

Optimizing spray-dried milk powder structure for the application in fat-based suspensions like milk chocolate

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Identification

Key words	chocolate, structure, processing behaviour, refining, milk powder, fat-based suspensions
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How does it work?

Primary objective	Improvement of powder structure of spray-dried milk powder for its application in the manufacturing of fat-based suspensions like milk chocolate, fillings or glazings.
Working principle	<p>Fat-based suspensions, like chocolates, fillings or glazings, consist of a continuous fat phase in which solid particles, like sugar particles or milk powder, are dispersed. In products like milk chocolate, milk powder is a main ingredient. Application of milk products in such suspensions is restricted to dry powder because excessive moisture may destroy the structure of the dispersed particles, e.g. sugar. Mainly spray-dried milk powders (SMP) are applied since it is a cost-effective and highly available material [1, 2, 3]. Together with the other solids, milk powders have to be subjected to a refining step during processing to obtain the desired smooth texture in the chocolate or filling [4]. However, the structure of SMP contains many air voids which lead to a low compactness and a craggy surface after refining. This results in a higher immobilization of fat on these particle surfaces leading to unfavourable processing behaviour of the fat-based suspensions (higher viscosity).</p> <p>The novel pre-treatment of SMP is based on a combined mechanical and thermal processing of the powder to initiate a controlled re-crystallization of the amorphous lactose resulting in a specific structure modification [6, 7, 8]. This is reached by heating the milk powder (about 4 % moisture content) above the glass transition temperature of the amorphous lactose in the powder. Such a treatment can preferably be carried out in an extruder without a die to avoid a compaction of the powder. The extruder enables a well-controlled temperature profile for the lactose crystallization during the treatment and induces high shear forces into the powder to obtain small lactose crystals which do not influence the texture sensation of the fat-based filling. As a result, a powder with higher density and smoother surface of the particles after refining process is obtained. Application of such a pre-treated SMP results for example in a milk chocolate mass with the desired flow properties, e.g. low viscosity for the same total fat content, due to reduced fat immobilization by the SMP particles.</p>

Images

Additional effects	<ul style="list-style-type: none"> • Increase of free fat content of whole milk powders, which results in lower viscosity of the fat-based suspension • Caramelisation and development of a light brown colour for whole and skimmed milk powders which is a favoured chocolate taste in many countries • Using such a treated SMP contributes to lower costs for raw material and processing in milk chocolate manufacturing, as less cocoa butter is needed (in comparison to regular SMP) to obtain the flow properties of the molten milk chocolate which are required for proper moulding or enrobing (processing behaviour).
Important process parameters	temperature course, shear rate, treatment time
Important product parameters	moisture, fat content, structure

What can it be used for?

Products	milk chocolate, fat fillings, glazings
Operations	structure modification
Solutions for short comings	The new technology contributes to saving of processing time in manufacturing of fat-based suspensions like milk chocolates or fillings as well as lowering raw material costs because no additional fat is required for adjustment of flow properties.

What can it NOT be used for?

Products	whey powders, very dry milk powders
Operations	pressure build-up during the pre-treatment process of SMP (loss of powder structure and possible blockage of the extruder)
Other limitations	Pressure build-up during the pre-treatment process of SMP should be avoided as it would result in loss of the powder structure due to compacting of the particles and to possible blockage of the extruder.
Risks or hazards	undesired sensory changes

Implementation

Maturity	successfully tested at lab-scale
Modularity /Implementation	The technology for SMP treatment can be implemented in the plants of milk powder manufacturers (directly after drying) as well as in the process for manufacturing chocolate of fillings (before mixing of the chocolate components).
Consumer aspects	Thermal treatment during structure modification may intensify the caramel taste of milk chocolates of fillings
Legal aspects	Directive 2000/36/EC of the European parliament and of the council of 23 June 2000 relating to cocoa and chocolate products intended for human consumption.
Environmental aspects	More efficient technology in terms of raw material consumption and processing time

Facilities that might be interesting for you

Title	Institute/company
Auditorium IRTA	IRTA
Clean room - Histocell	Noray
Video observation system for market research and product development tasks - Keki	NAIK EKI

Further Information

Institutes DIL

Companies

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