How to prevent Thermophile growth in Milk Evaporators

Karl Kieffer
Tetra Pak Inc.
February 20, 2013
How to create low spore powder

► Minimize growth

► Remove spores/spore formers
Temperature

**Fig. 4.9** Classification of bacteria by temperature preference.

**Fig. 4.8** Temperature conditions for bacterial growth.
Growth of thermophilic microorganisms during 17 hours of production

Comparison thermophilic count from raw milk to final product

- B1-B7 Raw milk thermodures
- Separator exit
- B1 -B7 After HEX

Time hour

10000
1000
100
10
1
Best Practices

► Minimize size of heat exchangers in critical range
► Keep separation out of critical range
► Allow cleaning of critical areas
Cold Milk Separation

► Application:
  - Good quality cream
  - avoid heat treatment
  - No thermophiles

► Sensitive operation

► Define Temperature
  - 40-42 vs 55-60 Deg F

► Lower capacities

► Skimming efficiency
  - Very temperature dependent
Separation Temp vs Skimming

Temperature not recommended: partially crystallized fat globules
Line concept with cold RO concentration

1. Cold separation
2. Cold RO concentration
   25-30% solids
3. Pasteurization
4. Evaporation
5. Drying
General benefits of solution

Ensuring bacteriological quality

► Keeping temperature low as much as possible
  - Eliminate possibility of bacteria growth

► Reduce size of PHE
  - Less residence time

► Increased solids into evaporator
  - Higher operating temperature = eliminate possibility for growth

= Ensuring low count powders
And we need

- Good quality of milk
Removing Spores

- Destroy spores
- Bactofugation
- Microfiltration
Bacteria

- Sensitive to temperature (+161 F)
- Sensitive to moisture content
- Some cells revert to spore when conditions are unfavorable

Spores

- Resistant to temperature (+250 F)
- Resistant to pH/UV/Pressure
- Resistant to moisture content
- Spore will revert to vegetative cell when conditions improve (time and conditions vary)
Bacteria vs Spores

Seconds vs Degrees F

- Streptococcus Thermophilus
- Thermophilic Spores
Bactofugation ®

- Up to 98% spore removal
- Can install in series
- 0.1-0.3% discharge

Skim Milk → Bactofugated Milk → Bactofugate

SNF 9.1%

SNF 15–20%
Tetra Alcross Bactocatch

- Unit design

- Ceramic membranes for optimum accuracy
- Concentration factor 200 on skimmed milk
- 99.99% reduction of Spores
Summary

- Spore Formers are present in all milk
- Heat treatment allows these to multiply
- Difficult to destroy
- Preventing growth is the surest path to success
- Can be removed with separation technology