AseptoTWIN

MAKING THE INVISIBLE VISIBLE

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PASTEURISATION LINES · VACUUM DEAERATION

Deaeration under control: the flash window

Why a deaerator commissioned on milk can under-deaerate or foam over on the next recipe — and how to see it before start-up.

AUTHORS
AseptoTWIN Engineering

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TWO-PHASE CFD · PRODUCT FOAMING · PROCESS ANALYTICS

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01 · EXECUTIVE SUMMARY

A vacuum deaerator works inside a window of a few degrees. Tuned for one product, it can leave air behind — or foam over — on the next.

Deaeration is an industry norm in pasteurisation lines: raw milk arrives carrying several percent air by volume, and dispersed air fouls heating surfaces, distorts volumetric measurement and weakens separation and standardisation. The vessel vacuum is set so the product boils a few degrees below its preheat temperature, flashing off air with a controlled share of vapour.

That margin is usually set during commissioning on the design product. This paper shows why high-protein, plant-based and high-solids recipes shift the window, and how AseptoTWIN combines two-phase CFD, a product foaming matrix and process analytics to check every recipe **before start-up**.

~6 %
average air content of raw milk by volume after milking

10 %+
air content possible at reception after transport

4–5 °C
typical flash margin between preheat and boiling point

Source: Tetra Pak Dairy Processing Handbook, ch. 7.7 “Deaerators”.

INDUSTRY PAIN POINTS

02 Why entrained air matters

2.1

An invisible ingredient

Raw milk: 5.5–7.0 % air by volume after milking; 10 % or more after transport and reception.
Source: Tetra Pak Dairy Processing Handbook, ch. 7.7.

Every pasteurisation line handles a product that is partly gas. How well that gas is removed decides how long the line runs between cleans and how accurate its measurements are.

Air eliminators at reception remove large bubbles but not the finest dispersed air. A vacuum deaerator after preheating removes the rest — provided its vacuum, preheat temperature, flow and level are matched to the product actually running through it.

> **“A deaerator is tuned for the product it was commissioned on. Every new recipe moves the target.”**
>
> ASEPTOTWIN ENGINEERING

WHEN DEAERATION FALLS SHORT, THE COSTS CASCADE

01

Heater fouling

Air promotes incrustation on pasteuriser heating surfaces — shorter runs, more frequent CIP.

02

Measurement & standardisation errors

Inaccurate volumetric metering, lower skimming efficiency and drifting in-line fat standardisation.

03

Product quality

Air in cream causes pre-churning and yield loss; cultured products lose stability and expel whey.

CASE STUDY IN RISK

03 One deaerator, many recipes: the flash window

Milk is preheated — for example to 64 °C — and enters a vessel whose vacuum puts the boiling point about 4–5 °C lower. The flash releases air with a controlled share of vapour, which a built-in condenser returns to the product.

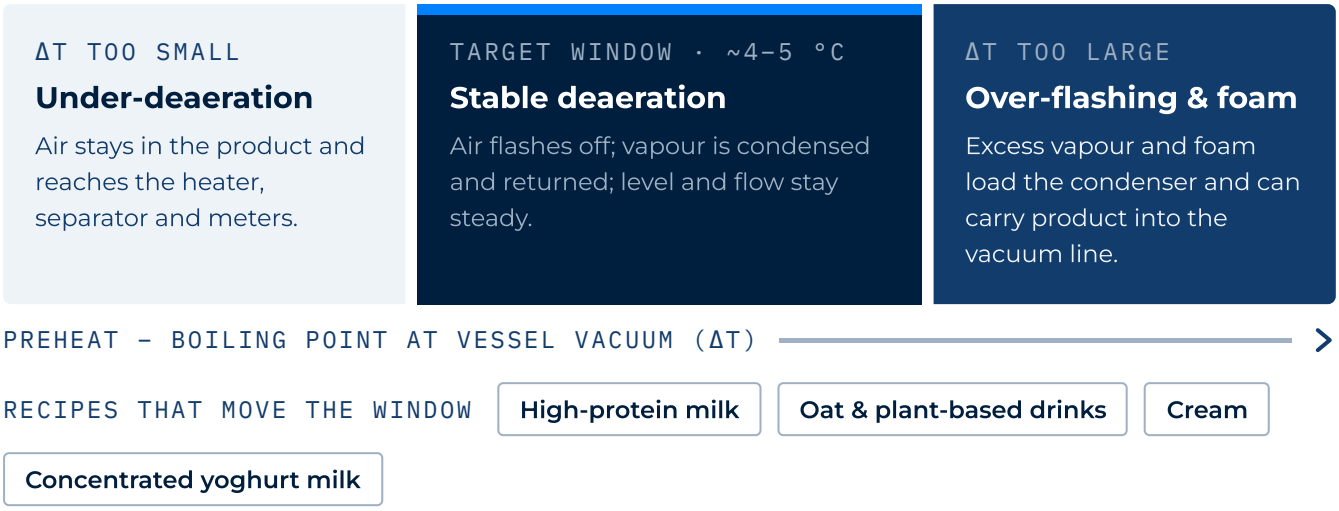


Figure 1 The flash window (schematic). Example values: Tetra Pak Dairy Processing Handbook, ch. 7.7.

THREE RISK FAMILIES

01 Flash margin & vacuum control

Vacuum and preheat setpoints are usually fixed at commissioning on the design product. Higher solids, different boiling behaviour or a changed preheat profile shift the effective ΔT, without any alarm showing it.

02 Foaming & carry-over

Protein-rich and plant-based recipes foam more readily than standard milk. Foam that reaches the condenser or vacuum line means product loss and deposits in areas that CIP reaches poorly — a hygiene risk as well as a cost.

03 Film, level & hydraulic interaction

The tangential inlet forms a thin film on the vessel wall; viscosity changes alter that film and the outlet level dynamics. With flow control, separator and homogeniser on the same line, a level loop tuned for milk can become unstable on other recipes.

THE ASEPTOTWIN APPROACH

04 Commission every recipe — virtually

AseptoTWIN maps each recipe onto the deaerator's real geometry and setpoints, and returns a validated operating window per product.

PILLAR I

Two-phase flow simulation (CFD)

Models the vessel, tangential inlet, condenser and outlet with each product's rheology, so flash, film and vapour flow are seen before start-up.

Wall film & residence time
Film thickness and stability on the vessel wall across viscosities.

Vapour velocity & entrainment
Head-space velocities that predict droplet and foam carry-over.

PILLAR II

Product foaming & flash matrix

Links each recipe's solids, protein, stabilisers and boiling behaviour to a recommended preheat–vacuum window, drawn from AseptoTWIN's aseptic application library.

Preheat → Flash ΔT → Condense & return

PILLAR III

Process analytics

Reads vacuum, level, temperature and flow trends from the running line to spot drift out of the window early — before it shows up as heater fouling or product loss.

Window drift	Fouling onset	Carry-over events

05 · CONCLUSION & STRATEGIC VALUE

Know each recipe's flash window — before start-up.

Adding an AseptoTWIN deaeration assessment to the design or recipe-change phase gives processing plants three outcomes:

01 **Stable deaeration across recipes**
A validated preheat–vacuum window for every product, not only the design product.

02 **Longer pasteuriser runs**
Less air reaching heating surfaces means less fouling between cleans.

03 **Hygiene by design**
Foam and product kept out of the condenser and vacuum line, where cleaning is hardest.

Book a deaeration assessment

info@aseptotwin.com

ABOUT ASEPTOTWIN

AseptoTWIN is an engineering solutions company that combines digital twins, aseptic processing know-how and simulation to show whether a product fits a processing machine — before the design is frozen.

CONTACT

info@aseptotwin.com

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