



Trends in Margarine and Shortening Products and Processing

by

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Outline of Presentation

- Focus on low trans fatty acid products
- *Trans* fatty acid issue
- Reformulation for low *trans* products
- Processing technology for low *trans* products
- Other market trends



Trans Fatty Acids Issue

Main reasons for change away from using partial hydrogenation

- Inexpensive hard stock of *trans* free palm oil fractions
- Health finding that *trans* FA are implicated in development of coronary disease

**Trans FA in
Partially Hydrog. Oil (<55%)**

↑ LDL ↓ HDL
Cholesterol

**Risk of coronary heart disease
Diabetes II**

**Trans FA in
Animal Fat (<5%)**

Health benefits

**Antioxidant
Anticarcinogenic
↑ Muscle : fat ratio**

Trans Fatty Acids Issue

Global trend towards a reduction of *trans* fats

Market drives

- Large food suppliers have moved towards low *trans* products
- January 2006 – FDA fat labelling
- January 2004 – Danish legislation

Trans Free Products

Reformulation: Matching fat properties

- Melting profile
- Crystallization behavior

Fractionation

Interesterification

**Optimal
Physical and Chemical
Properties**

Full Hydrogenation

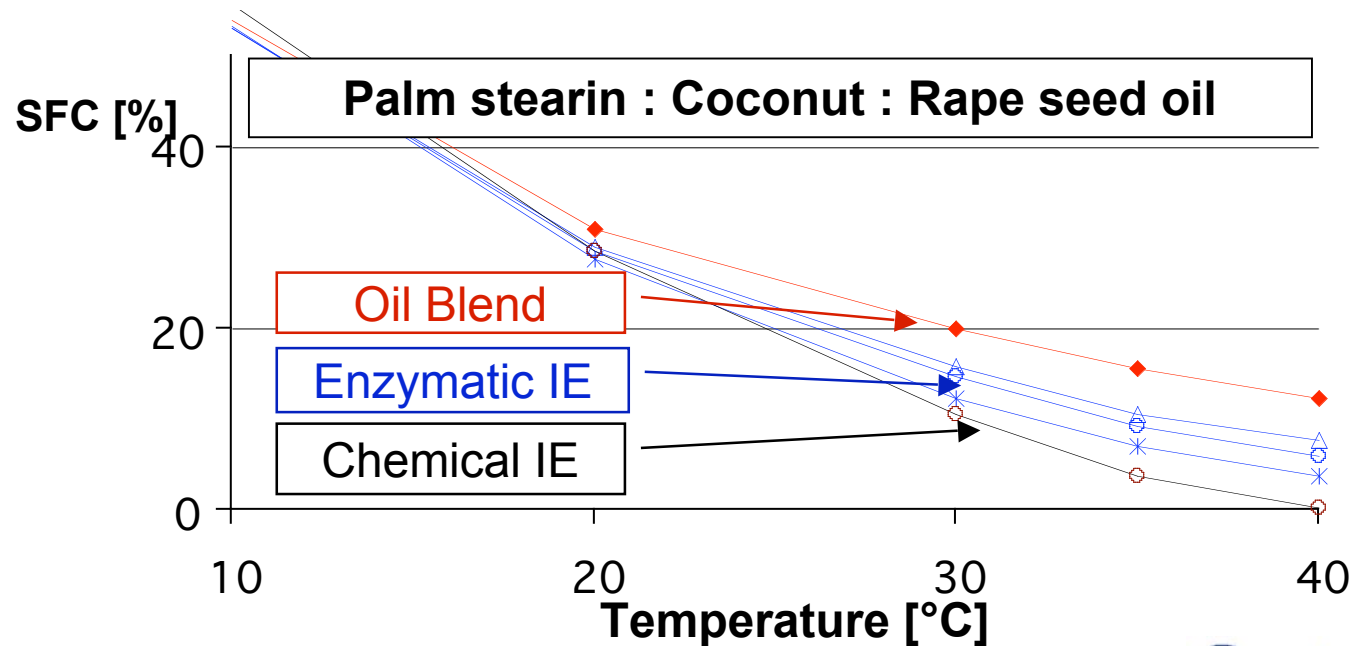
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Alternative Methods

Interesterification

- Alter melting property
- Can alter the crystallization habit of fat blends

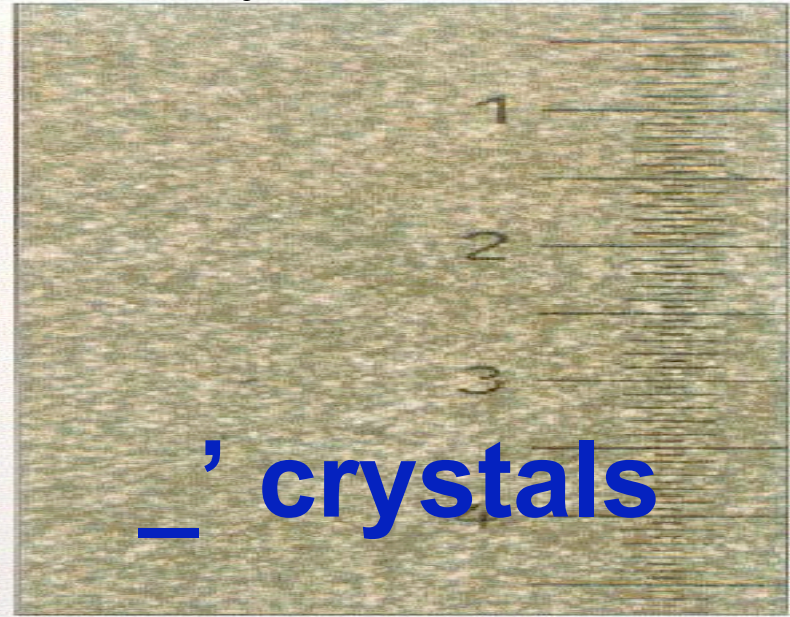
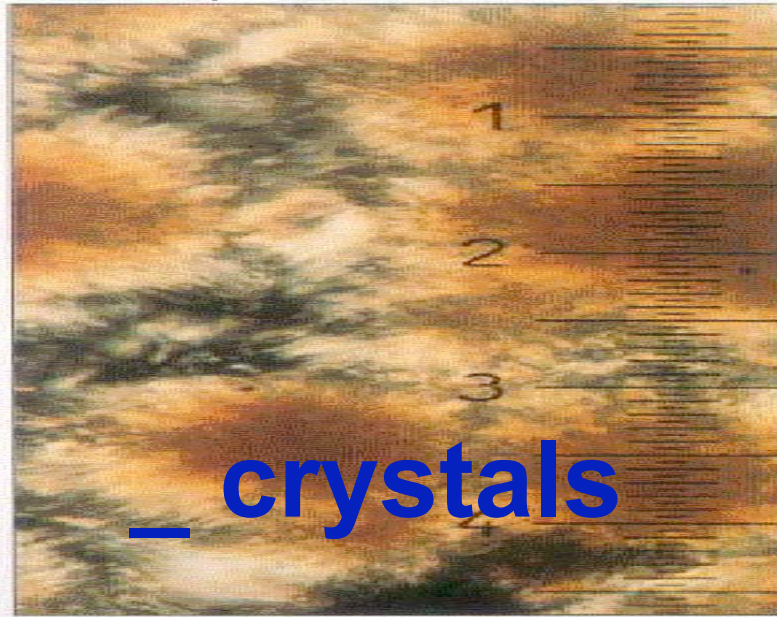


Ref: Novozymes A/S,
Denmark

Crystallization Habit

Functionality of fats:

- SFC profiles do not tell the whole story



Source: Danisco A/S, Denmark

- Loose structure
- Sandiness
- Oiling off

- Smooth texture
- Plasticity
- High crystal surface

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Alternative Methods

Palm oil

- Alternative source of hard stock for *trans* free products
- Raw material available at low price
- Fractionated intermediates:
 - Palm olein
 - RBD palm
 - Palm stearin
 - Hydrogenated products

Crystallization properties

- Good performance: tends to crystallize in the β' crystal form
- Slower crystallization rate than *trans* fats
- Tendency to post hardening: formation of large crystal compounds
- Implicate adjustment of processing conditions

Processing *Trans* Free Products

Set special demands for optimal product properties

Fat Properties

Melting Profile (SFC)
Crystallization habit
Crystallization rate

Process Conditions

Plant Layout

Capacity and
retention time

Chilling Intensity
Kneading Intensity

Tempering

Free *Trans* Product

Firmness

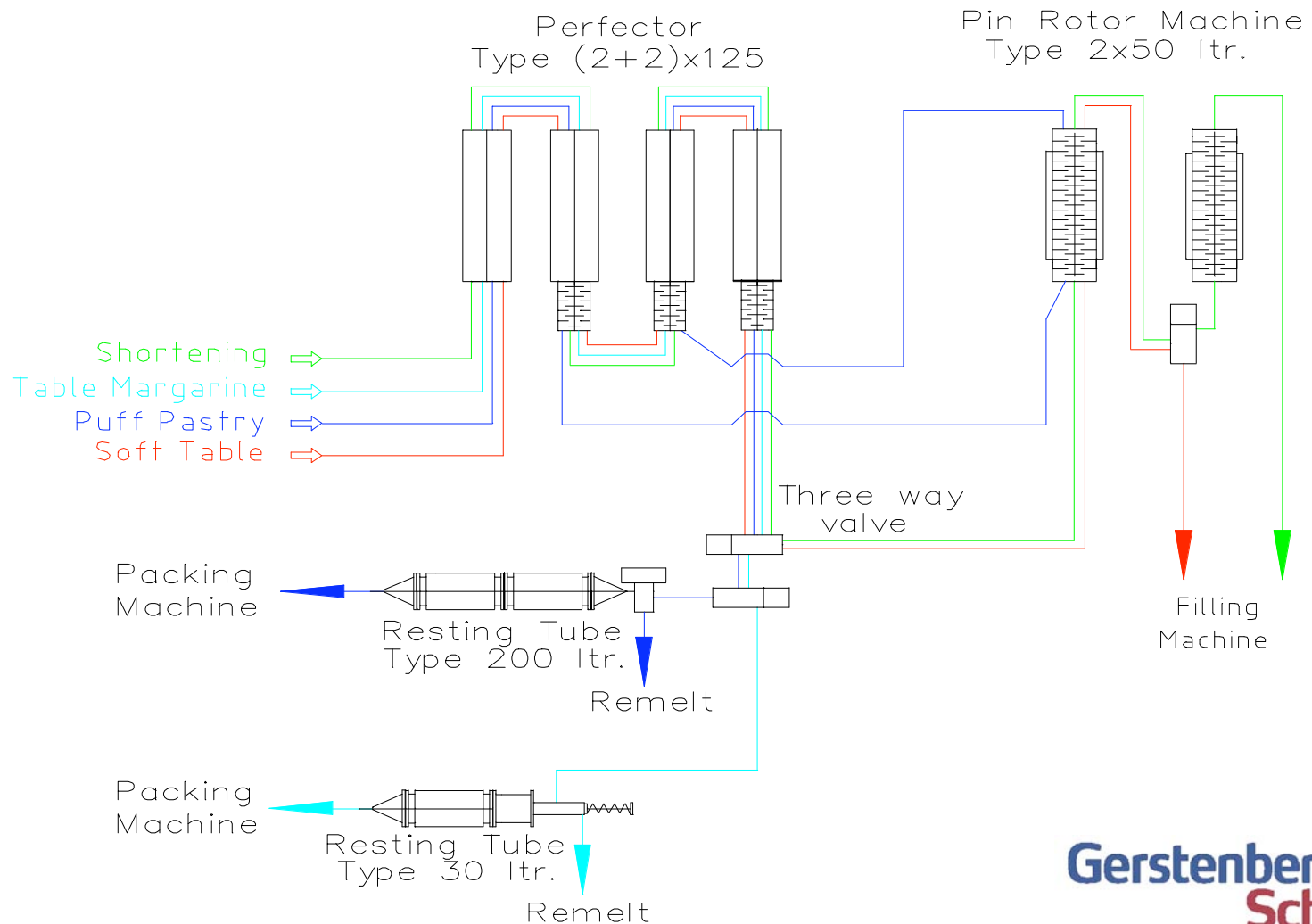
Spreadability
Texture

No Oiling out

No grainy texture

Flexible Perfector Plant

- Configuration of machinery and processing equipment
- Dimensioning of the plant



Processing *trans* Free Products

- Generally no problems with filled products
- For packed products: tendency to overwork easily and less pin volume is normally required for
- Lower capacity and packing temperature
- Need longer tempering time at different temperature
- Often different plant configuration
- Pilot plant trials are required to optimize processing of specific reformulations of fat

Other Market Trends

Market trends:

- Low fat products (including butter)
- Functional foods
- Pumpable shortening process
- Butter blends



Low Fat Products

- Less than 40% fat (veg. oil or butter)
- Very low fat products - 20% fat
- **Special Demands**

Ingredients

Emulsifiers
Stabilizers
Fat blend

Process Features

Preparation unit
In line pasteurizer

Chilling Intensity
Kneading Intensity

Remelt system
Phase Inverter

Low Fat Product

Viscosity
Food safety

Firmness
Texture
Spreadability
Water droplet size
No free water

Functional Foods

- Foods containing ingredients that provide health benefits
- Increase dietary intake of functional ingredients by fortification of common foods
- Margarine fortified with essential oils has been on the market in Europe in the past decade
- Cholesterol lowering spreads with sterol
- Margarine fortified with calcium and vitamins



Pumpable Shortening

- Larger bakeries go toward pumpable shortening as alternative for traditionally used bag-in-box plastic shortenings
- Delivered or on-site production of pumpable shortening
- Advantages:
 - compliance with recycling regulations
 - improved hygiene standards
 - more flexibility for oil selection
 - capable for reformulations: e.g. low *trans* shortenings
 - reduce costs: work force, raw materials, handling
 - easy to incorporate into product mix

Pumpable Shortening

- Important function is to interrupt the gluten network and incorporate air during mixing
- Process line:
 - Preparation: Oil blend + Emulsifier
 - Crystallization: Perfector plant + Maturing tanks



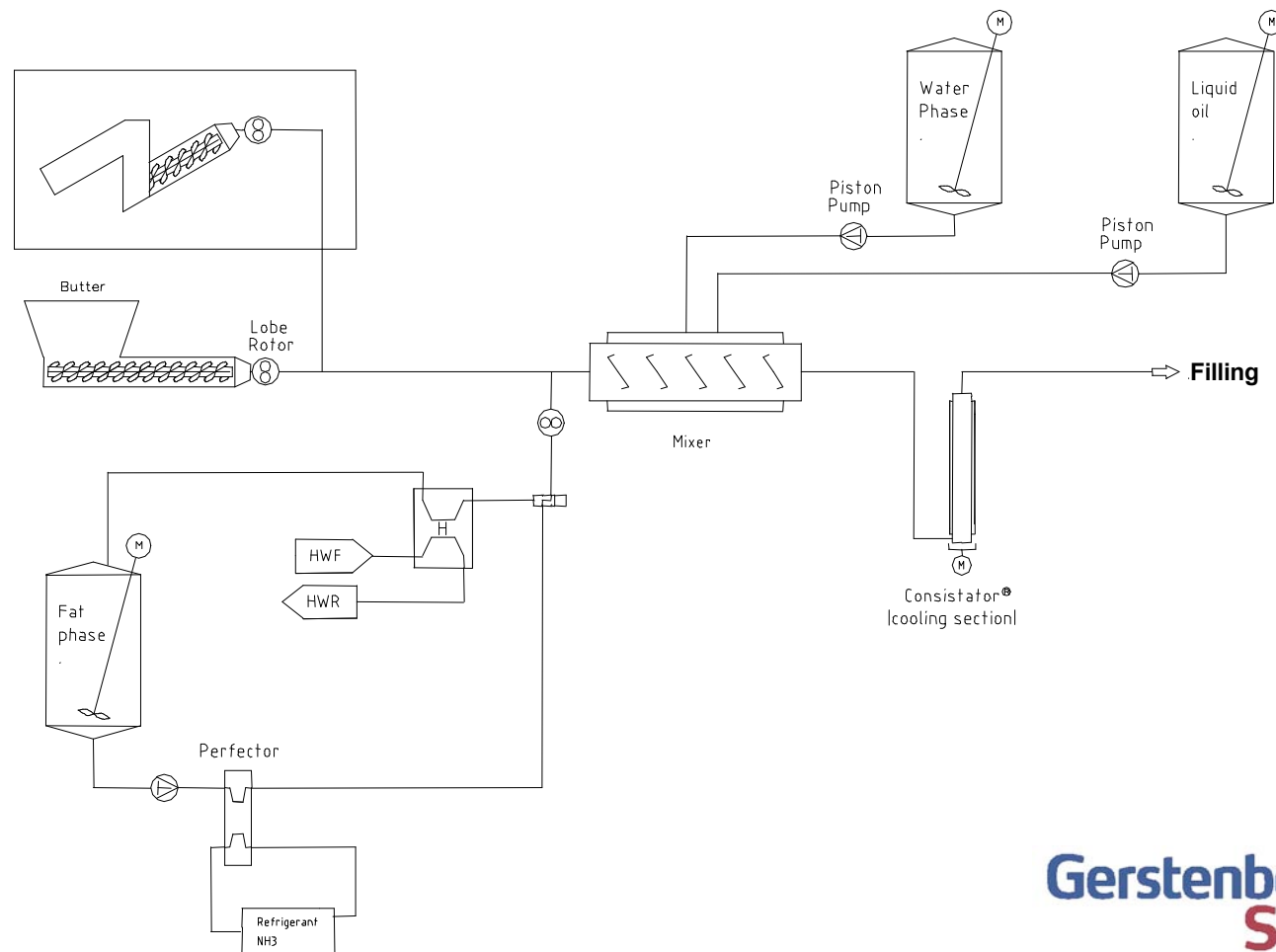
Butter Blends

- Spreadable butter
- On the market since early 1980's
- Consists of: Butter + liquid oil
- Additional incorporation:
 - Water phase
 - Oil and butter fractions
 - Hydrogenated oils
 - Other ingredients
- Margarine or butter blend process



Butter Blend Process

- Phase dosing: Butter + Crystallized oil phase + Water phase



Blending Process for Low Fat

- Full fat _ low fat products
- Same water droplet size distribution
- Same stability
- New possibilities for incorporation of ingredients



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