PROCESSING OF PALM-BASED SHORTENINGS FOR LOW TRANS BAKERY PRODUCT APPLICATIONS

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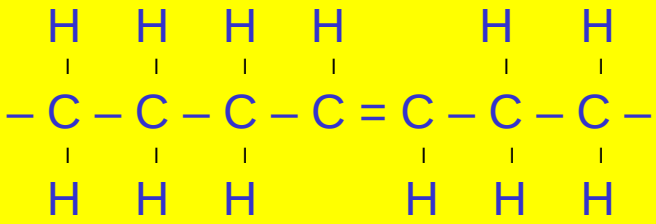
Overview

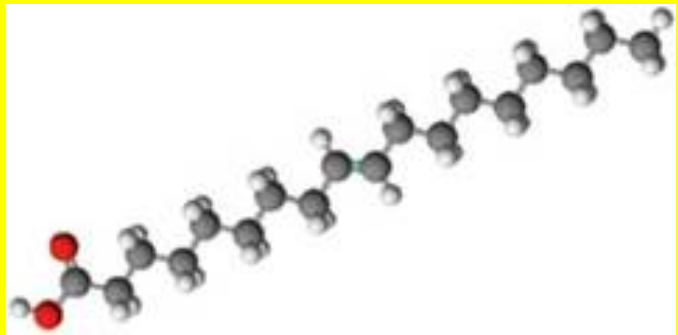
- Palm oil-based low TFA blend options
- Types of processing equipment
- Choices for process line configuration
  - Rationale
  - Supporting data
- Optimisation of processing conditions
    - SFC profile
    - Functional performance
- Downstream considerations
- Way forward for the future

Selection of Low TFA Blend Options

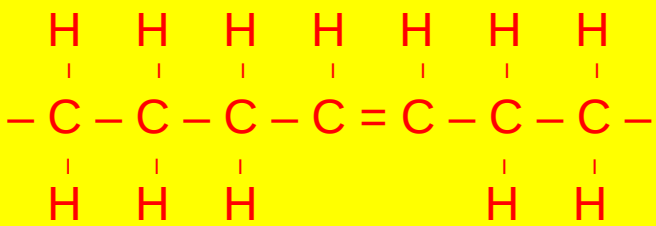
- Fundamental differences between cis and trans isomers
- Oil modification techniques
- Low TFA blend options – pros & cons
- Processing implications

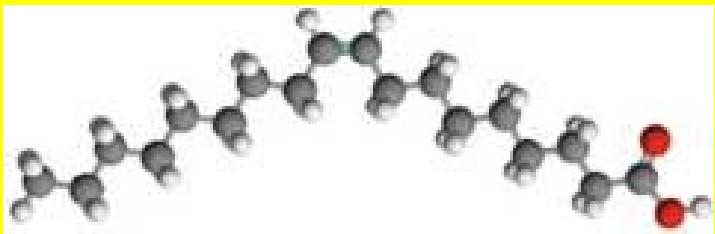
TRANS FATTY ACID ISOMERS – CIS vs TRANS





Trans fatty acid: linear, made during hydrogenation, bad health image, labelling required.





Cis fatty acid: non - linear molecule, naturally occurring isomer, good health image, labelling not required.

OIL MODIFICATION TECHNIQUES

- **BLENDING**
  - Mixtures of liquid oils & naturally-occurring solid fats
  - Vegetable fats include palm, palm kernel & coconut & their fractions
  - Precise control of SFC profile is possible
- **HYDROGENATION**
  - Chemical process
  - Reaction of liquid oil & hydrogen
  - Nickel catalyst + high temps/pressures
  - Random mixture of cis & trans
- **INTERESTERIFICATION**
  - Chemical (Sodium methoxide) or enzyme-catalysed reaction
  - Rearrangement of the fatty acid chains on the fat molecule
  - Trans isomers not formed
  - Enzyme-catalysed process is more controllable

PALM OIL-BASED LOW TFA BLEND OPTIONS

- COMPARABLE SFC PROFILES TO "STANDARD" BLENDS
- EXCELLENT FUNCTIONAL PERFORMANCE
- FAVORABLE RAW MATERIALS PRICES
- LOWER PROCESSING COSTS
- LOW/ZERO TRANS FATTY ACIDS CONTENT
- FREE FROM HYDROGENATED FATS
- PUMPABLE SHORTENING SYSTEM RECOMMENDED DUE TO :-
    - SLOW CRYSTALLISATION RATE
    - SOFTNESS OF BLENDS

PROCESSING IMPLICATIONS

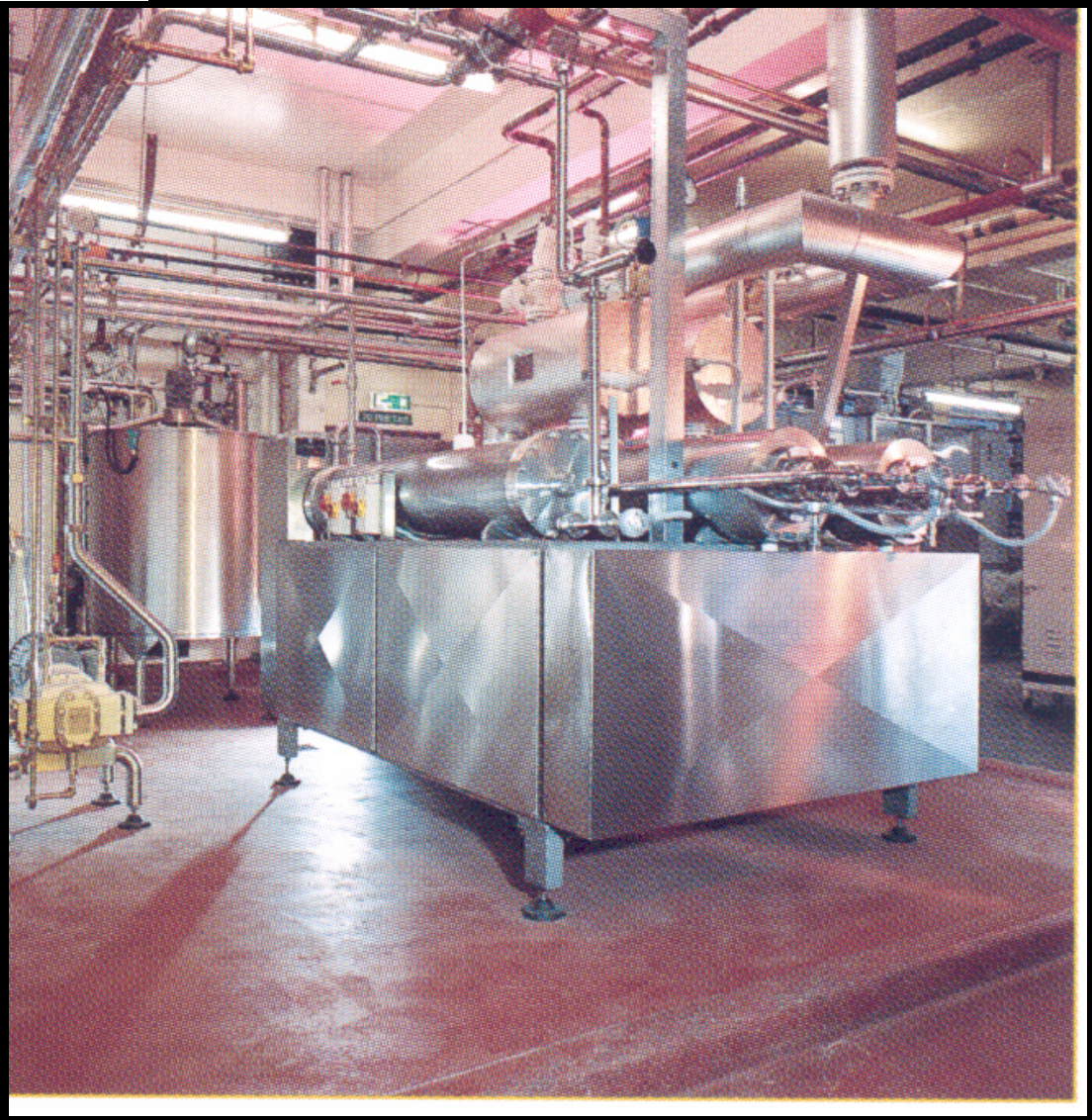
- CRYSTALLISATION RATES
- RESIDENCE TIME
- POST PROCESS TREATMENT
- IMPACT ON RHEOLOGICAL PROPERTIES
- TEMPERING TIME
- REQUIRED FUNCTIONALITY IN END-PRODUCT APPLICATIONS

Chemtech International

MARGARINE PREPARATION,
PROCESSING AND
PACKAGING EQUIPMENT

PALM-BASED SHORTENING PROCESS LINE

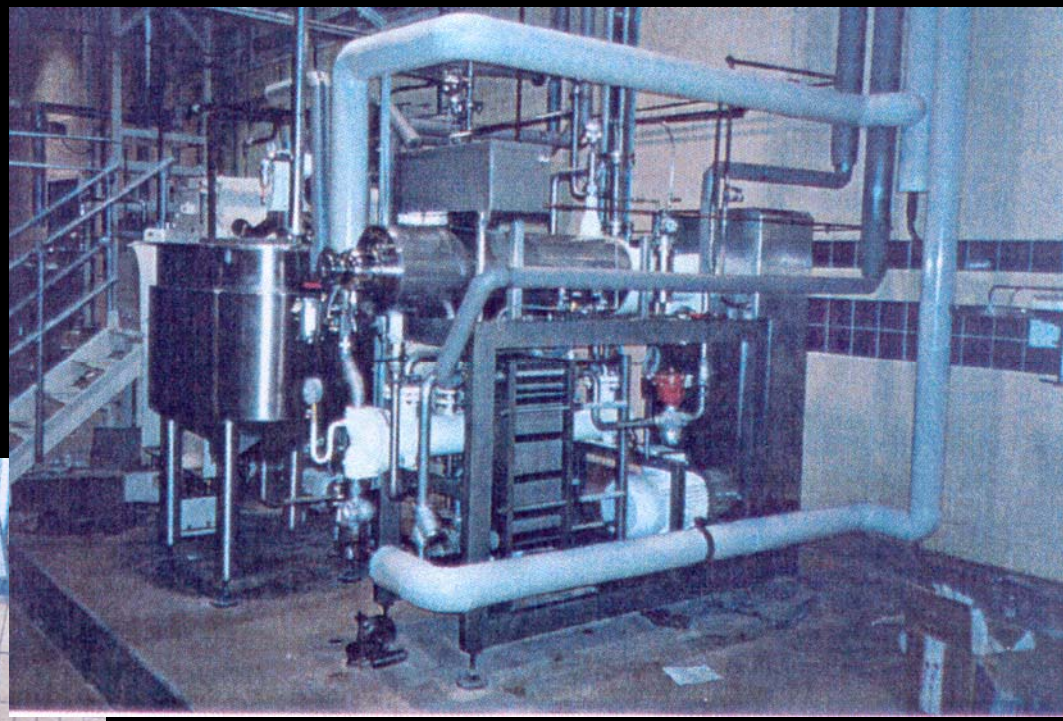
Chemtech International

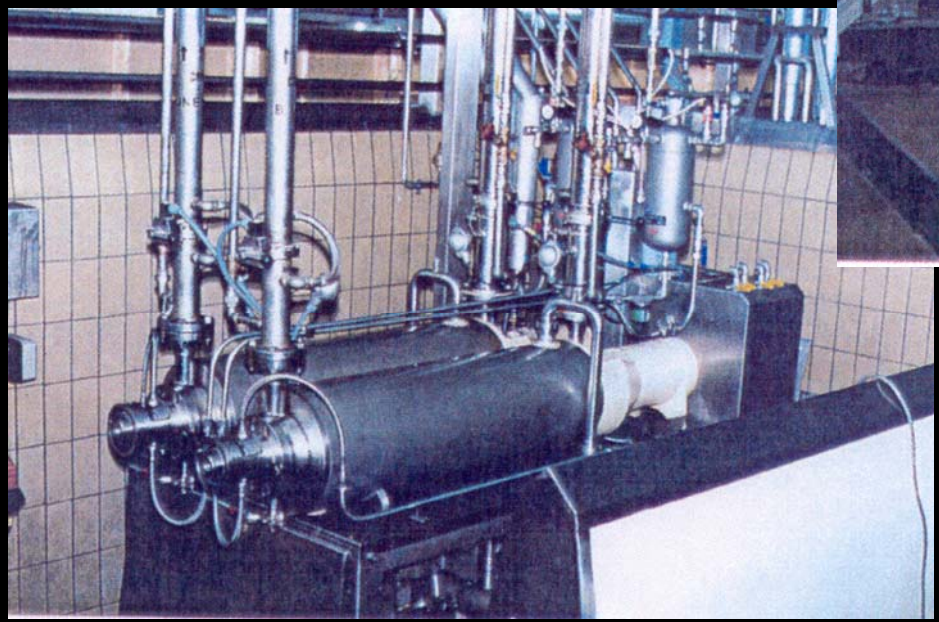


PUMPABLE
SHORTENING
SYSTEMS

Chemtech International

BISCUIT / COOKIE
CREAMS





FONDANT PASTE
PRODUCTION

Shortening Options

Boxed Fat

- Expensive (+$80/ton)
- Labour Intensive
- Factory Space Requirements
- Tempering Requirements
- Product Losses
- Disposal of Used Packaging

Plasticised Shortening

- Price +$40/ton
- Reliability of Supply
- Very Few Suppliers

Pumpable Shortening

- Many Oil Blend Suppliers
- Market Prices
- Simple to Change Formula
- Best Performance

Shortening Properties

Creaming Performance

OPTIMUM 15% SOLID FAT CONTENT

TYPICAL SFC:

20°C (68°F) = 28-32%
30°C (86°F) = 10-12%
35°C (95°F) = <6%

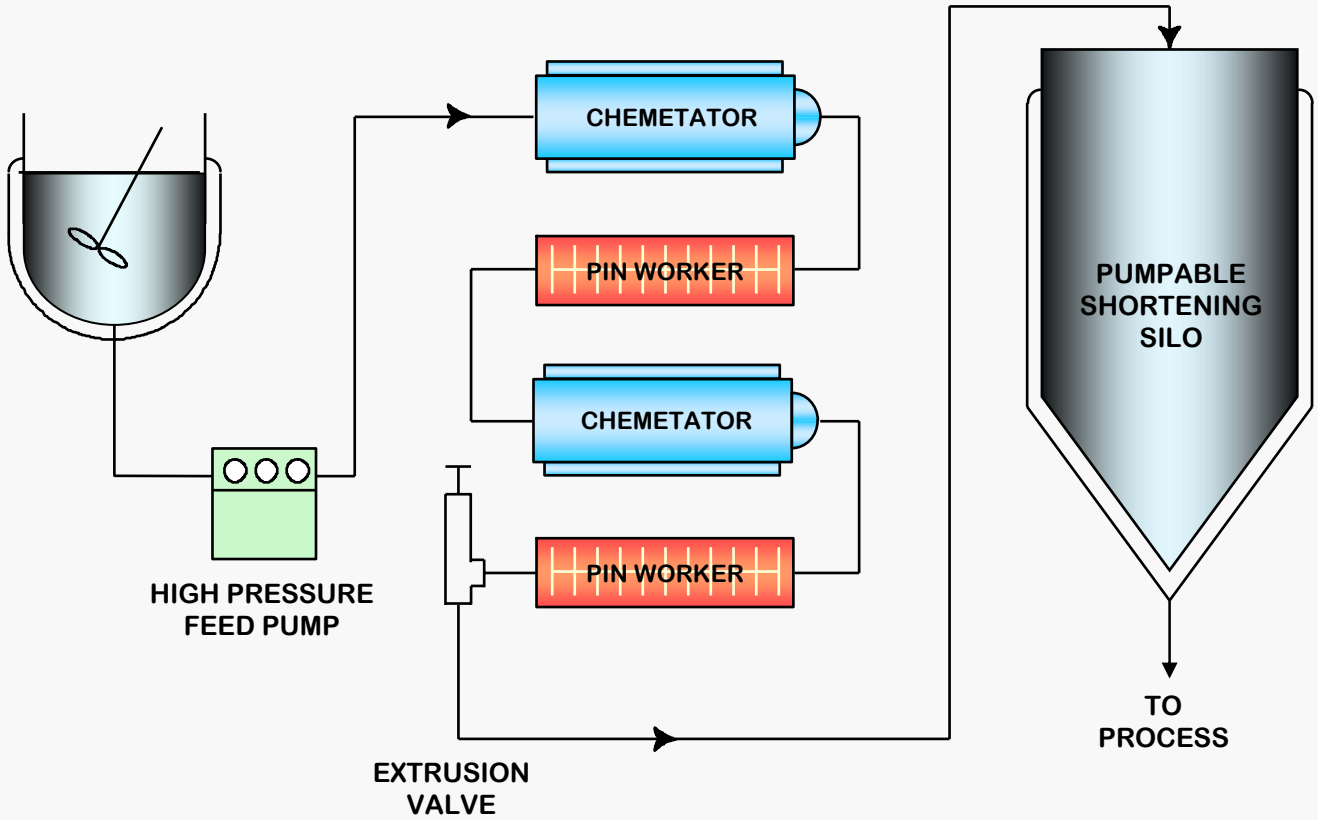
Measurement and Control

Creaming Volumes in Mixers

Baking Performance for Cookies & Cakes

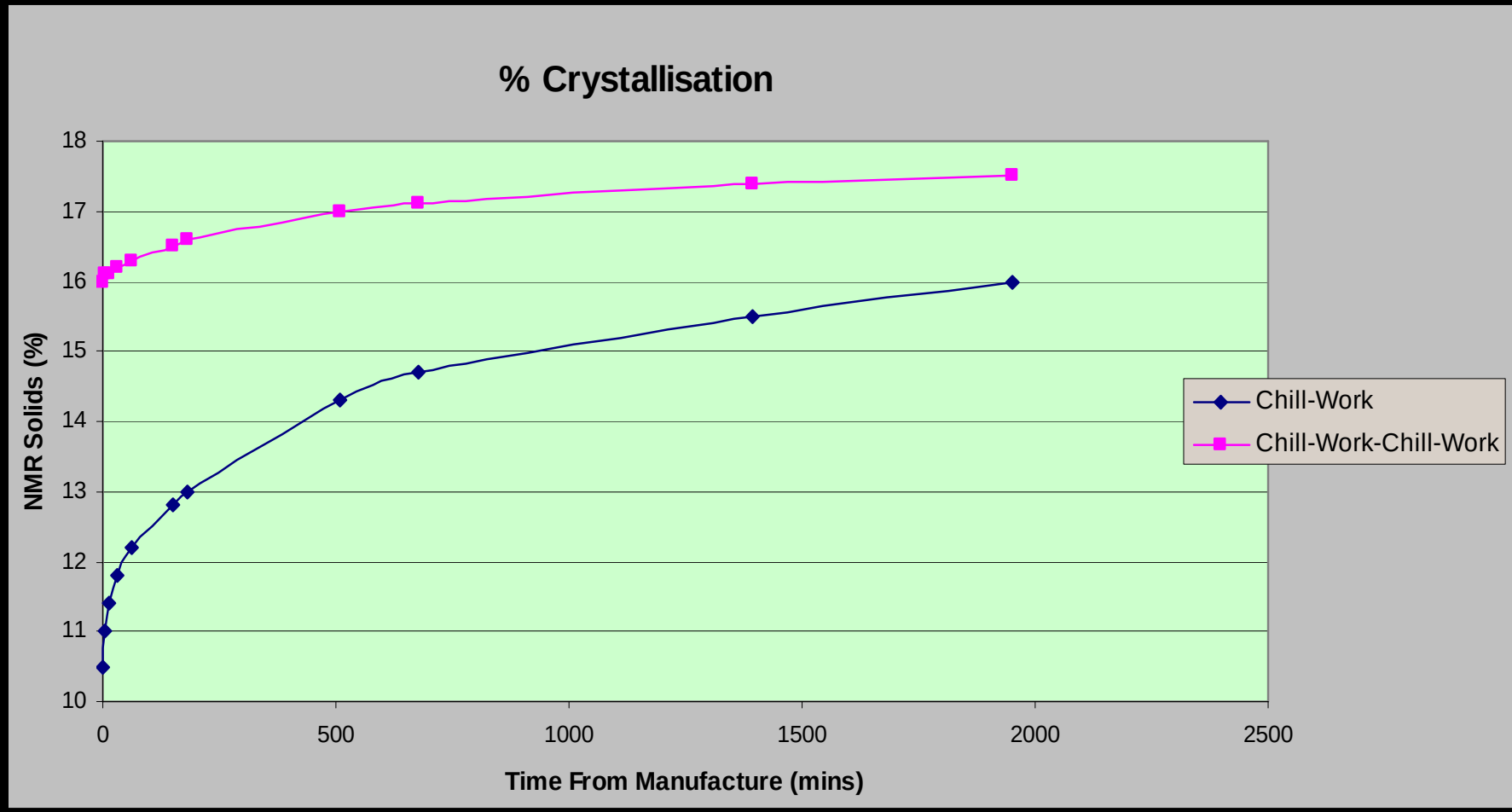
Controlled Temperature / Time

The Pumpable Shortening System



CHILL – WORK – CHILL – WORK TECHNOLOGY

Chill-Work vs Chill-Work-Chill-Work



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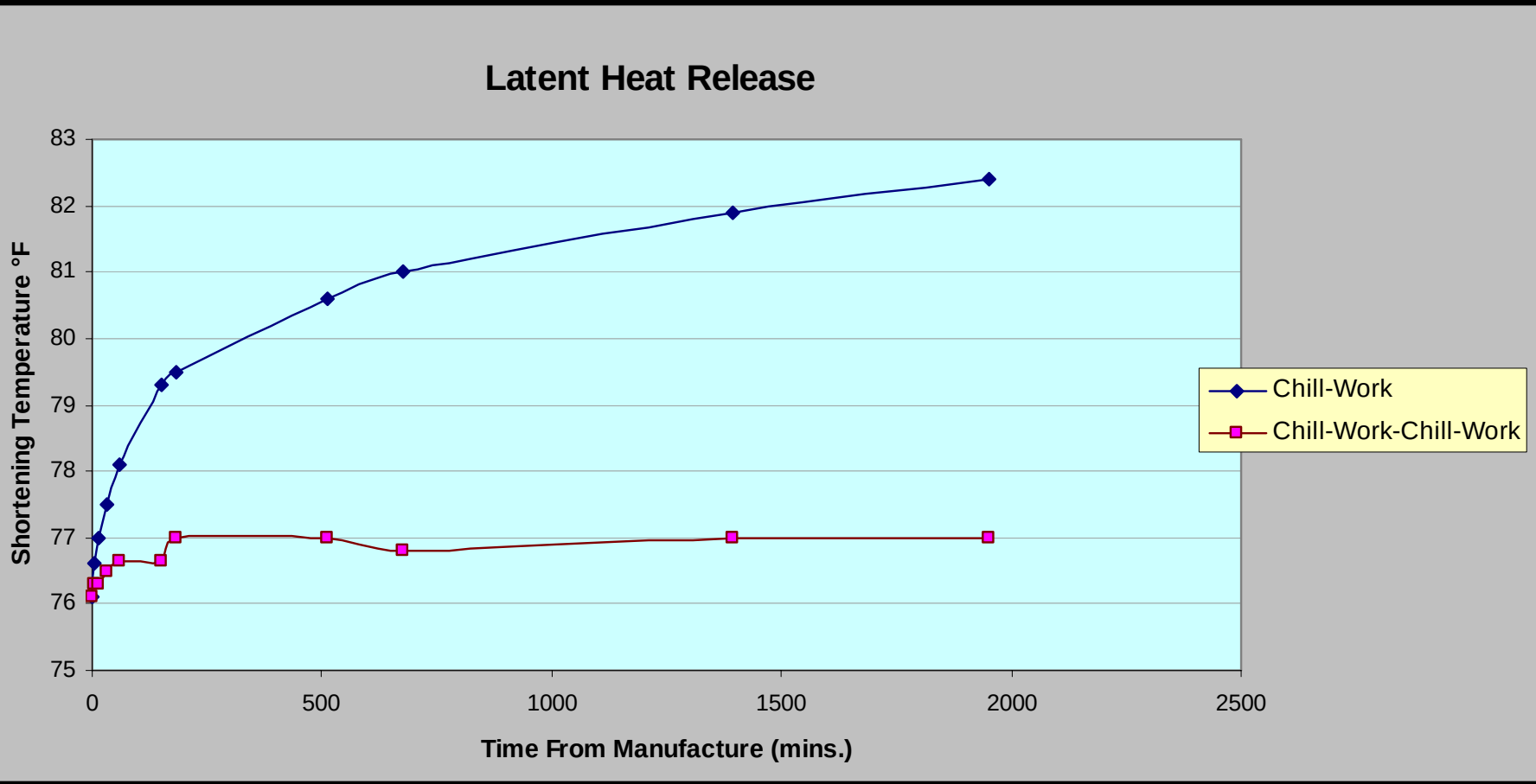

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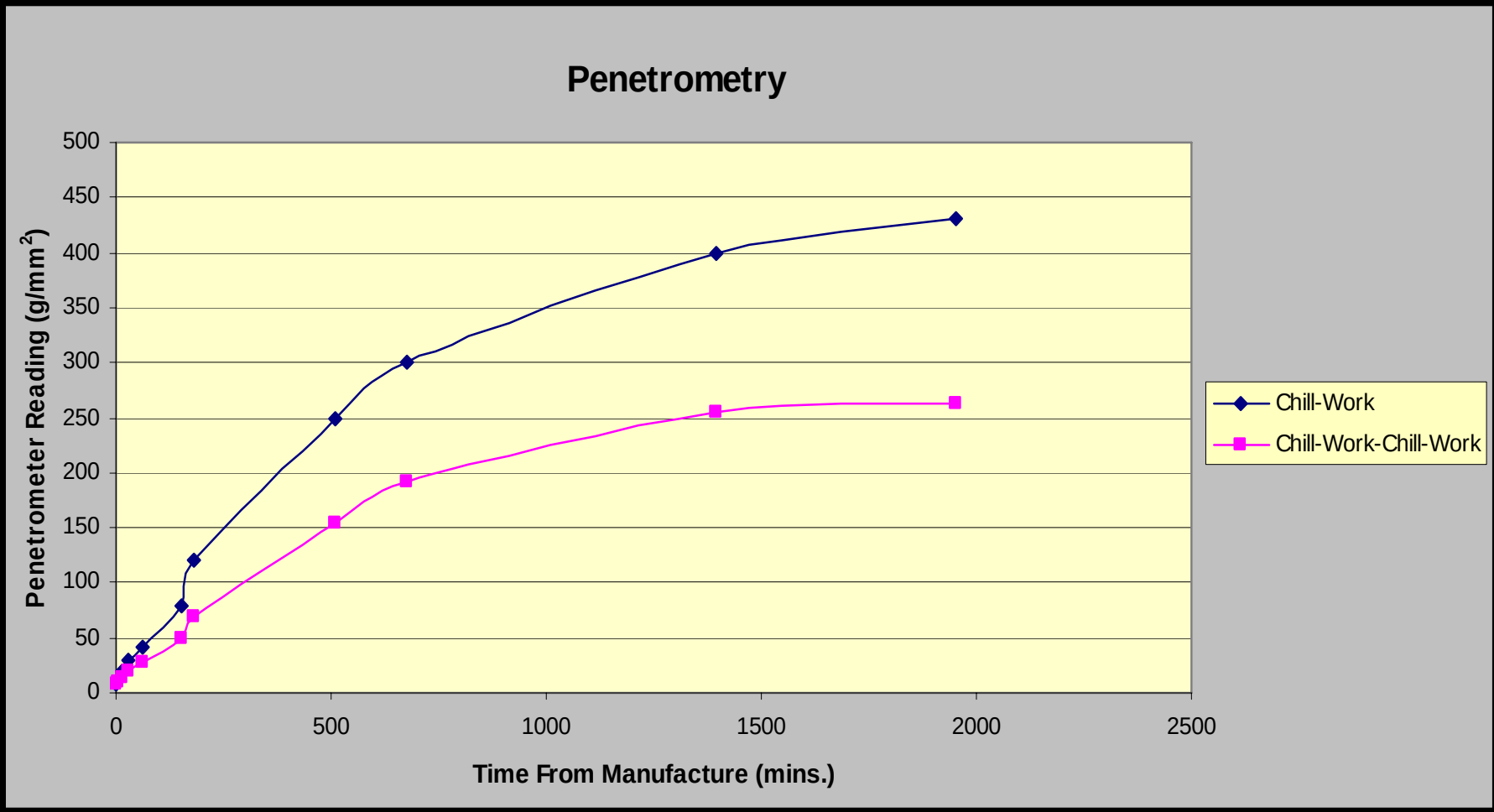


Pumpable Shortening Storage

1. Tempering Time

- 8 – 12 hours for Chill-Work product
- Less than 1 hour for Chemtech C-W-C-W System

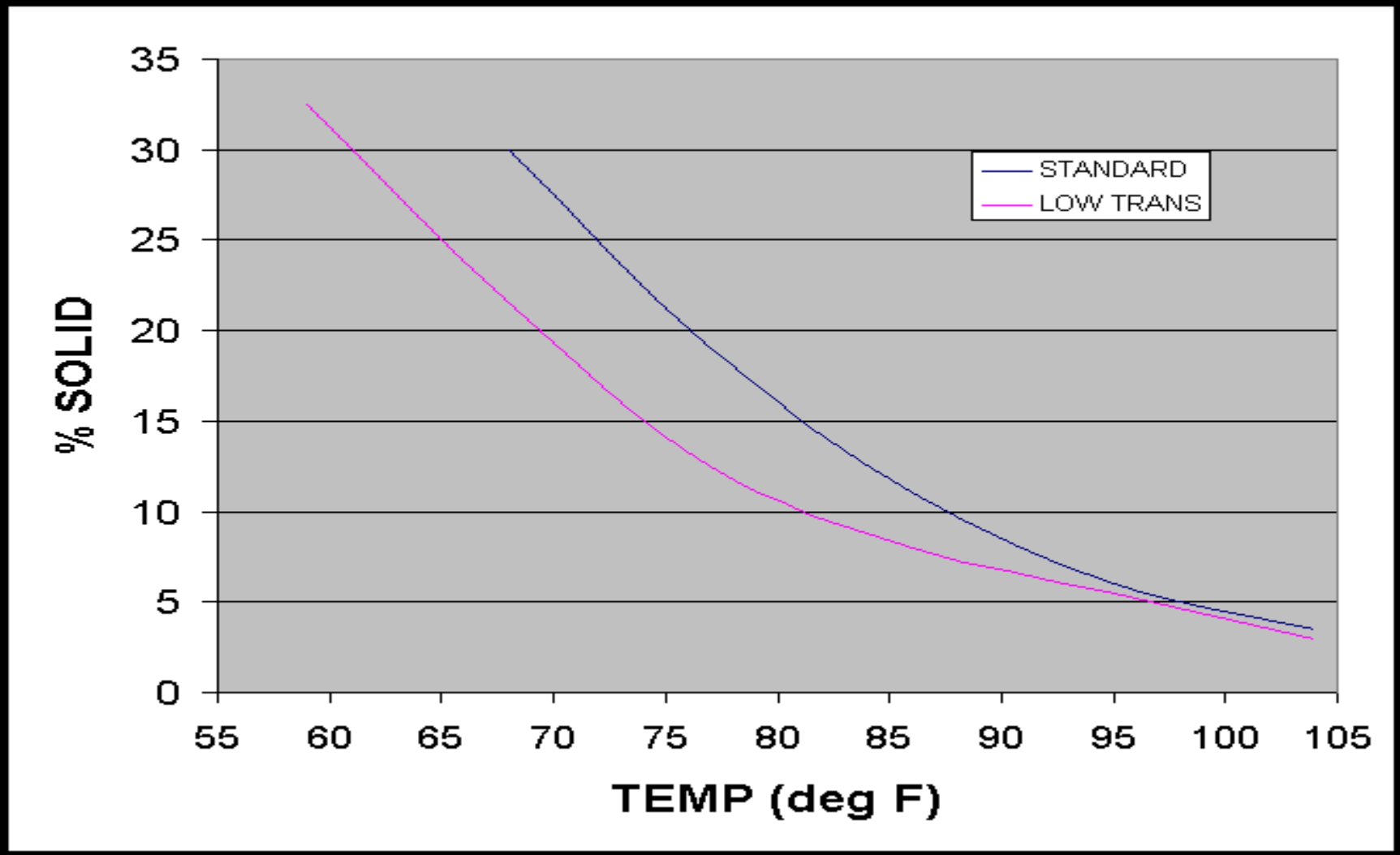
2. Product Treatment

- Tempered water tank and pipe jackets
- Slow speed, low shear pumps

3. Pumping Product

- Maximum of 20m from storage tanks
- Ramp up pump speed
- Air over-pressure on tanks for hard product

PROCESSING LOW TRANS BLENDS



CONCLUSIONS

- THERE ARE SEVERAL OPTIONS FOR LOW TFA SHORTENING BLENDS
- CHOICE OF BLEND OPTIONS IS DEPENDENT ON PRICE , LABELING IMPLICATIONS AND PERFORMANCE IN END-PRODUCT APPLICATIONS
- THE RECOMMENDED PROCESS LINE CONFIGURATION FOR USE WITH PALM OIL-BASED SHORTENING BLENDS IS CHILL-WORK-CHILL-WORK
- PROCESSING CONDITIONS CAN BE ADJUSTED IN LINE WITH BLEND FORMULATION AND REQUIRED FUNCTIONAL PERFORMANCE
- C-W-C-W ENABLES THE OPTIMISATION OF RHEOLOGICAL PROPERTIES, EXTENT OF FAT CRYSTALLISATION AND TEMPERATURE STABILITY IN THE FINISHED SHORTENING