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Importance of whey ingredients in confectionery products

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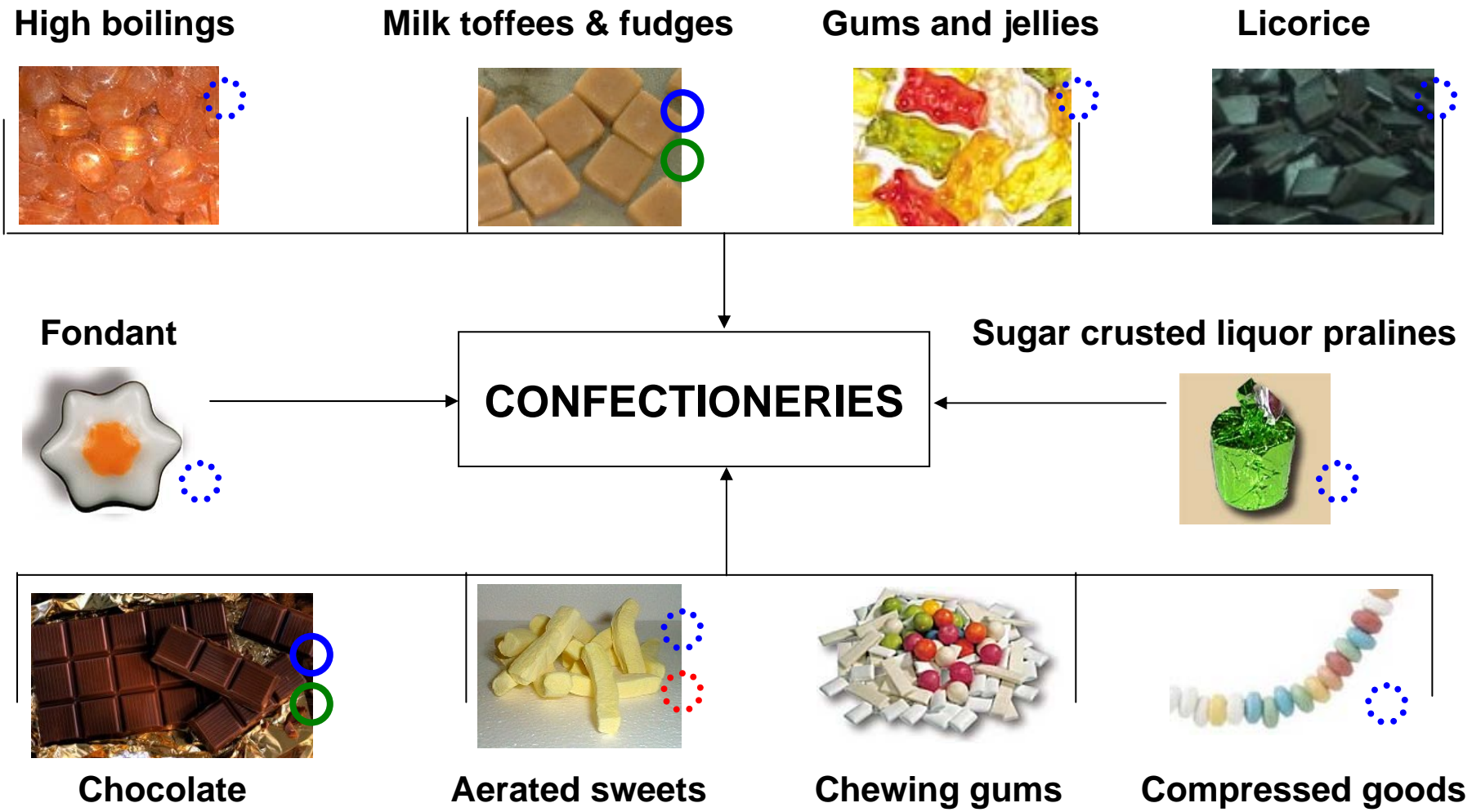
Central College of the German Confectionery Industry

Whey ingredients in confectionery

Lactose ○

Whey powder ○

WPC/WPI (defatted) ○





Whey ingredients – Functionality in confectionery

5th International Whey Conference

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Lactose provides many functional benefits as a food ingredient in confectionery products. This unique carbohydrate possesses **solubility**; acts as a **bulking agent**; acts as a **flow agent** in dry mixes; has a **low level of sweetness** yet contributes necessary solids; influences **colour**, **flavour** and **texture**; and influences **browning reactions**.

Demineralised whey powder and condensed whey mainly influence the **colour** and **flavour** of the end product via **browning reaction**.

WPC/WPI (defatted) have **whipping properties**.

Whey ingredients – Functionality in confectionery

- **Low solubility**
- **Low sweetness**
- **Reducing sugar**
- **Good flowability**
- **Low hygroscopicity**



Lactose is a substitute for **sucrose**, having distinct properties, however.

- **Reducing sugar**
- **Proteins**
- **Milk solids**



Whey powder and **condensed whey** replace other **milk products**.

- **Proteins**
- **Whipping ability**



WPC and **WPI** partially replace other aerating agents, i.e. **egg albumin**.

Application of lactose in confectionery

When using lactose in confectionery products, it is important to look first which category this confectionery product belongs to:

- Products without any crystalline phase (e.g. high boiled candies, milk toffees, gums & jellies).
- Products with a crystalline and a non crystalline phase (e.g. fudges, fondant, crusted liqueur pralines).
- Products nearly free of water in which sugar is only present in the crystalline state (e.g. chocolate, compounds, fat fillings, spreads).



The use of lactose will be more or less limited depending on the product category.

Application of lactose in confectionery

High boiled candies



High boilings are made of a supersaturated carbohydrate solution (usually sucrose and glucose syrup) obtained by cooking. The products are in a glassy state, i.e. that they are totally free of sugar crystals.

They are characterised by:

- a very low residual moisture (1 - 3 %)
- a low E.R.H., below 30%

Application of lactose in confectionery



High boiled candies

Lactose has been used industrially for decades in the making of high boiled candies.

Lactose brings less sweetness and improves the release of flavours.

Approximately 10% lactose is used calculated on the final product.

	Basic recipe	Recipe with lactose
Sucrose	15.0 kg	12.0 kg
Lactose	-	3.0 kg
Glucose syrup 42 DE A	15.0 kg	15.0 kg
Water	5.0 kg	5.0 kg

Application of lactose in confectionery

Fondant



Fondants is a white soft to semi-hard paste.

Fondant consists of tiny sugar crystals that are dispersed in a saturated sugar solution.

It contains a maximum of 12% of residual water and 98% of the sugar crystals have a size $< 20\mu\text{m}$.

Fondant thus consists of two phases, which are formed by the combined cooling and beating of a supersaturated solution.

Application of lactose in confectionery

Fondant



Particularly in the case of fondant or products made out of fondant, the manufacturing industry has repeatedly expressed the wish to produce a less sweet product to improve flavouring and meeting consumer demands.

Fondant can be made with up to **20% of lactose**. Lactose can be crystallized very finely and produces a quite firm fondant.

Application of lactose in confectionery

Fat based masses & fillings

These masses are suspensions, fat being the continuous phase and crystalline sugar part of the dispersed phase.

The manufacturing process is usually a mixing process, followed by a refining process, with a final homogenizing process.

In all those applications, **lactose** can replace part of the sucrose **up to 20%**. The limiting factor is the lack of sweetness.

Whey ingredients in confectionery



Nougat bars

Nougat bars are aerated products made of sucrose, glucose syrup, water and other added dry ingredients like skimmed milk powder, icing sugar, coconut rasps, cocoa powder.

The sugar mass is cooked and added to the previously prepared foam. Finally the dry ingredients are added, the mass is spread and cut after cooling.

Lactose can be used in the cooked sugar mass and as a dry ingredient. A high content of lactose is possible (**up to 19%**) aiming in a less sweet product with less stickiness and a better stability. **WPCs** and **WPIs** may replace part of the egg white solids for the preparation of the foam.

Whey ingredients in confectionery

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Milk toffees



Soft caramels are supersaturated solutions made of sucrose, glucose syrup, fat and an emulsifier produced during a cooking process.

They have a soft texture due to their water content of 6 to 10%.

Milk toffees additionally contain milk products. These milk products are responsible for the browning reaction which give the milk toffees their typical caramel colour and taste.



Whey ingredients in confectionery

Milk toffees

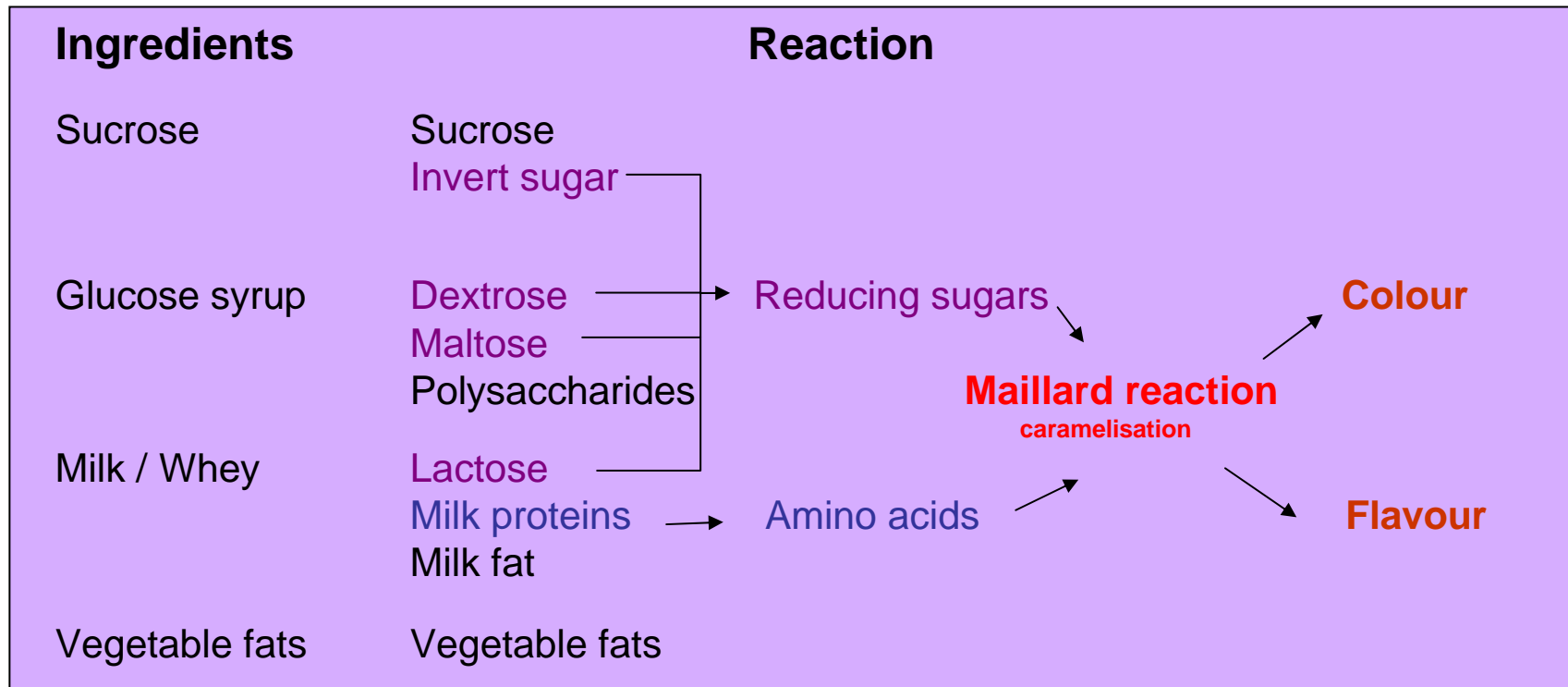
In this product group lactose is always present as part of the milk powder or condensed milk. The **addition of pure lactose** enhances the caramel flavour while slightly reducing sweetness. A total lactose content of **approximately 10%** is sufficient to achieve this desired result.



	Basic recipe	Recipe with lactose
Sucrose	5.4 kg	3.76 kg
Lactose	-	1.61 kg
Glucose syrup 42 DE A	8.25 kg	8.25 kg
Water	5.0 kg	5.0 kg
Sweetened condensed milk	6.2 kg	6.2 kg
Hard fat	1.8 kg	1.8 kg
Lecithin	0.05 kg	0.05 kg

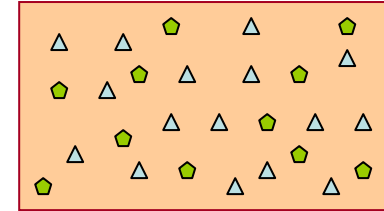
Why ingredients in confectionery

Milk toffees / Browning → Maillard reaction



Many recipes contain sweetened concentrated whey. This will increase the Maillard reaction during production and lower the raw material costs.

Chocolate and fat fillings



Chocolate and fat fillings are suspensions made of a continuous fat phase in which finely grinded solids (sugar crystals, cocoa dry substance, milk solids, ...) are evenly distributed.

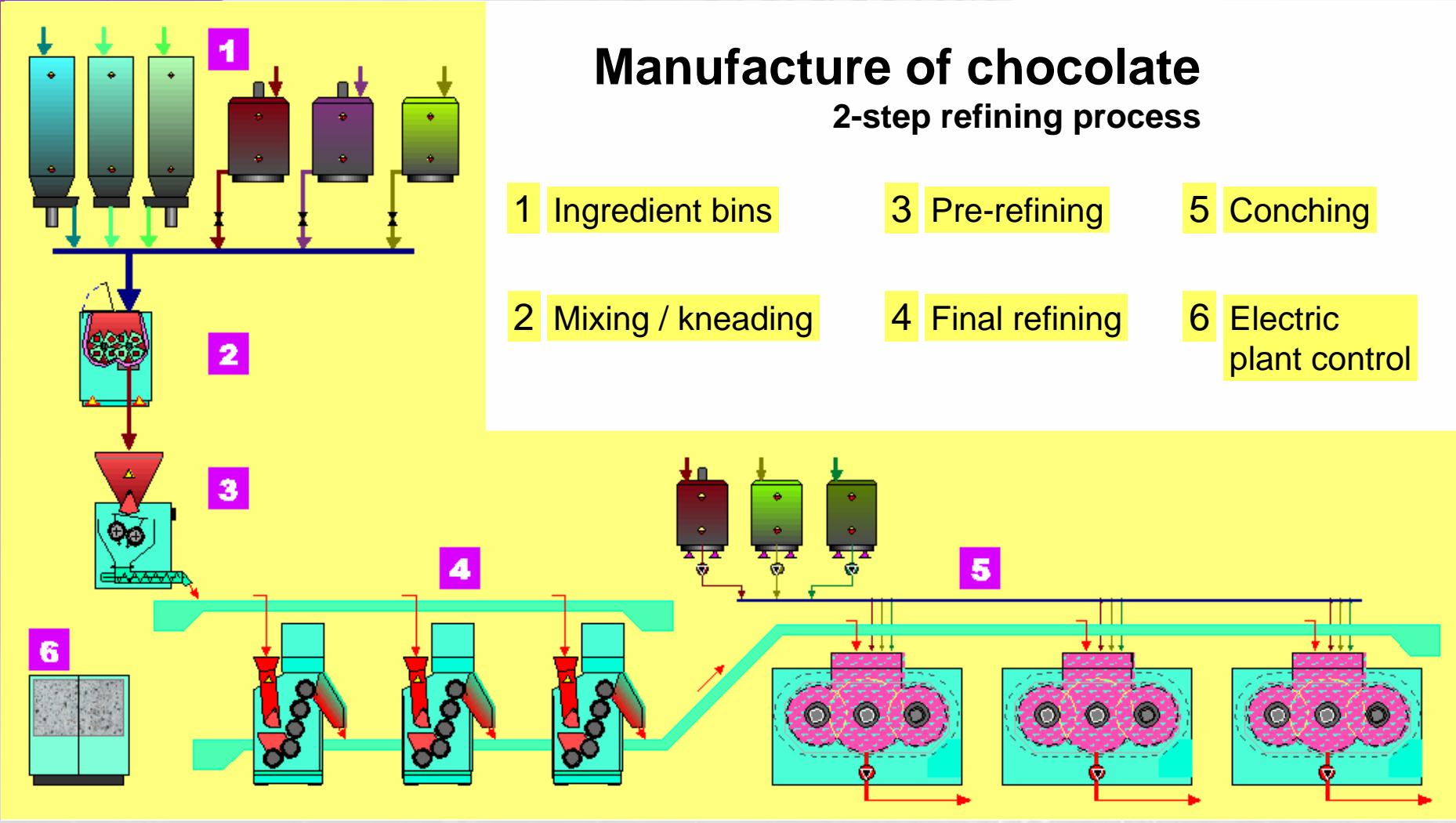
They are characterised by:

- a very low residual moisture of usually less than 1%
- a smooth texture (particle size less than $30\mu\text{m}$)
- hard to creamy texture at room temperature (depending on the fat used)

Whey ingredients in chocolate

Manufacture of chocolate 2-step refining process

- 1 Ingredient bins
- 2 Mixing / kneading
- 3 Pre-refining
- 4 Final refining
- 5 Conching
- 6 Electric plant control



Whey ingredients in chocolate

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In chocolate sugar has following functions:

- sweetening the product
- reducing the bitterness of cocoa
- giving body to the chocolate

Milk will give its special flavour to the milk chocolate.

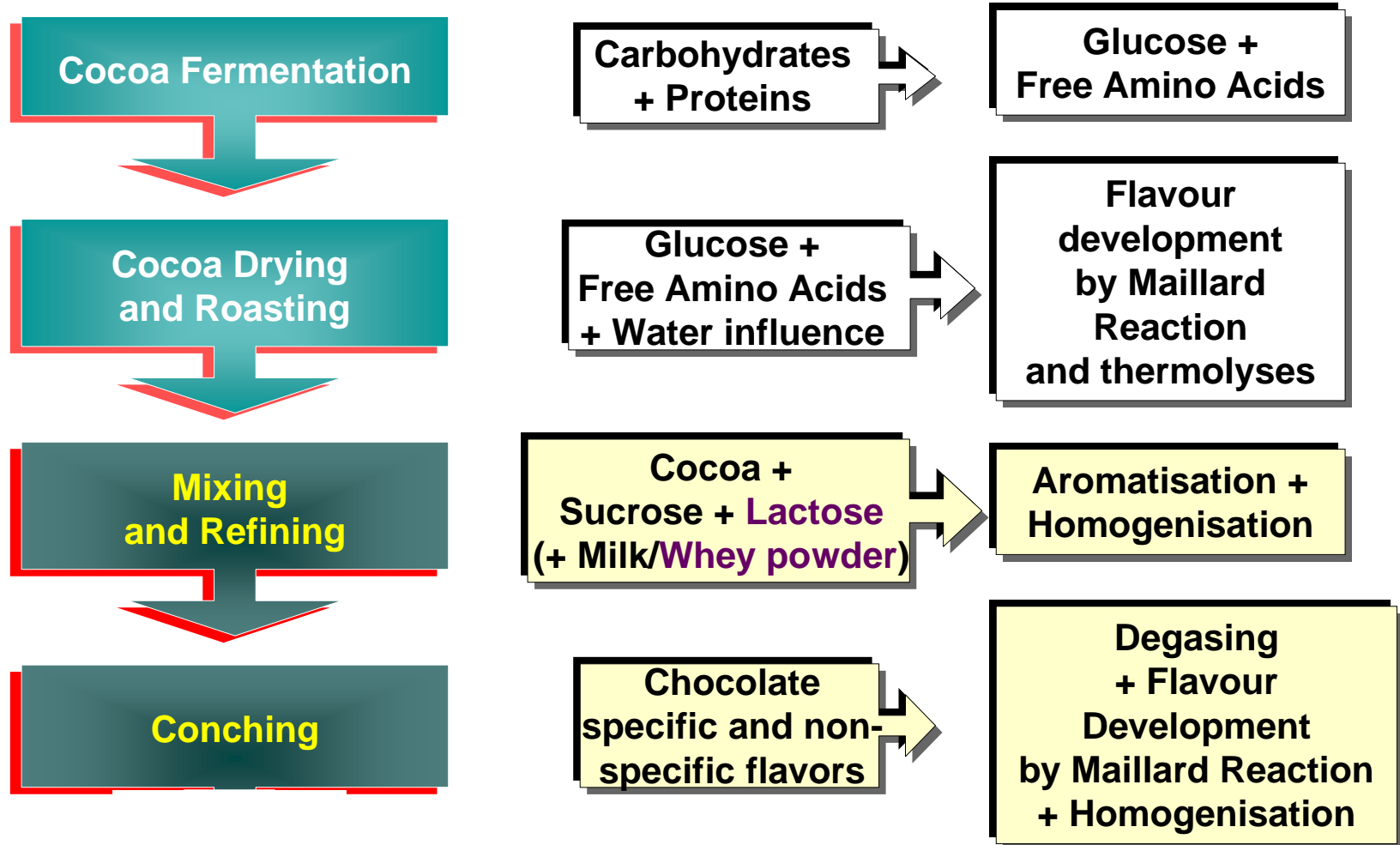
Commonly, recipes will contain sucrose and milk powder.

In the EU, up to August 2003, it was only possible to replace sucrose by other sugar types and to add whey powder up to 5% of the total weight.

With the new directive, the levels are not limited anymore.

Use of whey ingredients in chocolate

Stages of development of the chocolate flavour



Cocoa Fermentation

Carbohydrates
+ Proteins

Glucose +
Free Amino Acids

Cocoa Drying
and Roasting

Glucose +
Free Amino Acids
+ Water influence

Flavour
development
by Maillard
Reaction
and thermolyses

Mixing
and Refining

Cocoa +
Sucrose + Lactose
(+ Milk/Whey powder)

Aromatisation +
Homogenisation

Conching

Chocolate
specific and non-
specific flavors

Degasing
+ Flavour
Development
by Maillard Reaction
+ Homogenisation

Use of whey ingredients in chocolate



Manufacture of chocolate conching process

The conching process will give the last “touch” to the chocolate mass.

The mass is stirred during hours at quite high temperatures allowing bad flavors and moisture to escape and good flavors to be build.

Lactose and whey proteins will take part in the Maillard reaction, giving a particular flavor note to the chocolate.

As the conching temperature is far below 100°C, there is no risk of using lactose monohydrate in a recipe.



Samples from the market



Ingredients: Milk chocolate (Sugar, Cocoa butter, Whole milk powder, Cocoa mass, **Whey powder**, Butteroil, Emulsifier, Flavouring), Sugar, Wheat flour, Vegetable fat, Skimmed milk powder, Hazelnuts (3.5%), Butteroil, Cocoa mass, Invert sugar syrup, Flavourings, Cocoa butter, Whole milk powder, Emulsifier, **Whey powder**, Salt, Raising agent.

Ingredients: Milk chocolate (Sugar, Dried whole milk, Cocoa mass, Cocoa butter, **Whey powder**, Vegetable fat, **Lactose**, Butterfat, Emulsifier (Soya lecithin), Flavouring), Gum arabic, Sugar, Glucose syrup, Vegetable fat, Citric acid, Sorbic acid.



Samples from the market



Ingredients: Chocolate Flavoured Coating (40%) (Sugar, Modified Palm and Shea Oil, Cocoa Mass, Skim Milk Powder, **Whey**, **Whey Protein**, Milk Fat, Caseinate, Emulsifier, Salt and Vanillin), Peanuts (26%), Peanut Butter (17%) (Peanuts, Sugar, **Lactose**, Milk Fat, Salt, Corn Syrup, Antioxidant), Caramel (17%) (Invert Sugar, Corn Syrup, Sugar, Glycerol, Refined Palm Kernel Oil, **Whey**, **Whey Protein**, Caseinate, Salt, Vanillin, Emulsifier).

Ingredients: Sugar, Corn Syrup, Skim Milk Powder, Cocoa Butter, Vegetable Fat, Cocoa Mass, **Lactose**, Butterfat, **Demineralised Whey Powder**, Hardened Vegetable Fat, Salt, Emulsifier (Soja Lecithin), Egg Albumine, Hydrolised Milk Proteins, Flavour.



Samples from the market

Be light – Fruchtgummi plus Molke

A new gum with whey, commercialised by Aldi Süd (Germany)



Resume (1)

Commercially, four major categories of whey ingredients are used by the confectionery industry:

- demineralised whey powder
- sweetened condensed whey
- whey proteins
- lactose

They have different functionalities:

- reduce the sweetness
- enhance the Maillard reaction
- stabilise foams

Resume (2)

We find them mainly in:

- milk chocolate
- chocolate bars / aerated products
- milk toffees and fudges

They are low-cost dairy products for the candy industry.

The levels of use are not restricted.

They fit perfectly in recipes for healthier sweets, thus there is still a lot of opportunities for new developments.