Formulation and Production of Confectionery Fats

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Where are confectionery fats used?

- Coatings
- Fillings
- Toffees and caramels
- Ice cream

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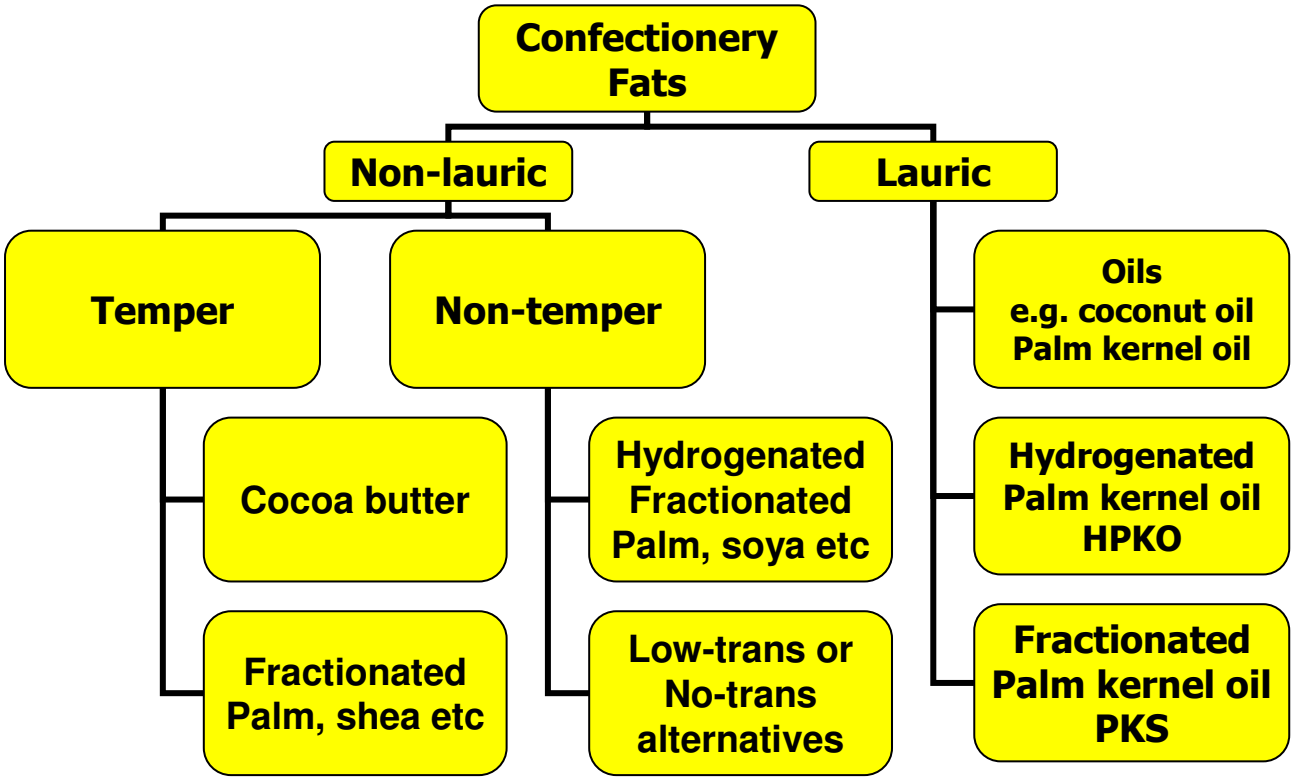
- **Coatings**
- **Fillings**
- Toffees and caramels
- Ice cream

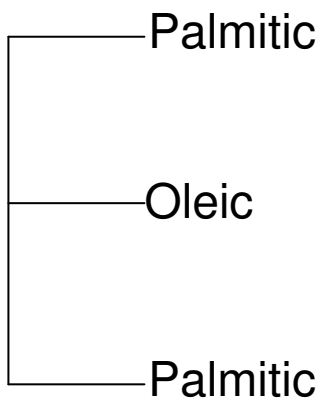
General groupings

- Vegetable fats used in both confectionery coatings and fillings fall into three major types:
  - Lauric
  - Non-lauric, non-temper
  - Non-lauric, temper

Confectionery Fat Groups

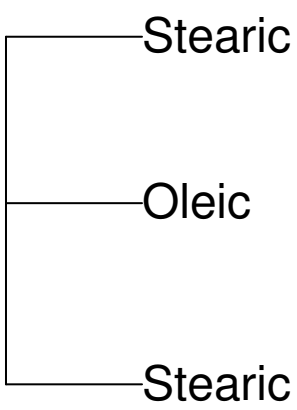


Triglycerides – abbreviated nomenclature



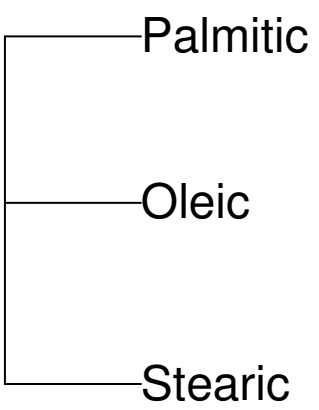
abbreviated to:

POP



abbreviated to:

StOSt



abbreviated to:

POSt

Cocoa Butter

- Rich in symmetrical monounsaturated triglycerides, e.g. POP, POSt, StOSt
- These give cocoa butter a very sharp melting profile
- They also mean that cocoa butter is polymorphic – and needs to be tempered.

Polymorphism of cocoa butter

- The ability to crystallise in a number of forms of different stabilities.
- Originally thought to be six forms (I-VI), now considered to be five main forms with one of these having a wide spectrum of sub-forms
- The important thing is to crystallise cocoa butter in its second most stable form:
  - Form V or β_V
  - It is not possible to crystallise directly into the most stable form (form VI or β_{VI})

Cocoa Butter Equivalents

- Permitted in EU and some other countries for use as ‘vegetable fats’ in chocolate
- Restricted to maximum 5% of the chocolate (with some added restrictions which can reduce this even further)
- Based on symmetrical triglycerides such as those found in cocoa butter
- Highly compatible with cocoa butter

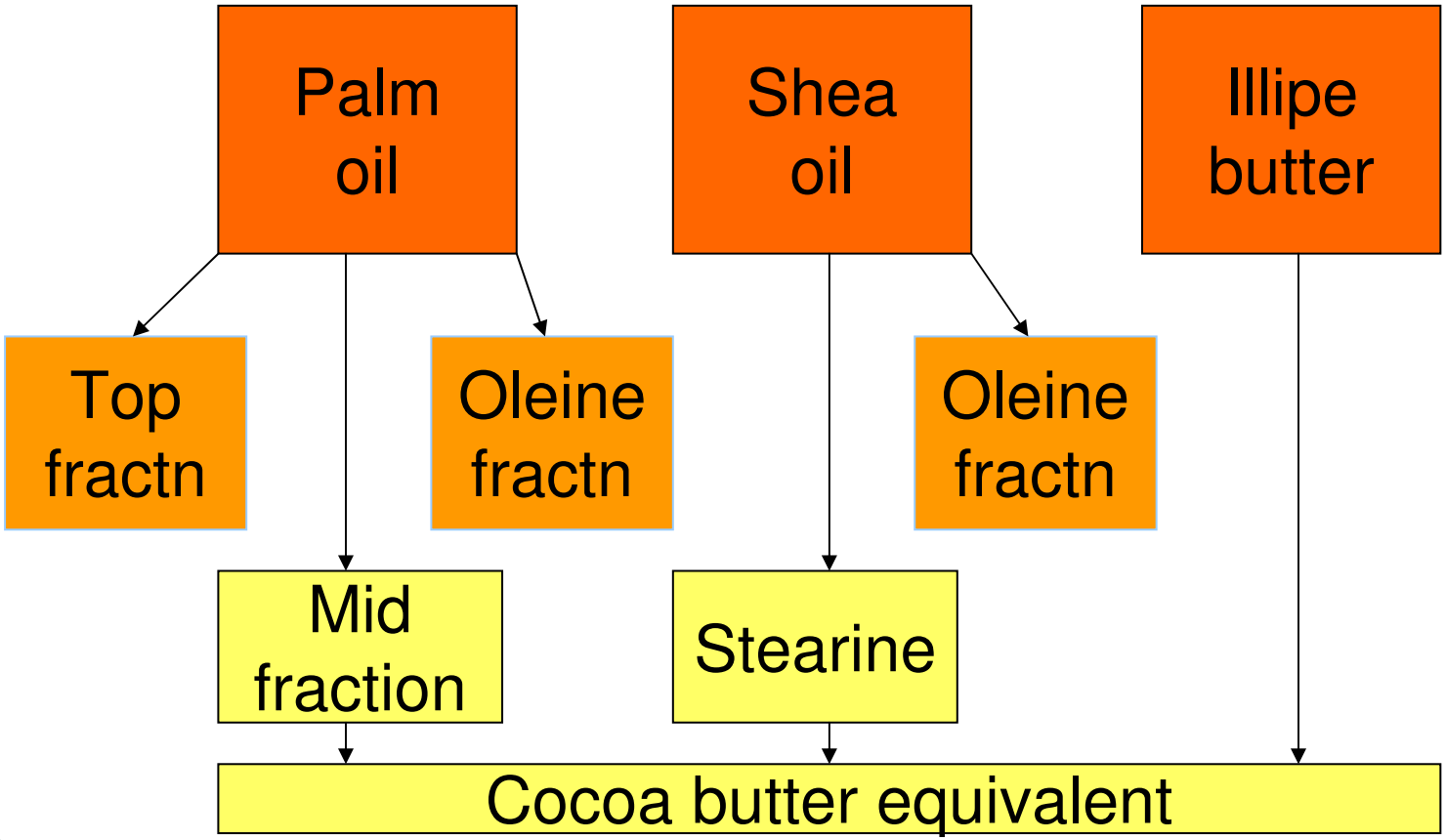
Cocoa Butter Equivalents

- Mainly sourced from the following oils:
  - Palm
  - Shea
  - Illipe
  - Sal
  - Kokum
  - Mango Kernel

Cocoa Butter Equivalents

- Only permitted processes in EU are:
  - Fractionation
  - Refining
- In non-EU countries which permit the use of CBEs it may also be allowed to produce them using enzymically-catalysed interesterification
- Hydrogenation is not recommended for reasons of compatibility of the vegetable fat with the chocolate – hence CBEs do not normally contain trans fatty acids

CBE Composition

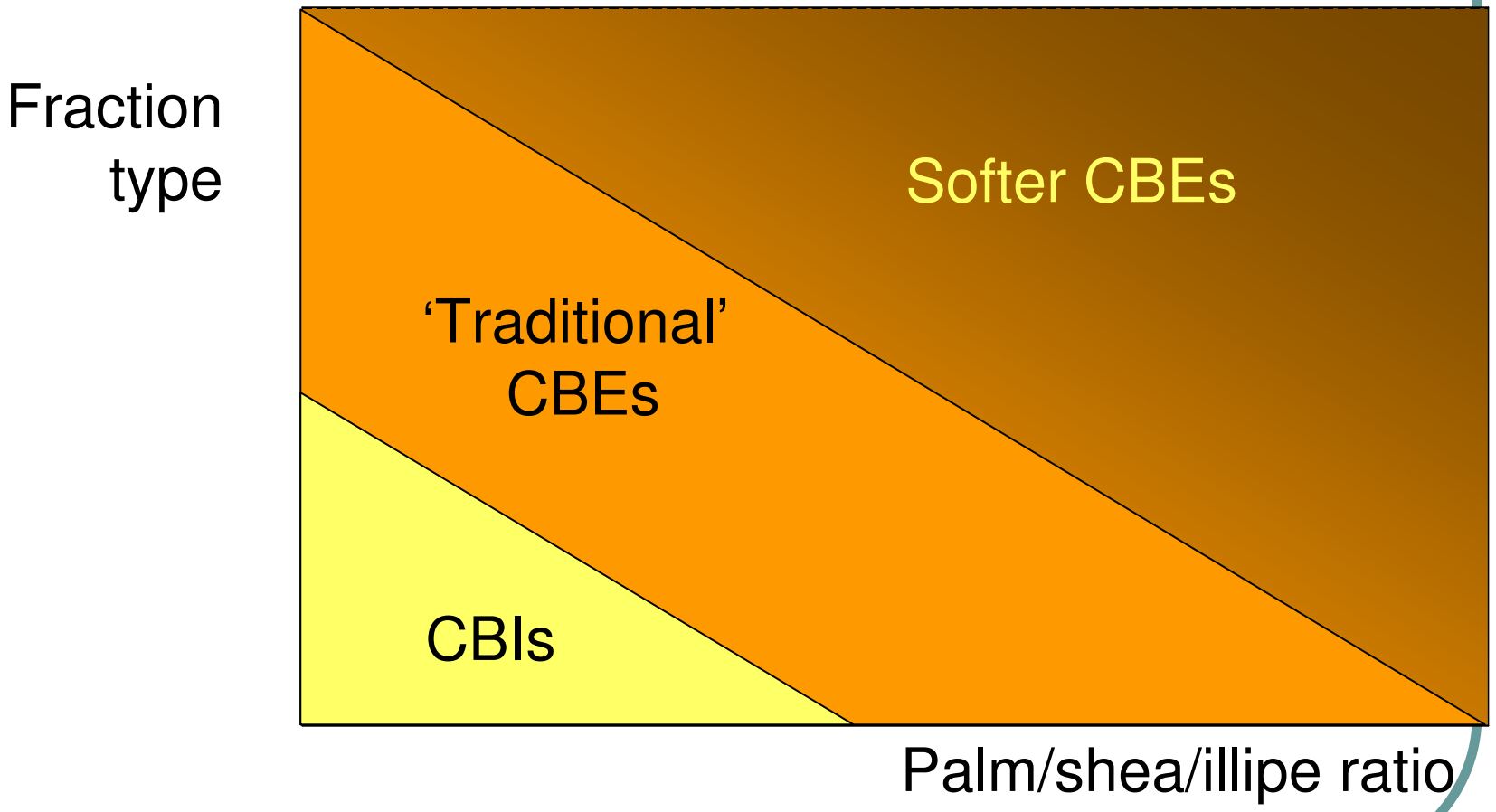


Triglyceride composition of cocoa butter and CBE components

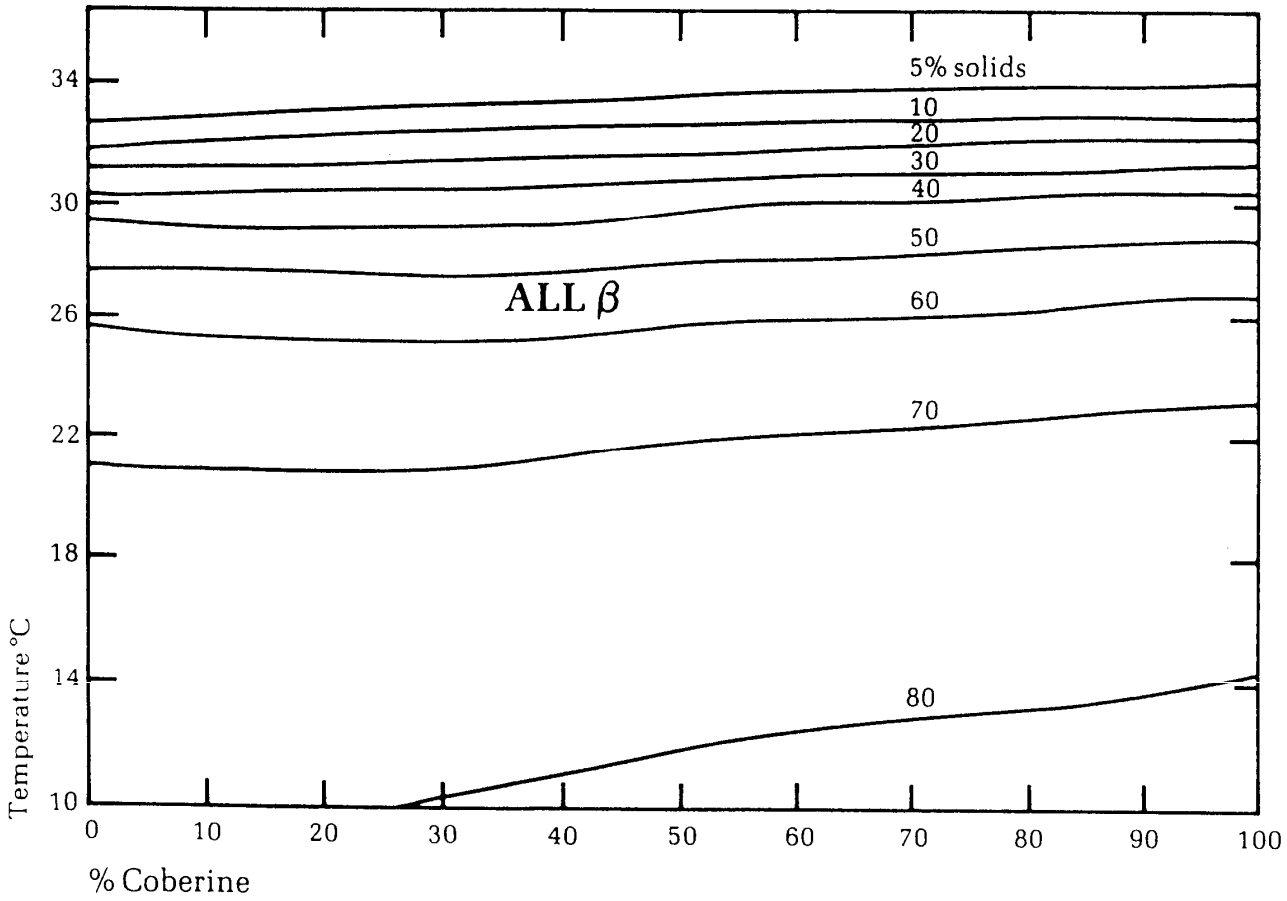
	Cocoa butter	Palm fraction	Shea fraction	Illipe	Sal fraction	Kokum	Mango kernel fraction
POP	16	66	1	7	Trace	Trace	1
POSt	37	12	7	34	10	6	16
StOSt	26	3	74	45	60	72	59

Variables in CBE formulation

Variables in CBE formulation



Cocoa Butter – CBE Blend Interactions



Source: Gordon, Padley and Timms
Fette Seifen Anstr **81** (1979), 116-121

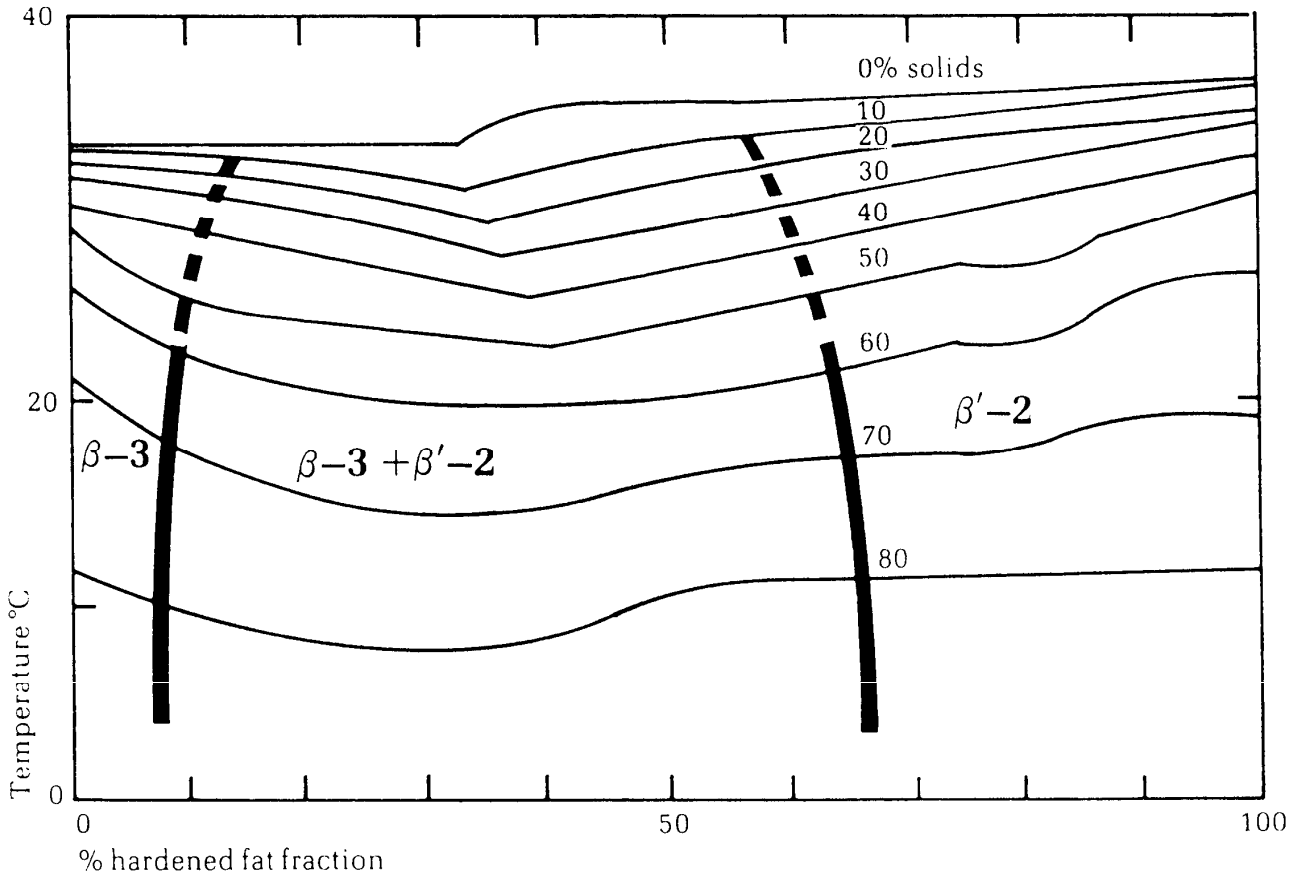
Supercoatings

- In many countries (even those which do not permit the use of CBEs at the 5% level in chocolate) it is possible to use these types of fat at much higher levels
- In these applications the vegetable fat replaces all the added cocoa butter that would be in a chocolate
- **The end product <u>cannot</u> be labelled 'chocolate'**
- Suitable labelling would be for example: 'chocolate flavoured coating'

Non-Lauric CBRs

- Produced from oils such as palm, rapeseed and soyabean – usually by hydrogenation and fractionation
- New versions are either non-hydrogenated or lightly hydrogenated to keep the trans content as low as possible
- Contain palmitic, stearic and oleic acids but in a different configuration from that found in cocoa butter
- Limited compatibility with cocoa butter

Cocoa Butter – CBR Blend Interactions



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Non-lauric CBR coatings

- Some tolerance to cocoa butter
- This allows up to 10% cocoa mass in the formulation (i.e. 15-17% cocoa butter on the fat phase)
- In milk coatings, the amount of milk fat plus cocoa butter in the fat phase should not exceed 20%
- Cocoa butter and milk fat have a softening effect on the end product

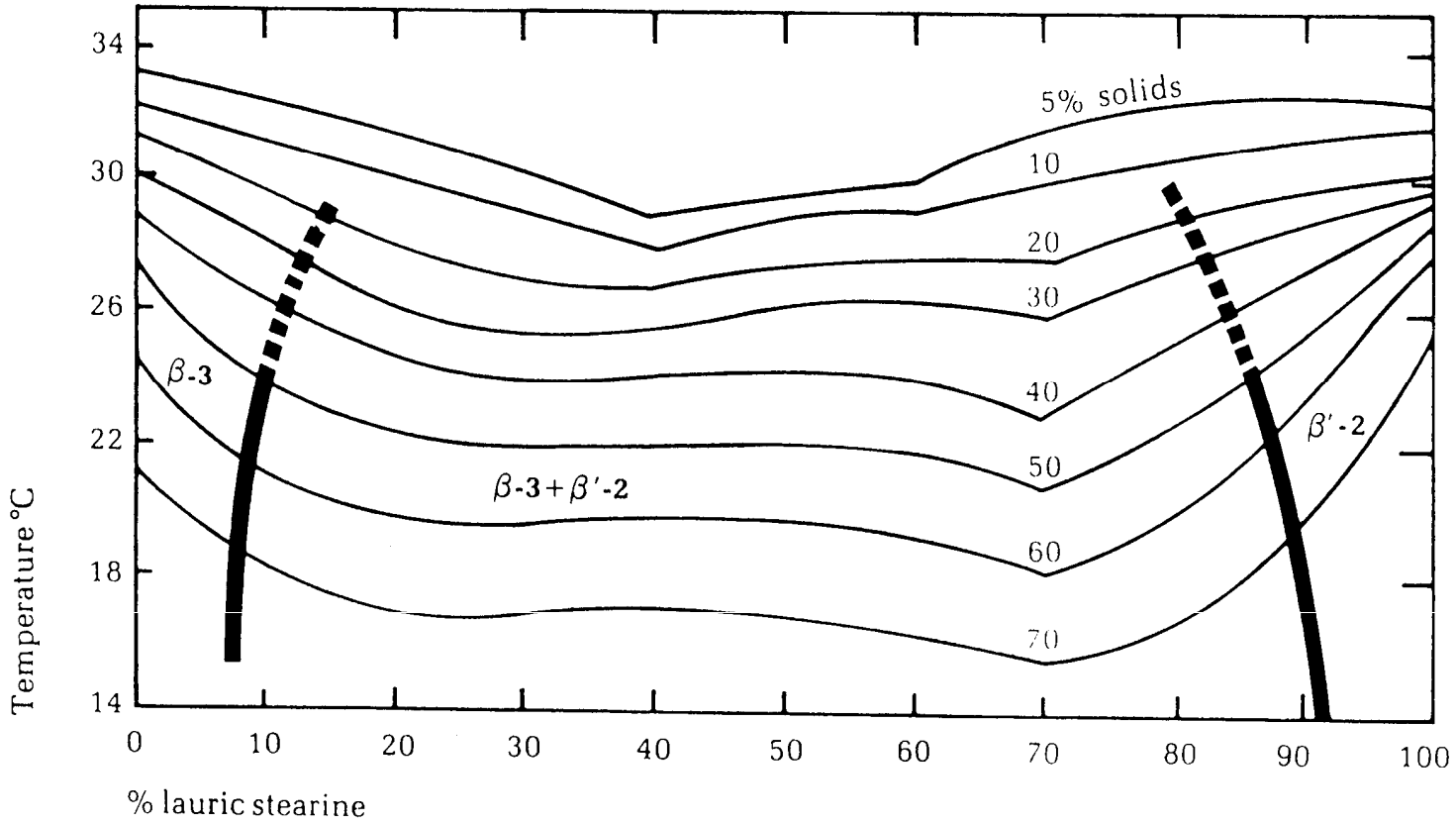
Non-lauric CBRs Attributes

- Non-brittle coatings
- Flexibility in processing
- Glossy appearance
- Long shelf-life
- Sometimes used to give structure to confectionery fillings

Lauric CBSs

- Based on palm kernel or coconut oil
- Produced by fractionation and/or hydrogenation
- Trans content either zero or low
- Completely different triglyceride composition to cocoa butter
- Incompatible with cocoa butter

Cocoa Butter – CBS Blend Interactions



Source: Gordon, Padley and Timms
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Lauric CBS coatings

- Effectively no tolerance to cocoa butter
- This prevents cocoa mass being used in the formulation and restricts cocoa usage to low-fat cocoa powder
- Milk fat also has a softening effect – full cream milk powder should be kept to a maximum of 10%

Potential for contamination with chocolate

- Produce and process lauric CBS coatings in chocolate-free clean equipment
- Thoroughly clean machines, pipelines, pumps when changing between lauric coatings and chocolate
- Flush out with fat

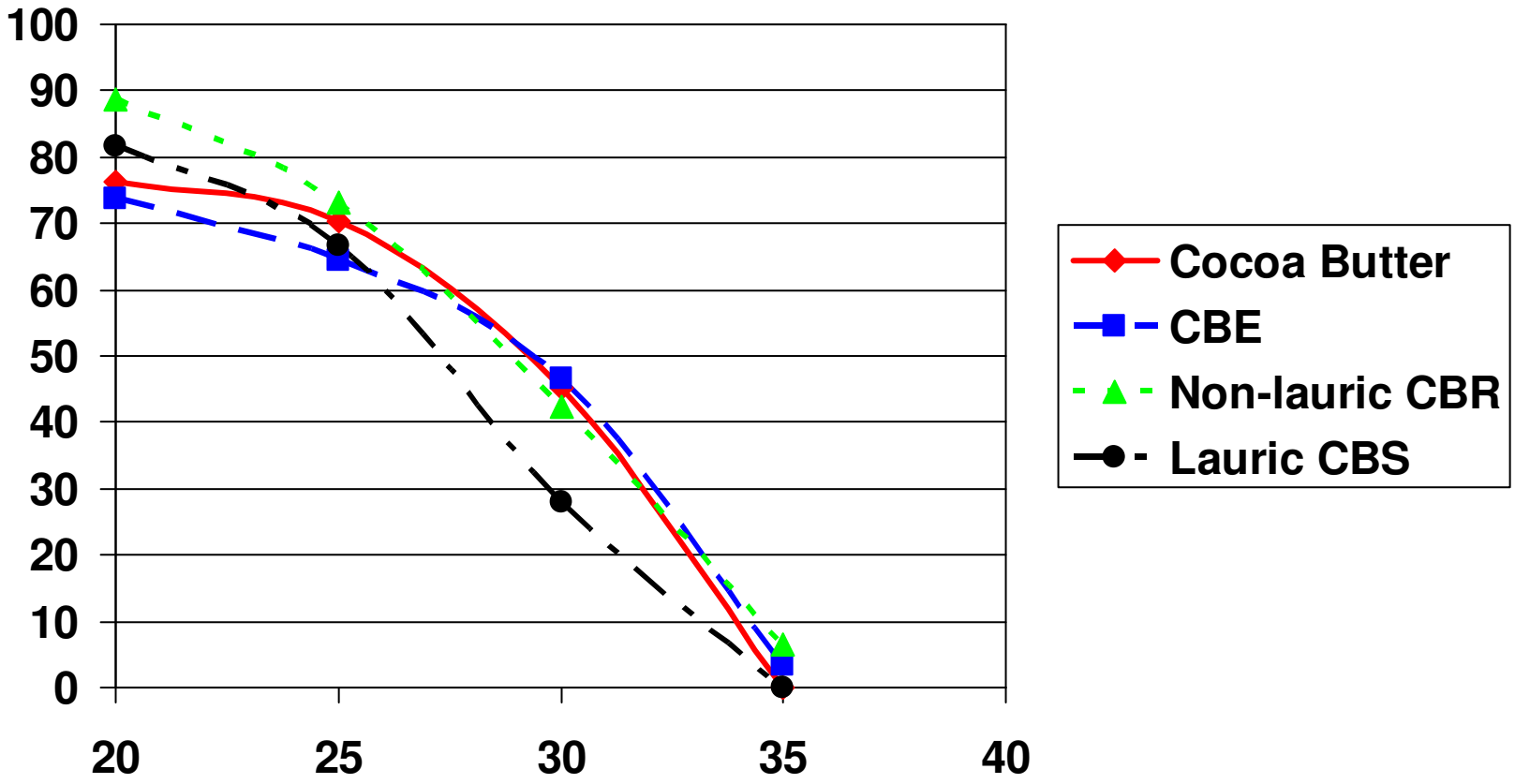
Hydrolysis

- Lipases can cause hydrolysis of fats in the presence of moisture
- Hydrolysis liberates free fatty acids
- In lauric fats the main liberated acid is lauric acid
- Lauric acid has a soapy taste
- A soapy taste in compound chocolate based on lauric CBSs can only occur in the presence of lipase and sufficient water

Uses of lauric CBS coatings

- Wafer and biscuit coatings
- Home bakery coatings
- Ice cream coatings
- Thin moulded candy bars

Melting Profiles



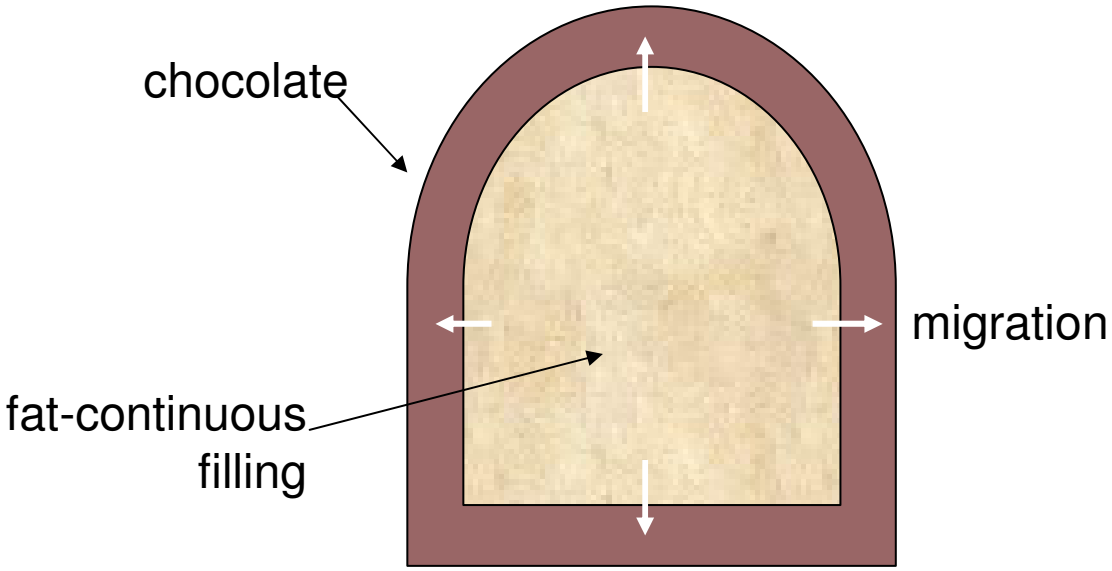
Advantages and Disadvantages

	Cocoa Butter Equivalents (CBEs)	Non-Lauric Cocoa Butter Replacers (CBRs)	Lauric Cocoa Butter Replacers (CBSs)
Advantages	●Fully compatible with cocoa butter ●Gives desired hardness, snap, mouthfeel ●Improved heat resistance with CBIs ●Stable consistency and taste ●Non-hydrogenated	●Non-temper ●Taste Stability ●Possibility to incorporate chocolate or cocoa mass	●Non-temper ●Texture and melting characteristics like cocoa butter
Disadvantages	●Requires sophisticated tempering	●Tend to become harder on storage giving inferior flavour release ●Hardness and snap not like cocoa butter ●Often hydrogenated	●Recipe must be virtually free of cocoa butter ●Risk of soapy off-taste and bloom ●Sometimes hydrogenated

Filling Fats

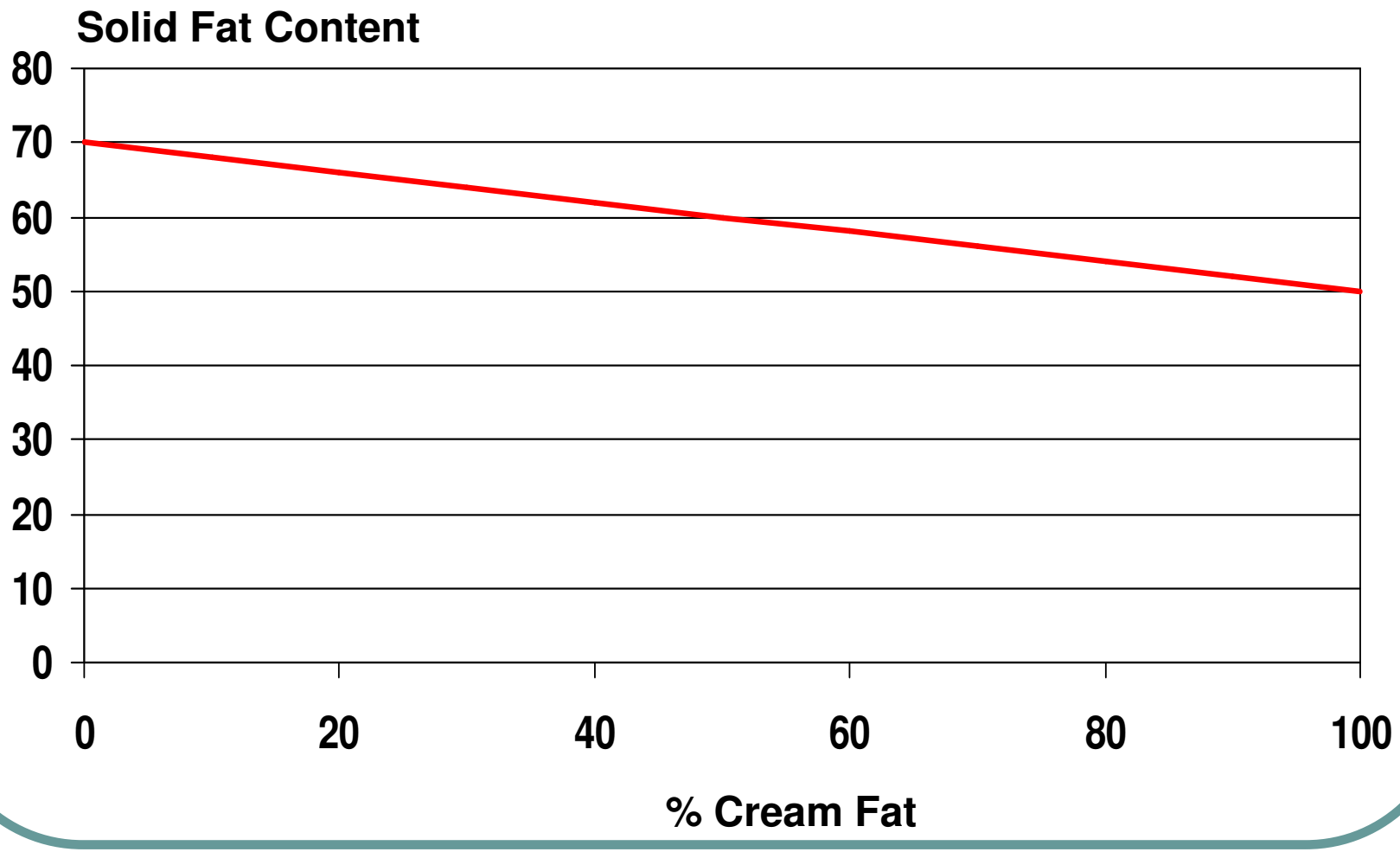
- Most confectionery filling fats fall within the same basic categories as the coating fats – **but they are softer**
- For example they are based on:
  - Soft fractions of palm oil or shea oil
  - Lightly hydrogenated and fractionated soyabean or palm oil
  - Coconut oil or palm kernel oil

Potential for Fat Migration Chocolate-coated Pralines

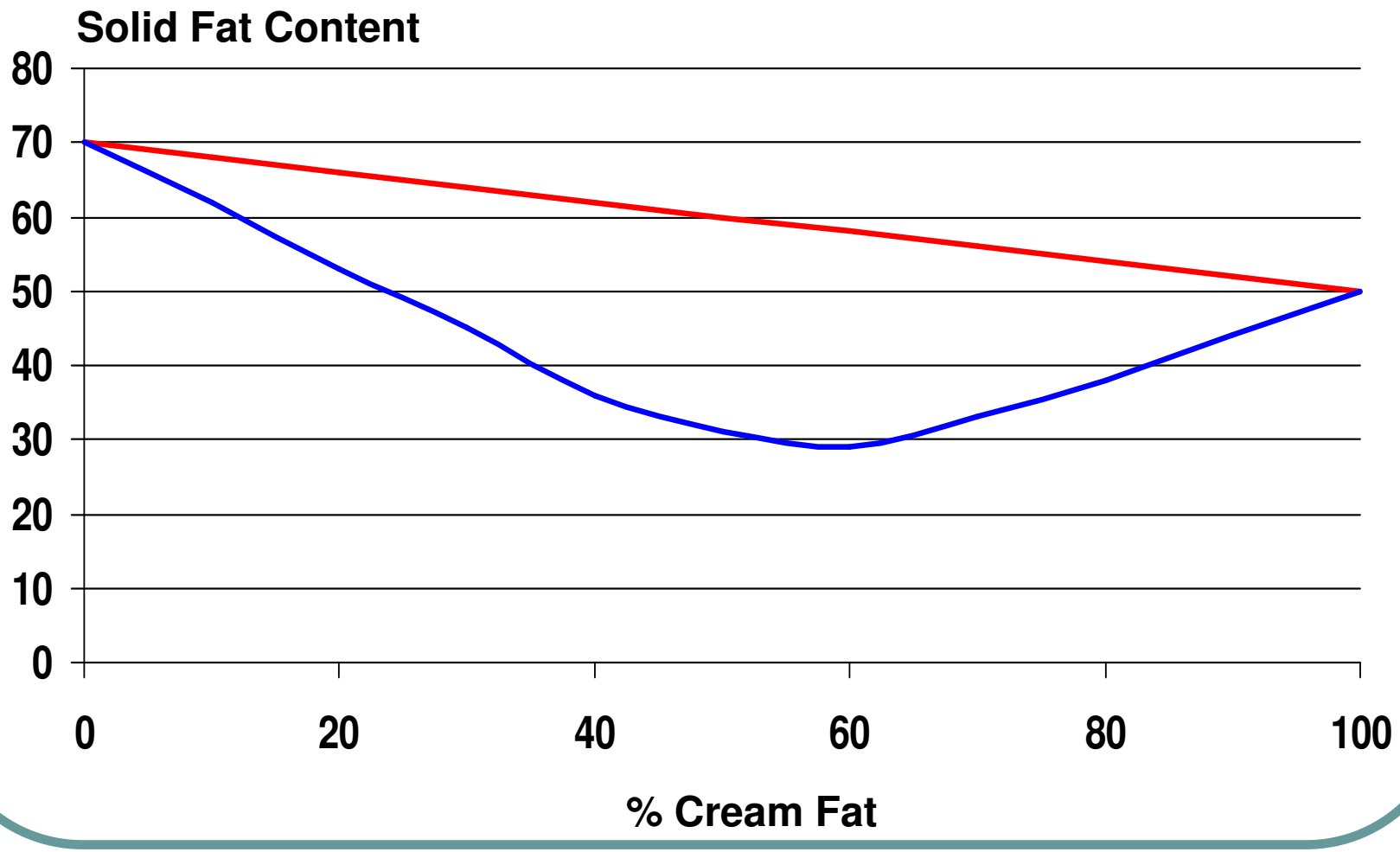


Compatibility between filling and coating fats is therefore very important

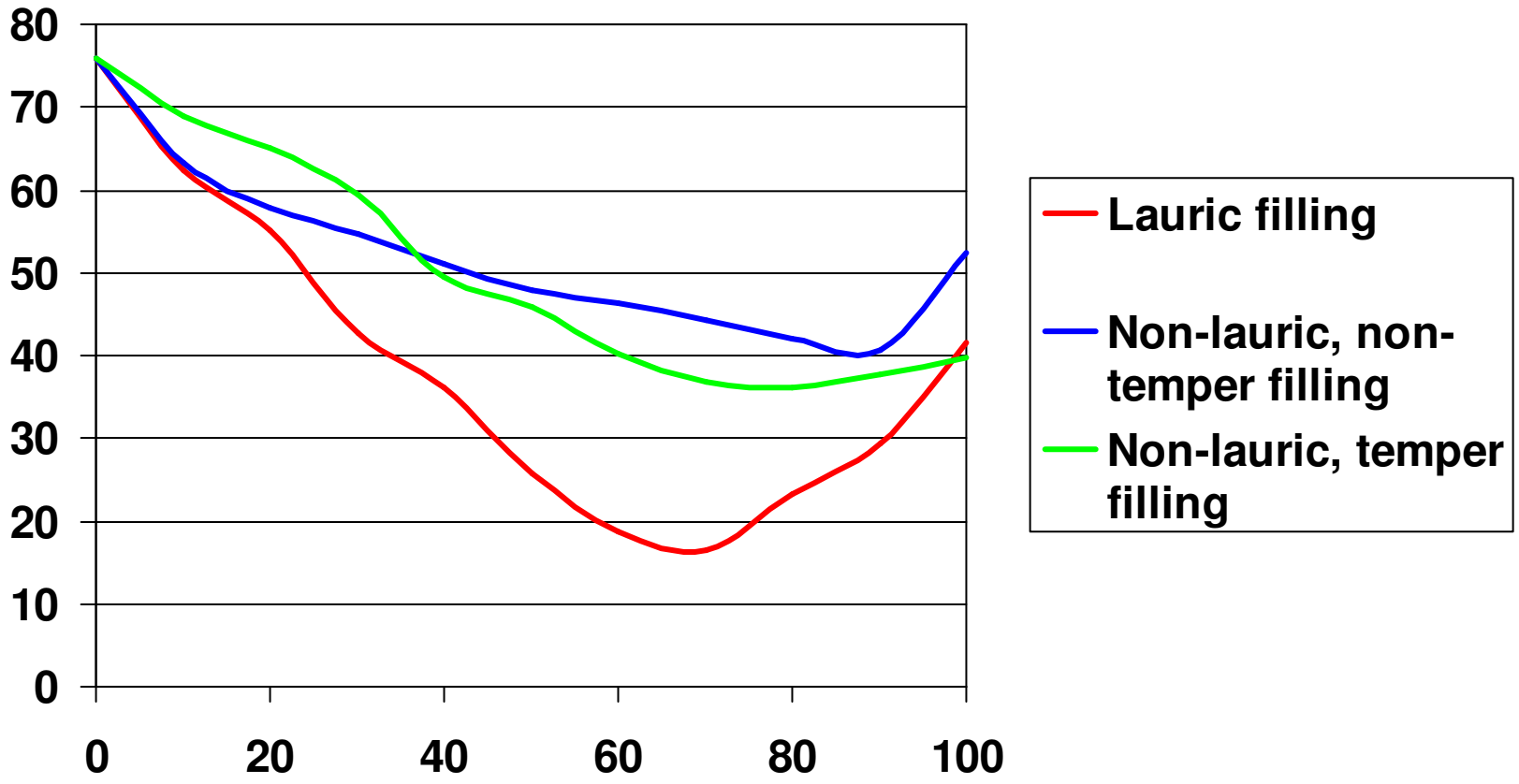
Filling Fat Migration "Ideal" Case



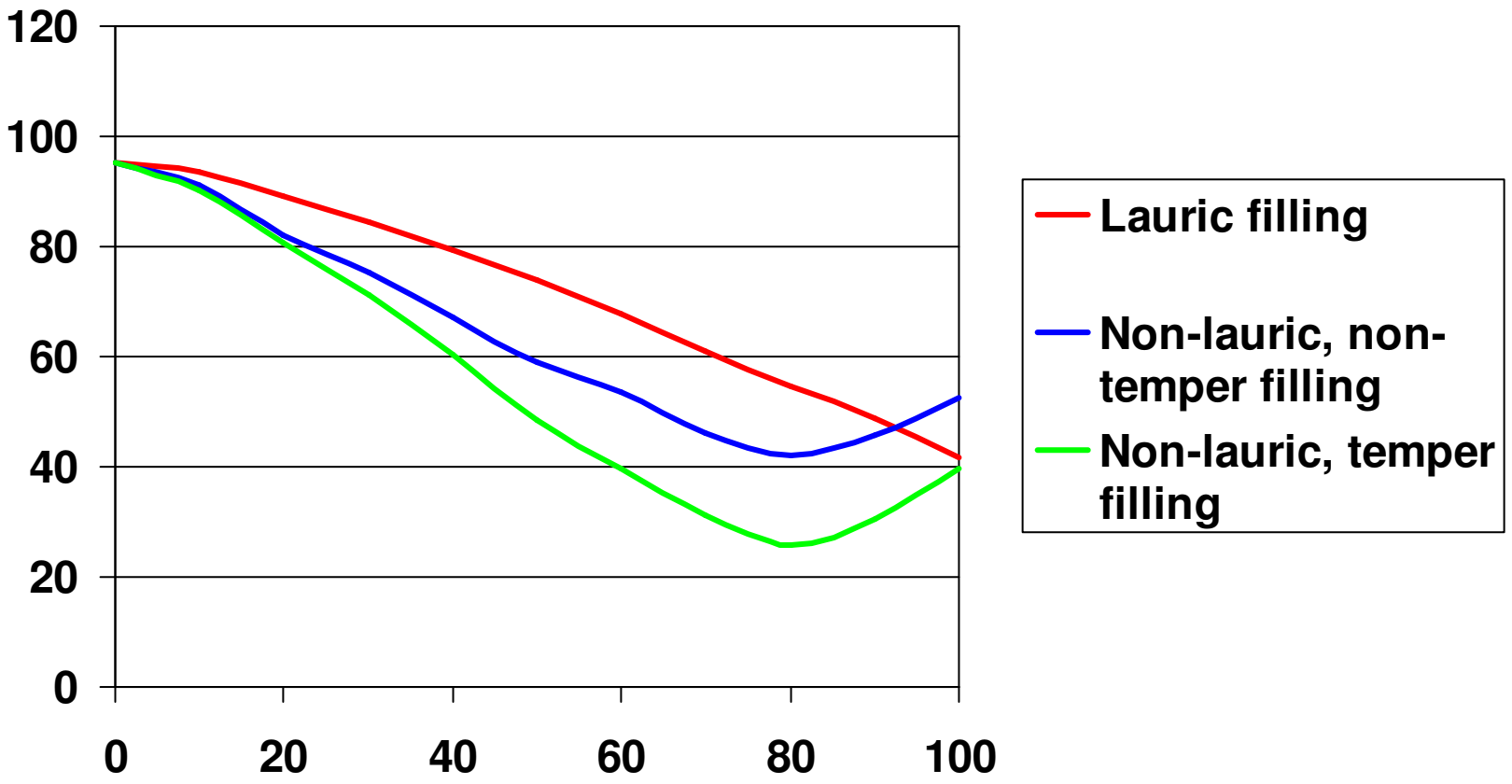
Filling Fat Migration "Eutectic" Case



Effect of various filling fats on solid fat content (at 20°C) of cocoa butter chocolate



Effect of various filling fats on solid fat content (at 20°C) of a lauric coating



Matching compatibilities

- These types of interactions make it important to match fats used in coatings and fillings so that they are of the same general type:
  - Chocolate with a non-lauric temper filling
  - Lauric coating with a lauric filling
  - Etc etc

Thank you for your attention

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