Microparticulation of Whey Proteins – Applications in Dairy

Berit Skindersoe
Global Technology Sales Manager
Membranes & Microparticulation

INOFOOD EXPO2011, Santiago - Chile

GLOBAL INFRASTRUCTURE  X  PROCESS EQUIPMENT  X  DIAGNOSTIC TOOLS
Global Technology Sales Manager – Membrane & MP
Year’s with SPX – APV Brand – 4 years (Aug’07)

Background:

EDUCATION
• MSc. Dairy Science and Technology (KVL, Copenhagen) - 2002
• BSc. Organisational Theory and Strategic Management – 2010

BUSINESS
• Key Account Manager – Distributor for Pall Corporation

Responsibilities
• Membrane Technology Sales & Sales Support
• Business & Market Development (TM, R&D, Marketing)
• New Product Launching & Training
AGENDA

- What is Microparticulation?
- Benefits from using Whey Proteins
- Functionalities of Microparticulated Whey Proteins
- The Equipment
- SPX Leancreme™ Technology
- Applications of Leancreme™ – new idea’s
- Contact Details
What is Microparticulation?
Product Definition

Thermal and Mechanical Treatment to Denature Whey Proteins and create Ideal Particles similar to the size of fat globules in milk.

Product Name: The SPX Microparticulation unit, produces Leancreme™

Principle: High Heat Treatment combined with Controlled Shear Force

Product: Boosting functionality compared to traditional WPC: Water Binding, Emulsifier, Stabiliser

Plant Sizes: From 150 l/h to 3000 l/h

Common Applications

- Cheese
- Fermented Milk Products & Milk Desserts
- Protein Enriched Drinks
- Dressings, Sauces and Mayonaise
- Icecream, Chocolate and Confectionary
- Nutraceuticals and Powder Ingredients
- Bakery
- Meat

Feature | Benefit
---|---
Variable Shear Force | Superior accuracy in Particle Sizes & High reproducibility
Variable Holding Time | Optimal Degree of Denaturation (for feed)
Variable Temperature Setting | Optimal Degree of Denaturation (for feed)
Variable Feed | Essential for end product functionalities
Benefits from using Whey Proteins
Benefits from using Whey Proteins

- Previously Whey = Waste product from cheese-production – Animal Feed, Disposals to rivers etc.
- Today Whey Proteins are valorized due to superior functional & nutritional properties
- Growing market for healthy protein-boosed products
- Increased demand for functionalized foods especially for; malnourished Children, Elderly and Hospitalized people

- With Leancreme™ you can tailor-make products for specific customer segments
Functionality of Microparticulated Whey Proteins

GLOBAL INFRASTRUCTURE  X  PROCESS EQUIPMENT  X  DIAGNOSTIC TOOLS
SPX LeanCreme™
- excellent functional properties

- Product Characteristics:
  - Creamy mouth feel and viscosity and colour like coffee cream
  - From Lactic whey: Flavour and viscosity like buttermilk
  - Protein particles identical to the size of fat globules in milk (5 µ)

- Functional properties in dairy and food products:
  - Creamy mouth feel particularly in low-fat products
  - Water-binding, improved texture and viscosity
  - Excellent emulsification properties
  - Soft consistency and excellent foaming/whipping stability
  - Superior gelation capabilities
  - High nutritional value

- Pure dairy based ingredient designed for various functions

New dimension of excellent functional properties
The Equipment

GLOBAL INFRASTRUCTURE  X  PROCESS EQUIPMENT  X  DIAGNOSTIC TOOLS
The LeanCreme™ process line
- from whey to LeanCreme™
SPX LeanCreme™ Technology

GLOBAL INFRASTRUCTURE  X  PROCESS EQUIPMENT  X  DIAGNOSTIC TOOLS
Microparticulation of whey
- the traditional process versus the new innovative SPX solution

- The old process – a two-step solution:
  - Thermal treatment in PHE or THE to denature the protein
  - Mechanical treatment in a homogeniser or a stir mixer to particulate the protein aggregates

- The new SPX process – a combined one-step solution
  - Thermal treatment in PHE and ASA at controlled high shear force

- Advantages of the new SPX LeanCreme™ solution:
  - Highly accurate particle size distribution and variable particle sizes
  - Excellent particle structure and functional properties of the LeanCreme™

The APV Shear Agglomerator (ASA) makes the difference
Traditional MP versus the new SPX solution

Traditional process in two steps

Step 1 – thermal denaturation and protein aggregation

Step 2 – microparticulation of the protein aggregates

New SPX solution in one step

Thermal denaturation and microparticulation in one step

The APV Shear Agglomerator (ASA) makes the difference
Benefits of the **process**
- a superior system and technology

- The innovative SPX Shear Agglomerator (SSHE) and process parameters ensure:
  - Superior accuracy in particle size distribution
  - High reproducibility of particle size distribution
  - Possibility to vary the particle size
  - Optimal degree of denaturation
  - Long running time between CIP
  - MP plants from 500 l/h to 3000 l/h
  - Proven system and process technology

The APV Shear Agglomerator (ASA) makes the difference
UF of cheese whey
- various WPC composition

% of total solids

Whey | WPC 35 | WPC 60 | WPC 80

Standard LeanCreme
Which whey proteins will form microparticles?
- Whey protein distribution in WPC 60

Maximum 75% of whey proteins will form microparticles
Excellent distribution of particle size

![Particle size distribution graph]

- 1) LeanCreme 60 - low speed (35%)
- 2) LeanCreme 60 - medium speed (65%)
Raw materials for LeanCreme™
- liquid or powder based

- Based on sweet whey
  - WPC 28-35-50-60-70-80
- Based on lactic acid whey
  - WPC 28-35-50-60-70-80
- Based on HCl acid casein whey
- Based on reconstituted WPC powders …
  - High-quality powder > low denaturation, high solubility and excellent hydration
- For high TS LeanCreme™ (for powder ingredients)
  - WPC can be evaporated prior to the LeanCreme™ process
  - High TS WPC types can be made by RO of whey prior to UF
- WPC can be mixed with cream prior to the LeanCreme™ process
- Sweet WPC can be fermented prior to the LeanCreme™ process
Applications of LeanCreme™ - new idea’s

GLOBAL INFRASTRUCTURE  X  PROCESS EQUIPMENT  X  DIAGNOSTIC TOOLS
Benefits of LeanCreme™ in Cheese Production

- Production of cheeses with 5 – 45 % fat in TS with increased yield partly from replacement of casein in the cheese by LeanCreme™, but also from the increase of water content in the cheese
- Improved creamy taste and texture in low fat cheese
- Easier to cut and handle in prepress and moulds - Important for low fat cheese
- Cheese meltability maintained – Pizza-cheeses
- Proven Recovery of > 80% of Leancreme™ in the cheese curd
- Increased yield of 6-10 %
- Premium price due to excellent quality
- A payback time of less than one year

Cheese Types where Leancreme™ is used

- Semi Hard Cheeses; Gouda, Edam & Swiss Types
- Soft Cheeses; Camembert & Brie Types
- Cheddar’s
- Mozzarella & Pizza Types Cheeses
- Feta & Queso Fresco
- Cottage Cheese (incl. cream dressing)
- Processed Cheeses
- Fresh Cheeses; Cream Cheese, Quark, Petit Suisse etc.
- Ricotta & Mascarpone
Protein Enriched Drinks & Joghurt Drinks

**Benefits of Leancreme™ in Drinks**

- Easy “on-the-go” access to protein sources
- Ideal products for the gym, travels, etc.
- Natural stabilized product
- High viscosity
- Perfect for any WPC source
- Drinks based on 100% WPC60 Leancreme™
- Drinks based on Joghurt or Milk Base + WPC35 Leancreme™
- High product stability during shelf time
- Long shelf life product – UHT

**Benefits of Leancreme™ in Drinking Milk**

- Improved whiteness of low fat milks
- Improved mouthfeel, especially for low fat milks
- Excellent opportunity for long shelf life with Microfiltration or UHT
- Excellent opportunity for innovative drinking products
- Perfect for usages of Leancreme™ Powder
Joghurts & Icecreme

Benefits of Leancreme™ in Joghurts

- Replace part’s of skim milk and milk fat with whey proteins
- Ideal Application for usage of Leancreme™ Lactic
- Joghurt’s with no concentration of skim milk
- Joghurt’s with no addition of skim milk powder’s
- Low fat Joghurt’s with rich and creamy mouthfeel
- Reduce amount of stabilizer’s added
- Simulate a 3,5% fullfat Joghurt with 0,3% fat
- Increased content of essential amino acids in the Joghurt → healthier products

Benefits of Leancreme™ in Icecreme’s

- LeanCreme less expensive than skim milk concentrate
- Low fat product of high quality
- More healthy ice cream, lower fat%, far more essential amino acids
- LeanCreame suitable for all types of ice cream.
- Possible to make ice cream with lower TS level
- Melting down is delayed
- Less stabilisers necessary

COMPANY CONFIDENTIAL
Other potential applications

- Dressings
- Sauces and Mayonaises
- Chocolate and Confectionary
- Nutraceuticals and Powder Ingredients
- Bakery Products
- Meat
- Etc. Etc.
Superior customer benefits - CONCLUSION

- Superior accuracy in particle size distribution and high reproducibility
- Flexible particle sizes > Tailor made LeanCreme for different products
  - Examples: Yoghurt and Ice cream 1 to 2 micron and 5 micron for cheeses
- Recovery of LeanCreme in cheese is 80 - 82 % - Unmatched yield
- Optimal degree of denaturation > high recovery degree and functionality
- Unmatched plant performance with 6 to 8 hours between CIP > short down time
- Extra yield of 6 % and up to more than 10 % in low fat cheese
- Excellent texture and taste in low fat and full fat cheese after maturation
- Excellent meltability
- Unmatched customer satisfaction > Reference visit to confirm
- Unmatched reference list > 21 commercial plants and 7 MP pilot plants
Contact Details

GLOBAL INFRASTRUCTURE  X  PROCESS EQUIPMENT  X  DIAGNOSTIC TOOLS
SPX Flow Technology

Driven by Innovation

A global leader in the food & beverage, energy, and industrial markets worldwide, SPX Flow Technology helps customers improve the performance and profitability of their manufacturing operations and processes with solutions enriched by in-depth application expertise and a finely meshed customer service and spare parts network.

Key Markets

SPX Flow Technology serves a wide range of industries, including food, dairy, beverage, biotechnology, pharmaceutical and personal care; HVAC; power generation, oil and gas and compressed air. From engineered components like pumps, valves, heat exchangers and dryers to complete packaged systems, our products feature uncompromising design and quality, while offering long service life, production efficiency and cost-effective performance.

Customer Focused

Visit us at; www.spxft.com
Dedicated team of specialists in innovation, engineering, sales and service
3 decades > 1200 references
Strong Know-how platform build up
Pioneers in innovative Dairy applications and Engineering solutions
Test Centers and Pilot plant service
Excellent customer service
World wide experts and local contacts
Thank You for Your Attention!

Any Questions??