Particle Size Analysis of Cocoa Powders

Introduction

The consumer success of chocolate is due to its recognised appeal to the taste buds, but also to the particle size of each of the ingredients [1].

This is an important factor in the manufacturing process as particles that have been ground too finely will make the chocolate sticky whereas particles that are too large will make it too coarse to the eye and to the palate.

It is therefore essential to have total control over the particle size of cocoa powders to provide consumers with a product that is pleasing to the eye and to the taste buds.

Figure 1 : Various types de chocolate

The various stages in the manufacture of chocolate

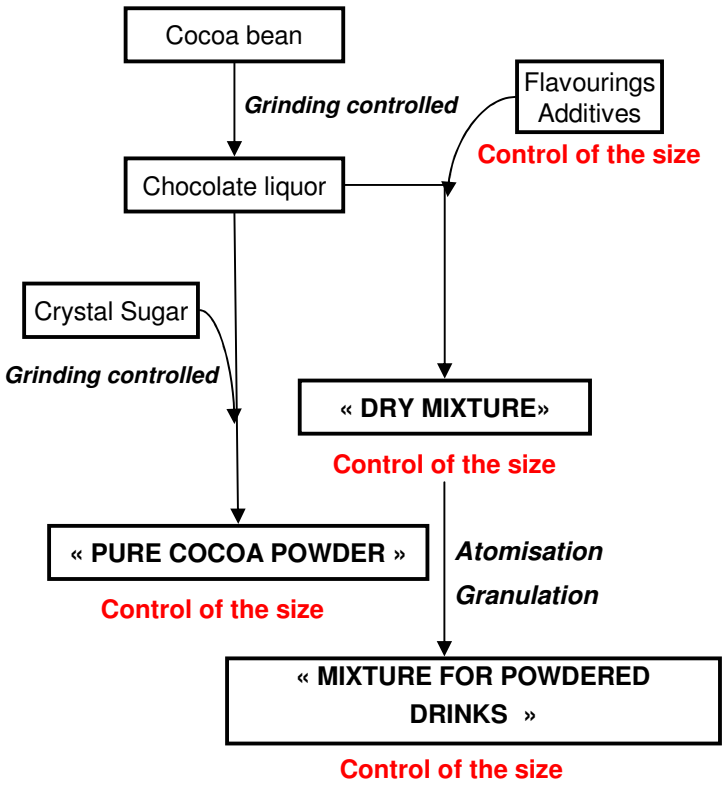

Figure 2 : The various stages in the manufacture of chocolate

Manufacturing chocolate entails several essential steps, shown in figure 2, starting with grinding the cocoa beans to obtain a paste called cocoa liquor.

Adding preground sugar, flavourings or additives will result in pure cocoa powder or a dry mixture.

Finally, a granulation phase obtains a mixture used for the production of powdered drinks.

At every stage in the manufacturing process, the size of the incorporated powders is controlled in order to obtain a final mixture with the required particle size.

Measuring particle size by laser diffraction

Measuring particle size by laser diffraction is a quick and simple technique that is suitable for determining the particle size distribution of all types of chocolate dispersed in dry mode after the dispersion protocol optimization.

The measurements are taken in air, with an air pressure that is suitable for the friability of powders, or in liquid with a carried liquid based on vegetable oil.

Particle size measurement is possible with various chocolates such as couverture chocolate, milk chocolate, or agglomerated chocolate used for powdered drinks.

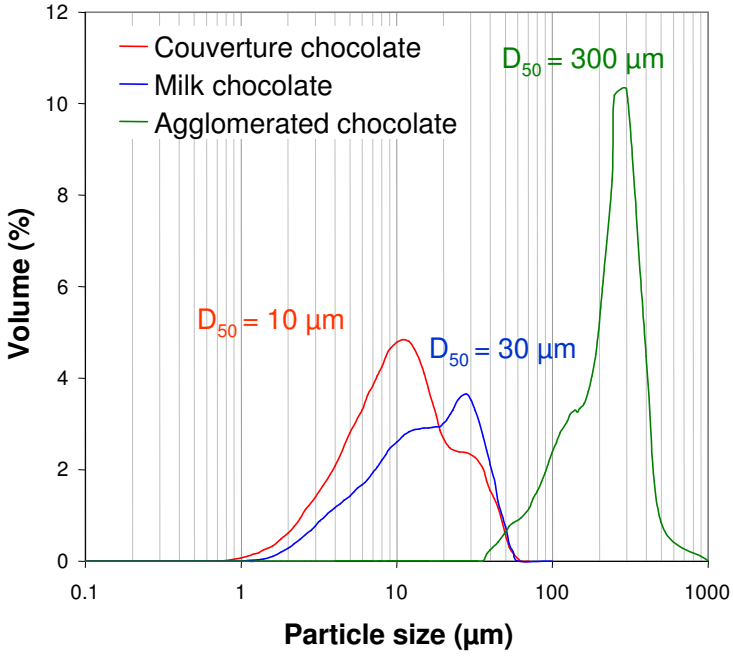

Figure 3 : Particle size analysis of various chocolates

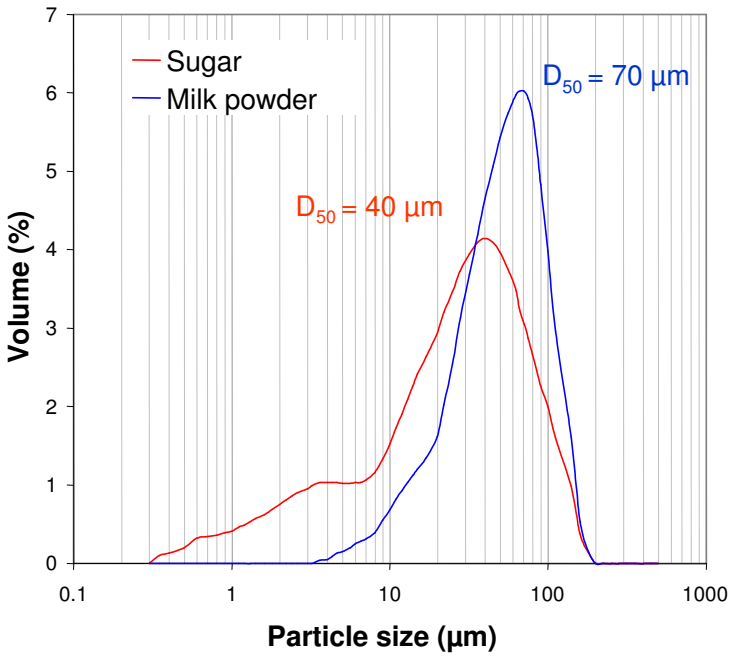

Figure 4 : Particle size analysis of additives

All the analysed chocolates have a different particle size distribution (figure 3). Couverture chocolate and milk chocolate have bimodal-size distributions with diameters equal to 10 µm and 30 µm. The particle diameter of agglomerated chocolate is equal to 300 µm.

Particle size distribution is also controlled by laser diffraction for additives such as milk powder or sugar [2,3].

In the example shown in figure 4, the average diameters are equal to 40 µm for sugar and 70 µm for milk powder.

These additives are incorporated once their particle size has been reduced. Adding milk powder therefore tends to shift the particle size distribution to large-diameter particles (figure 3).

Conclusion

Determining the particle size distribution of cocoa powders by laser diffraction in air or in liquid makes it possible to control every key stage in the manufacturing process of chocolate, enabling consumers to enjoy better quality products.

By using a reliable analytical methodology, formulators can generate the desired particle sizes quickly and reproducibly throughout the manufacturing process.

With their robust design, the analyses can be performed in both an industrial environment to ensure that quality control is unaffected by vibrations or dust, and in Research and Development laboratories for the validation of new formulations.

References

[1] Milling, mixing and tempering - an engineering view of chocolate
Journal of Process Mechanical Engineering
Volume 215, Number 1, p.1-8 (2001)

[2] Effects of Milk Powders in Milk Chocolate
Journal of Dairy Science
Volume 87 p. 20-31 (2004)

[3] Effects of particle size distribution and composition on rheological properties of dark chocolate
European Food Research and Technology
Volume 102, Number 7, p. 1-10 (2007)

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