction chocolate stability at the end of the process

Introduction

Crystallization is one of the most critical steps for chocolate makers. Chocolate can crystallize in six crystalline forms but only one is stable (β(VI)) and one is metastable (β(V)). The latter one provides several interesting characteristics: it is stable up to 2 years, has the glossy aspect, the snap and the organoleptic properties a chocolate maker searches for his chocolate.
If chocolate crystallizes in the other unstable forms, these will evolve to the stable forms (mainly β(VI)) which will recrystallize on the surface and initiate fat bloom (chocolates with a white aspect).
It is now possible, thanks to the RHEOLASER Crystal, to control, easily and quickly, the major crystalline form of a chocolate directly at the end of the process. This control allows monitoring of the entire process (tempering and cooling) in order to avoid the fat bloom.

KEY **BENEFITS**

PREDICITIVE

ACCURATE

EASY

Crystalline forms of chocolate

Method

In the first part, we present two types of chocolates, with the exact same composition:

- A correctly tempered chocolate, with a temperindex of 5.0 (*)
- An under-tempered chocolate, composed of unstable forms with a temperindex of 1.5(*)

Chocolates were analyzed after the same cooling protocol (10 minutes at 12°C + 1 hour at 18°C).

In the second part, we used two correctly tempered chocolate with the exact same composition, but different cooling conditions:

- A chocolate cooled at 12°C during 6 minutes, then 1h at 18°C.
- A chocolate cooled at 12°C during 15 minutes, then 1h at 18°C.

Analyses were performed with a RHEOLASER Crystal: samples were heated from 16°C to 40°C at a speed of 3°C per minute.

Experimental results

➢ Impact of tempering

By analyzing the samples according to the method described in the previous paragraph, the following results were obtained:

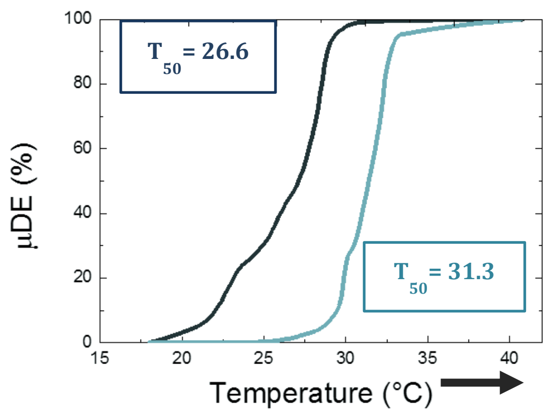

Figure 1: Micro-Dynamics Evolution in function of temperature for a tempered chocolate (blue) and for an under-tempered chocolate (grey).

The under-tempered chocolate shows a lower transition temperature than the well-tempered chocolate.

Micro-Dynamics Evolution (µDE) shows a transition temperature of 26°C for under-tempered and 31°C for well-tempered chocolate (figure 1).

These temperatures correspond to the melting temperature of β'(IV) (an unstable form) and of β(V) (the desired form).

We can certify that the under-tempered chocolate is mainly composed of cocoa butter under the β'(IV) form while the well-tempered chocolate is mainly composed of β(V) form.

Under-tempered chocolate will have a high probability to evolve in a stable form (generally, the β(VI) form) and to initiate blooming. After some weeks, the under-tempered chocolate presented visually a grayish aspect on the top (fat bloom), while the other one was still shiny and good-looking.

- Impact of cooling

Tempering is an important step in the process of chocolate, but a good tempering does not guarantee the stability of chocolate. In figure 2, both chocolates are well tempered (temperindex of 5.0) but cooling conditions differ. The chocolate cooled during 6 minutes shows a lower transition temperature than chocolate cooled during 15 minutes. That means it was composed, in large part, of unstable crystals. In contrast the chocolate with 15 minutes of cooling had a part of unstable crystals (increase of signal below 30°C) but was principally composed of stable crystals (increase after 30°C).

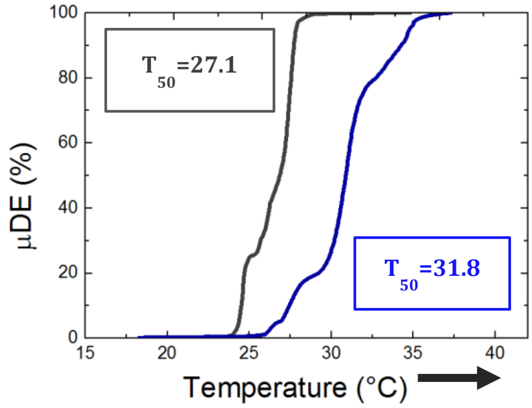

Figure 2: Micro-Dynamics Evolution in function of temperature for two tempered chocolate. A chocolate was cooled during 6 minutes (grey) and a chocolate was cooled during 15 minutes (blue) at 12°C.

After 3 months, chocolate with 6 minutes of cooling shows bloom formation, not the other one.

The temperindex does not guarantee a quality of crystals in chocolate, only a quantity. RHEOLASER Crystal, can easily, discriminate a stable or instable chocolate at the end of the production line, depending on any parameters of the process.

***TEMPERINDEX**

The temperindex is a tool used to control chocolate tempering. It is based on increase of temperature during crystallization. A well-tempered chocolate has a temperindex of 5.0 (optimal crystal percentage), an under-tempered chocolate shows a temperindex below 4.0 (not many crystals after tempering).

CONCLUSION

The RHEOLASER Crystal enables to determine the major crystalline form of a chocolate, at the end of the process. Just like in DSC (Differential Scanning Calorimetry), the determination of crystal form is based on the difference of melting temperatures but the RHEOLASER Crystal is easier to set up through an easy to use sampling system which limits the risk of modification of the crystalline form and enable to work with multi-component system.