Effect of Electric Field on CB Crystallization

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In recent years, chocolate has attracted attention not only as a luxury food but also as a health food. The major factor that determines the texture of chocolate is the crystal polymorphism of cocoa butter (CB). CB has six crystal polymorphs, of which form V (melting point: 33°C) shows the best snap and mouth feel for the product. Therefore, it is important to crystallize CB in the form V during production. Tempering is generally used as the crystallization methods for form V. On the other hand, external fields, in which crystallization can be controlled by applying external forces, such as shear stress, ultrasound stimulation, magnetic field etc., are attracting attention as a more efficient crystallization control method rather than temperature control methods (tempering). Among these, the electric field has attracted attention. This is because the strength of the electric field, which has a sufficient influence on crystallization behavior, is smaller compared to other external fields and hence, does not require large equipment. This method has been used to the crystallization control of proteins and metal complexes. However, the usefulness of the electric field for the crystallization of lipids has not yet been clarified. Therefore, in this study, we proposed an electric field as a new external field to control the crystal polymorph of CB, and aimed to clarify the effect of the electric field on the crystallization behavior of CB.

First, CB (BARRY CALLEBAUT) dispensed into cells was placed in an incubator at 50°C to eliminate crystal history. Then, it was stored another incubator at 15°C for one week. The samples were divided into 2 groups; with (group 1) and without (group 2) an electric field. The electric field was continuously applied for one week to the group 1. We measured changes in their crystal polymorphs by polarized light microscopy (PLM).

After one week of storage at 15°C, form V crystals appeared among the form IV crystals dispersed throughout. The nucleation rate was calculated by counting the number of form V crystals in a unit volume. PLM revealed that the nucleation rate of form V crystals in the group 1 was greater than that in the group 2. These results indicate that an external electric field promotes the polymorphic transition of CB to form V. Thus, it was shown that the electric field was useful as a new external field for controlling the crystal polymorph of CB.