

Predictive microbiology in the food industry

Pernilla Arinder

par@sik.se

An industrial research institute with the task of reinforcing client company competitiveness

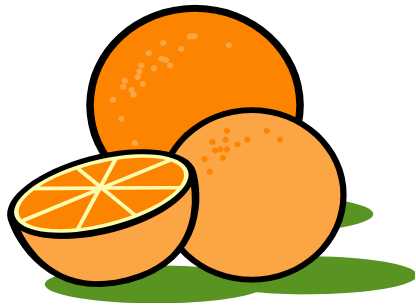
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When could predictive microbiology be used?

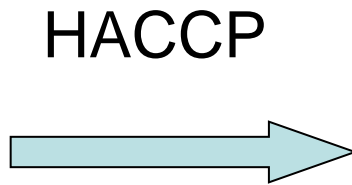
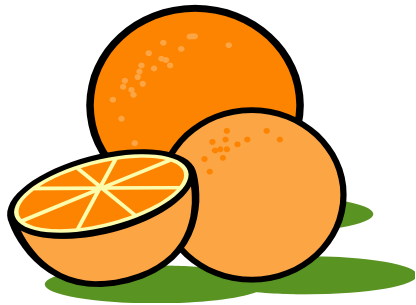
- Predict growth/no growth
- Predict growth rate
- Predict survival



ill?



- Microbial risk assessment
- HACCP



HACCP

Conduct a hazard analysis

Identify critical control points

Establish critical limits for each critical control point

Establish critical control point monitoring requirements

Establish corrective actions

Establish record keeping procedures

Establish procedures for ensuring the HACCP system is working as intended

Proces

Effect on microbial hazard

Raw material

Contamination



Wash

Contamination



Unshell/press

Contamination



Storage
Mixing

Contamination
Growth



Pasteurisation

Inactivation



Storage
Pour into bottles

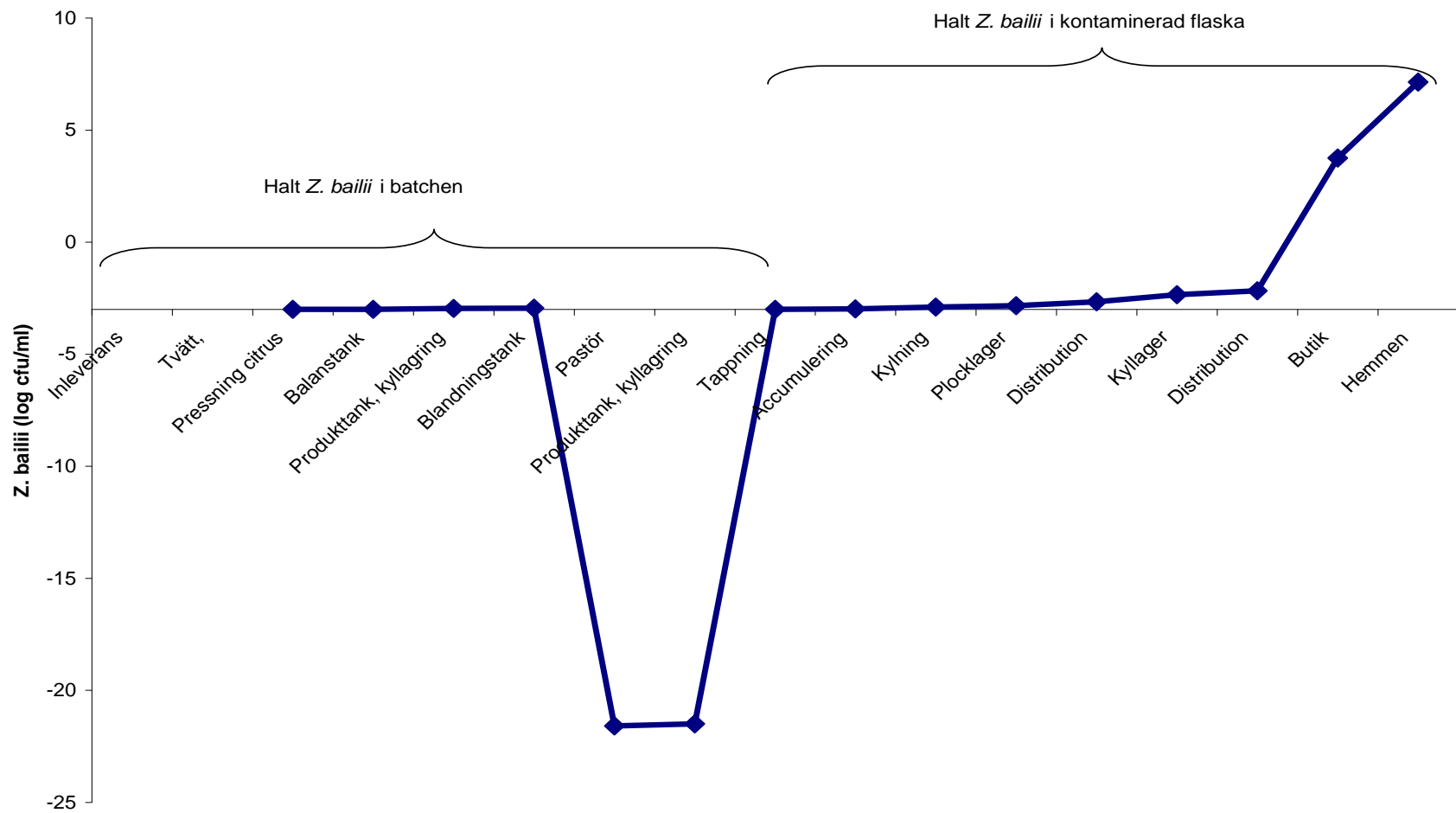
Contamination
Growth

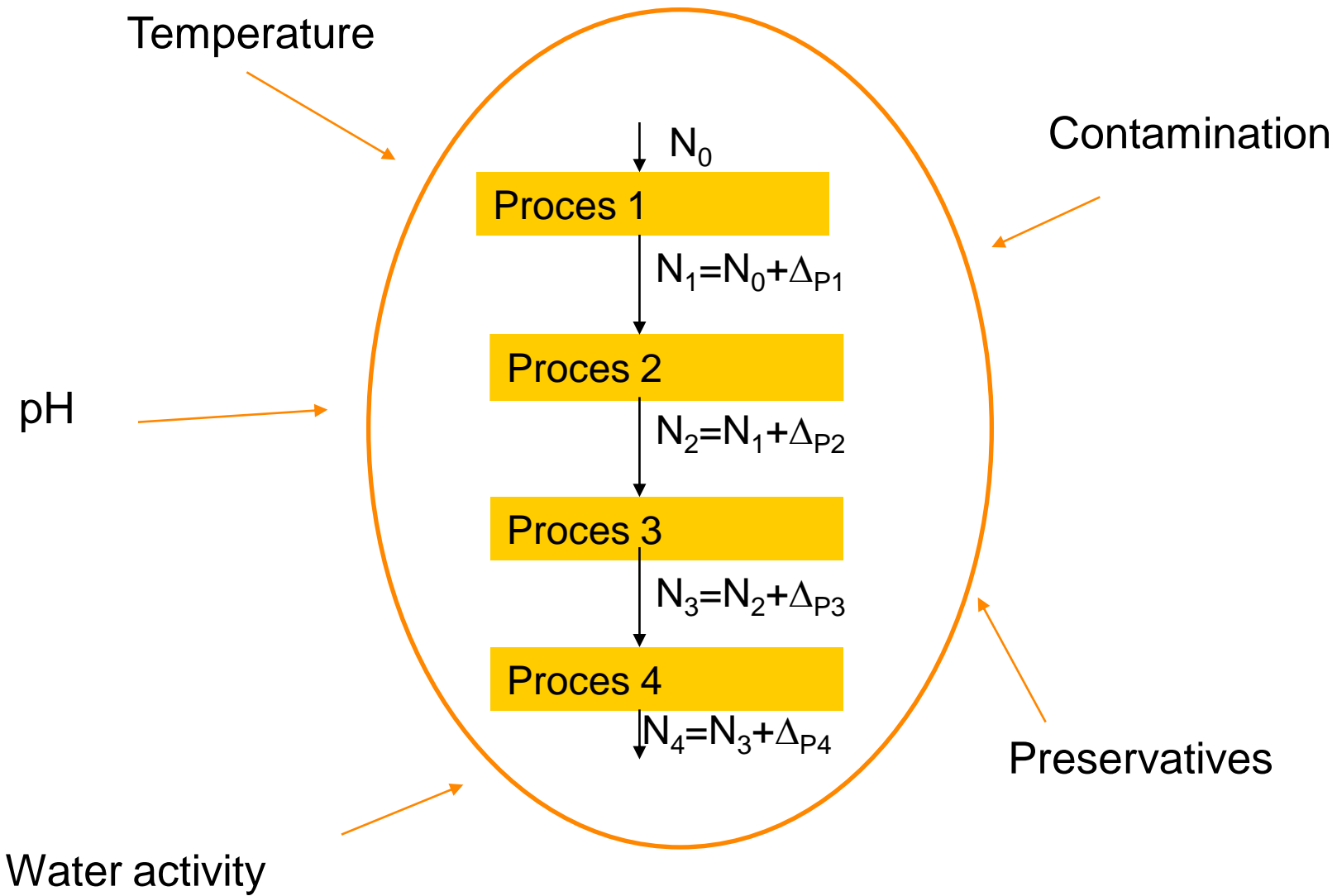


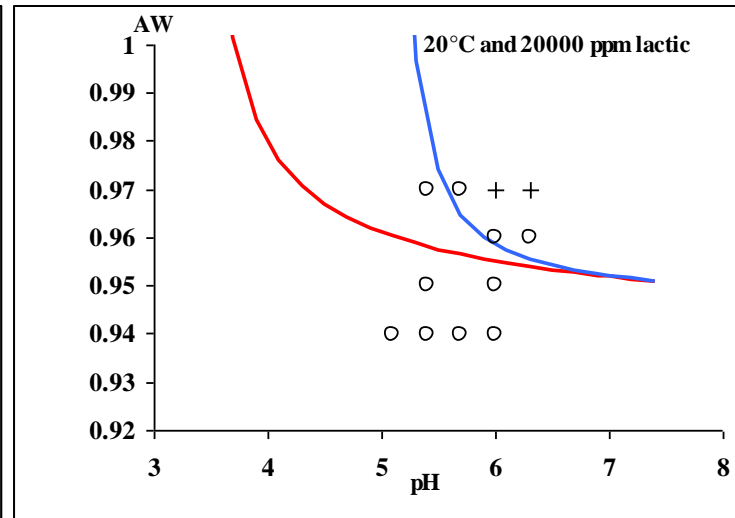
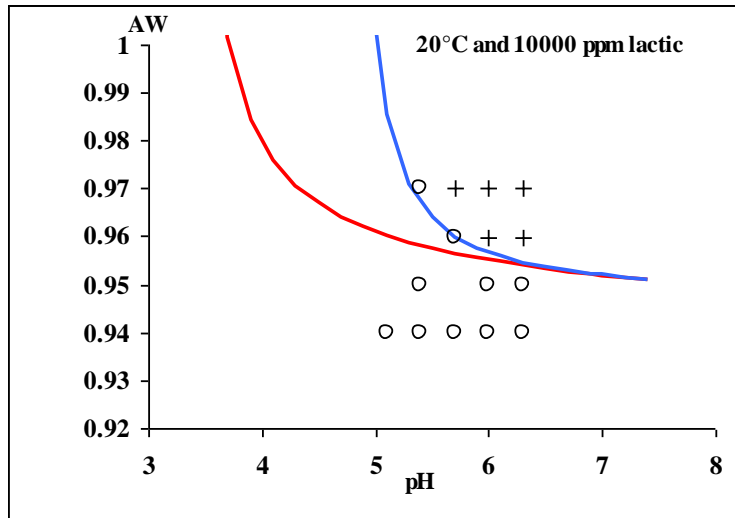
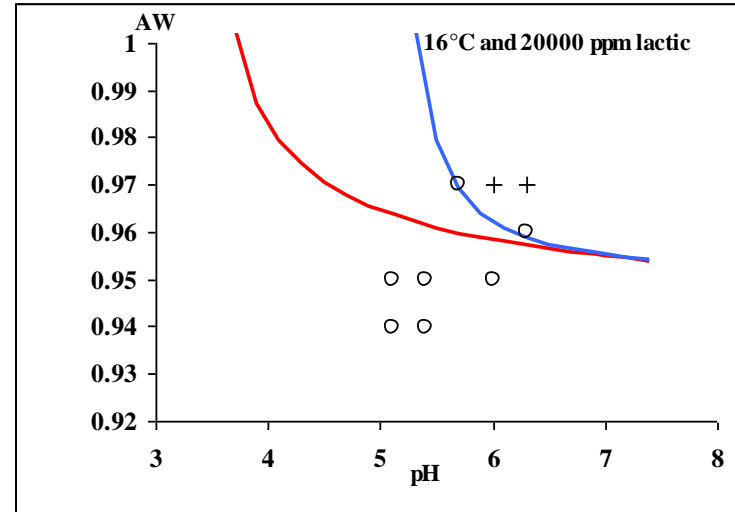
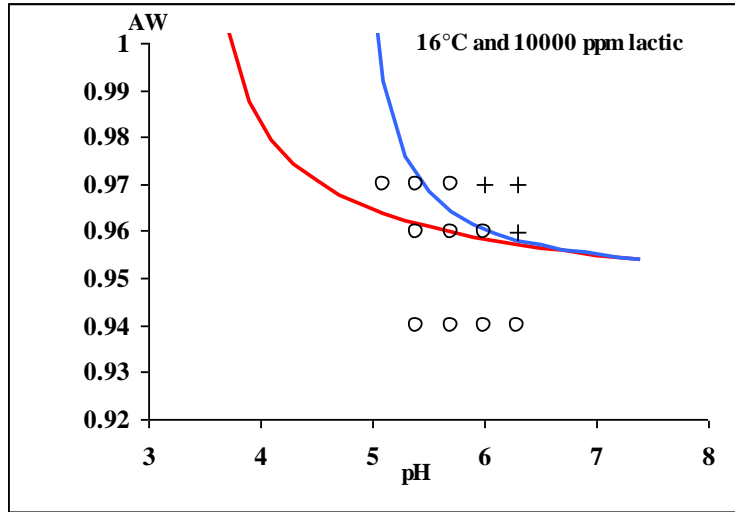
Storage, distributions
Storage in homes

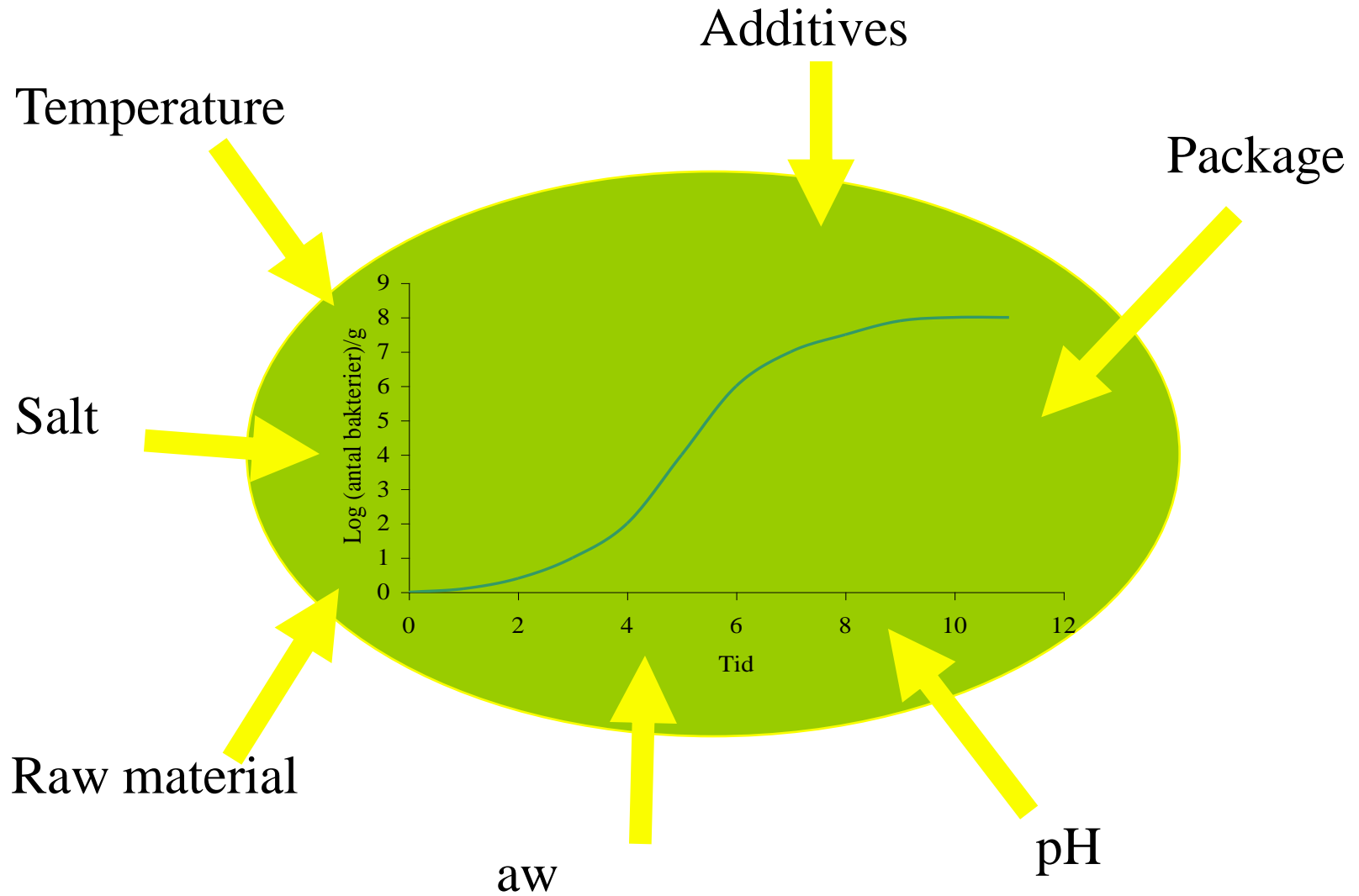
Growth and or inactivation





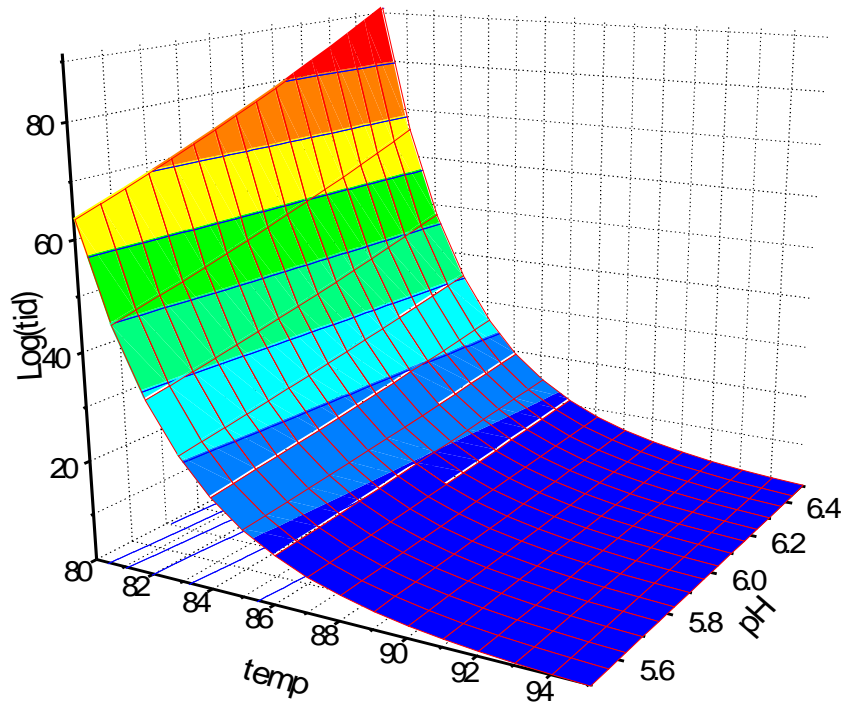






Reduction of *B. cereus* in broth

sa = 20.000

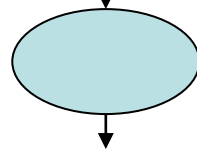
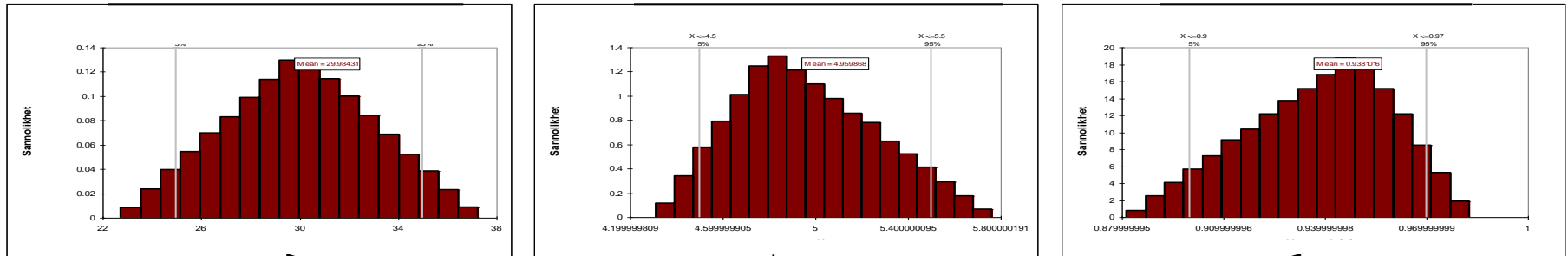


The spores were easier to reduce when:

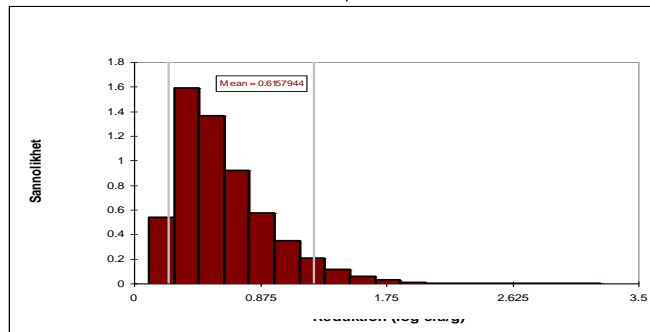
- ↓ pH decreased
- ↓ the salt level decreased

Probability simulation with @-Risk i Excel

Variations in product/process parameters



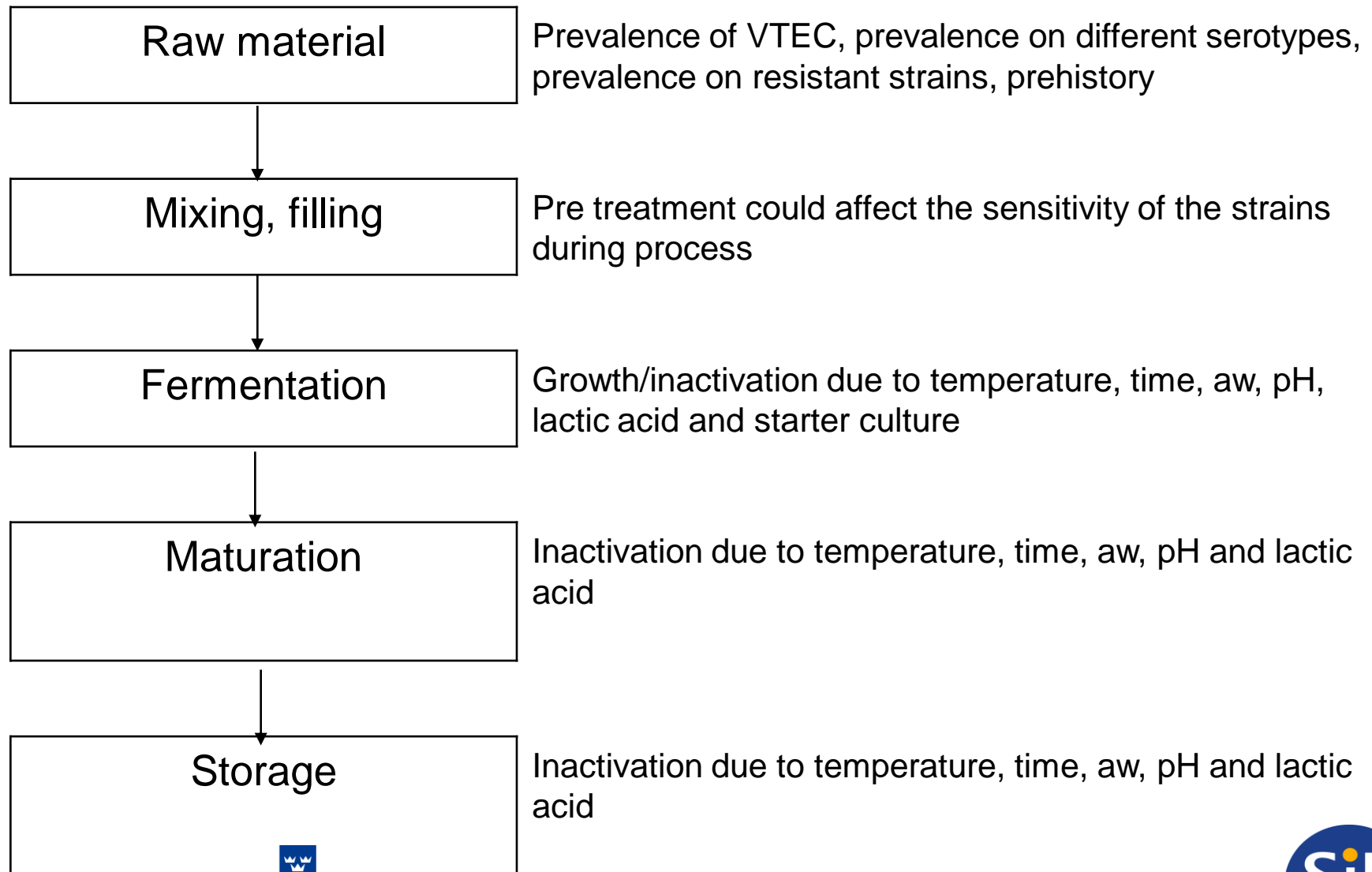
Variations in the final product



VTEC in fermented sausage

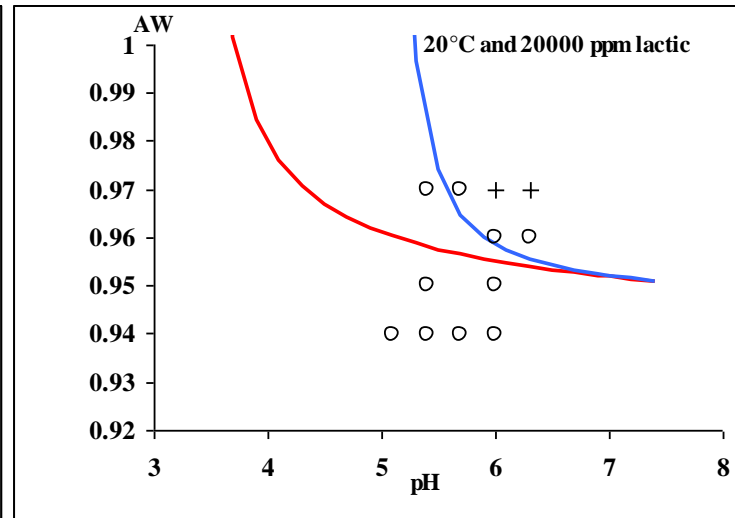
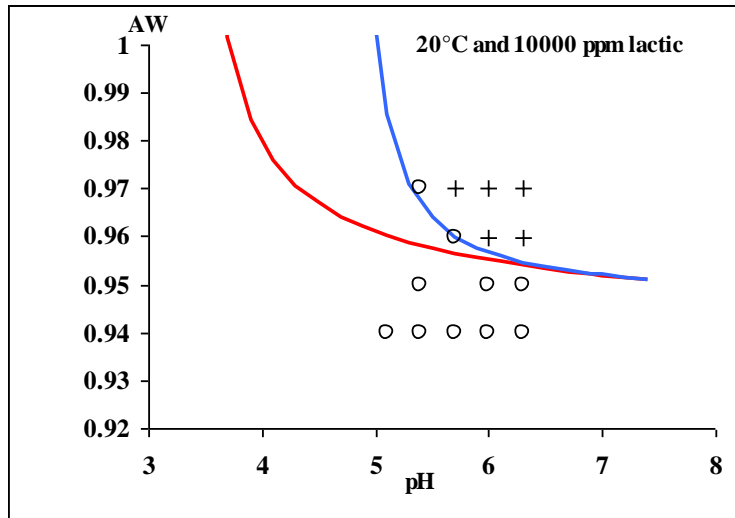
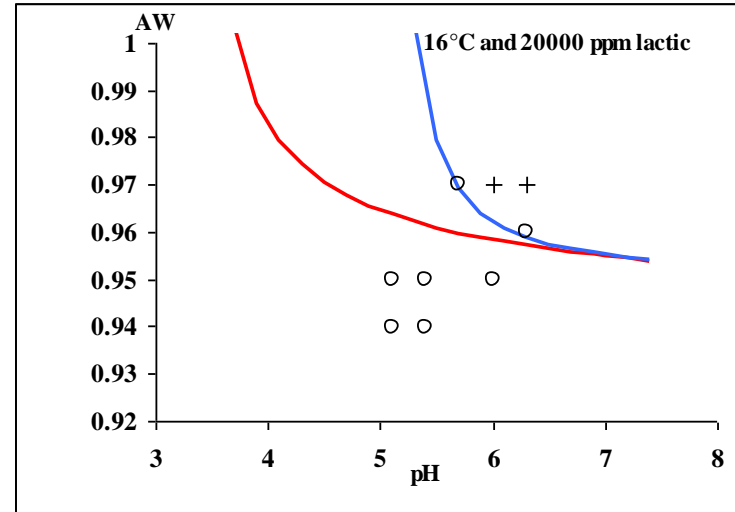
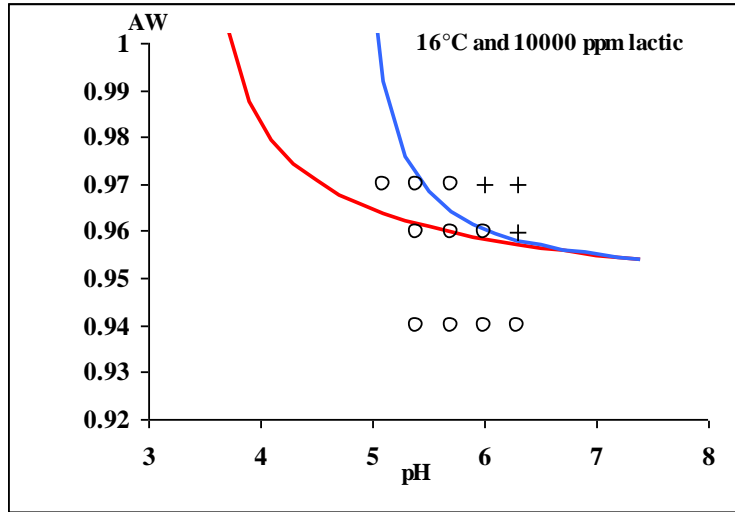


Process exposure assessment

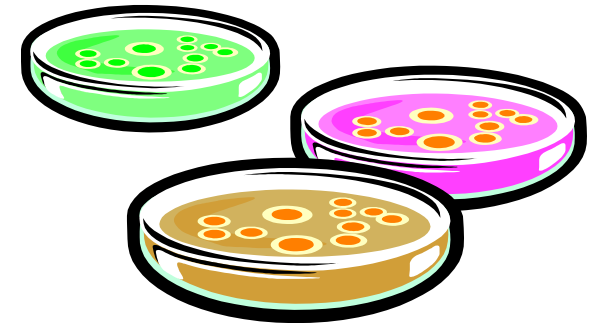
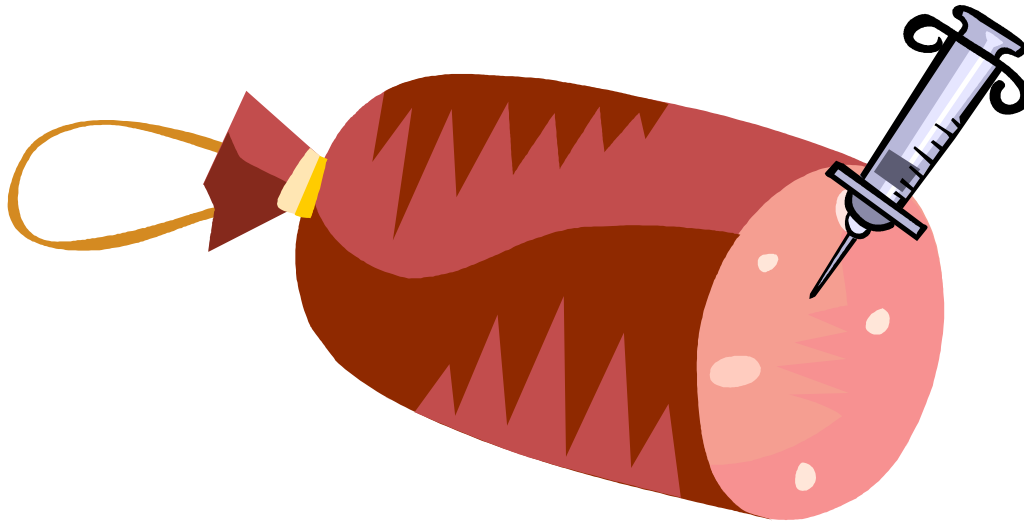


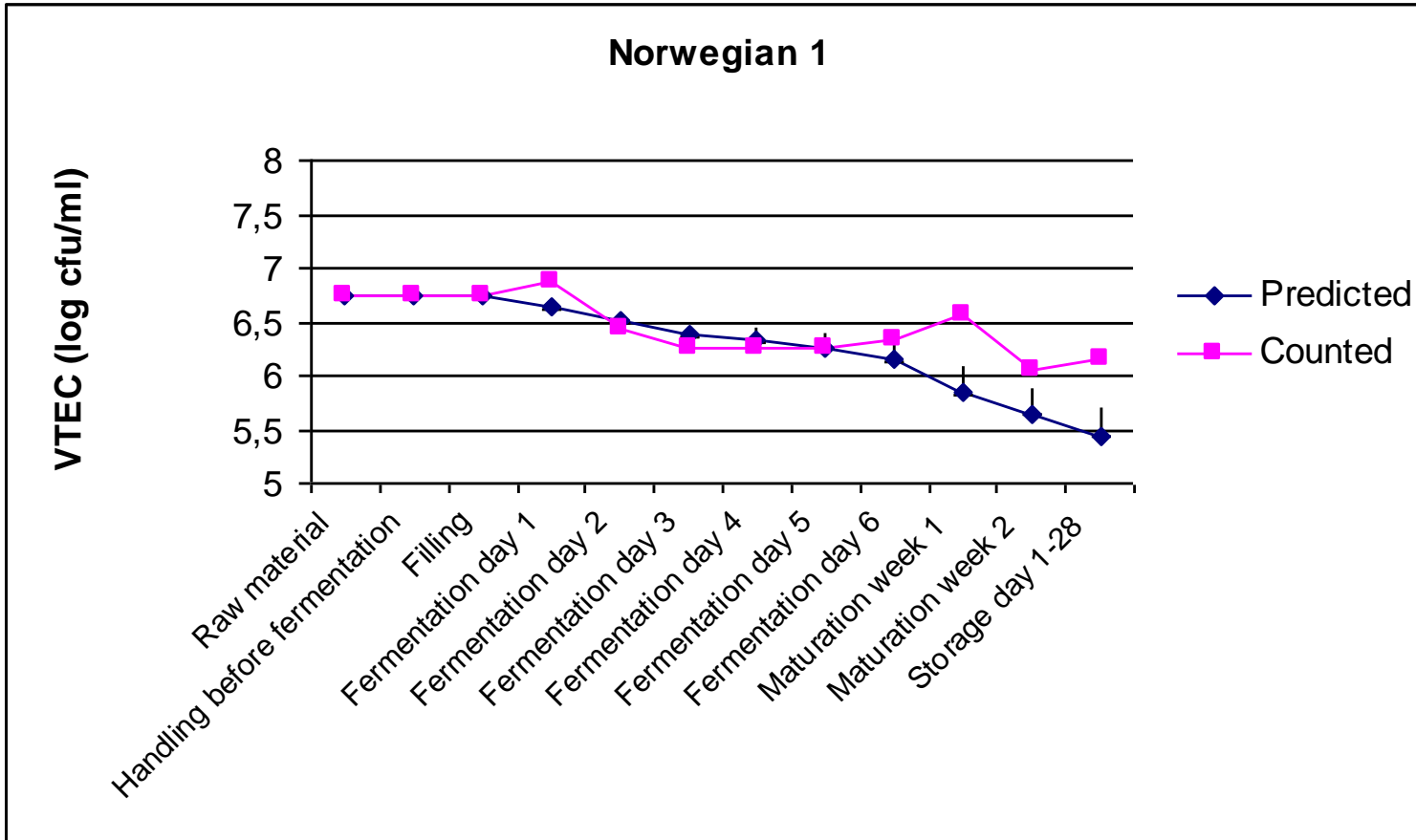
Models

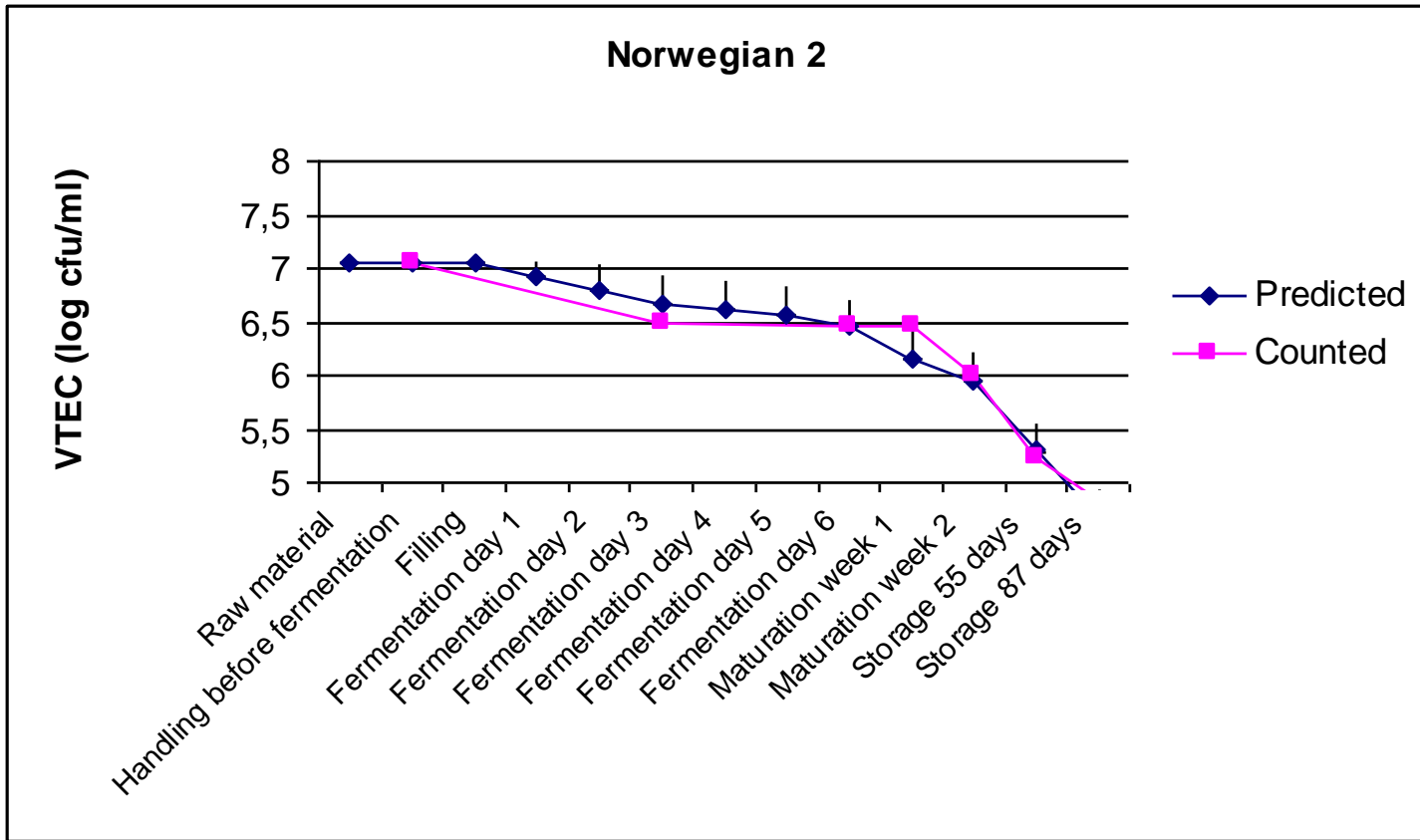
- Probability of growth no growth
 - Temperature
 - pH
 - Lactic acid
 - Water activity
- Growth
 - Temperature
 - pH
 - Lactic acid
 - Water activity
- Inactivation
 - Temperature
 - Lactic acid
 - (pH)

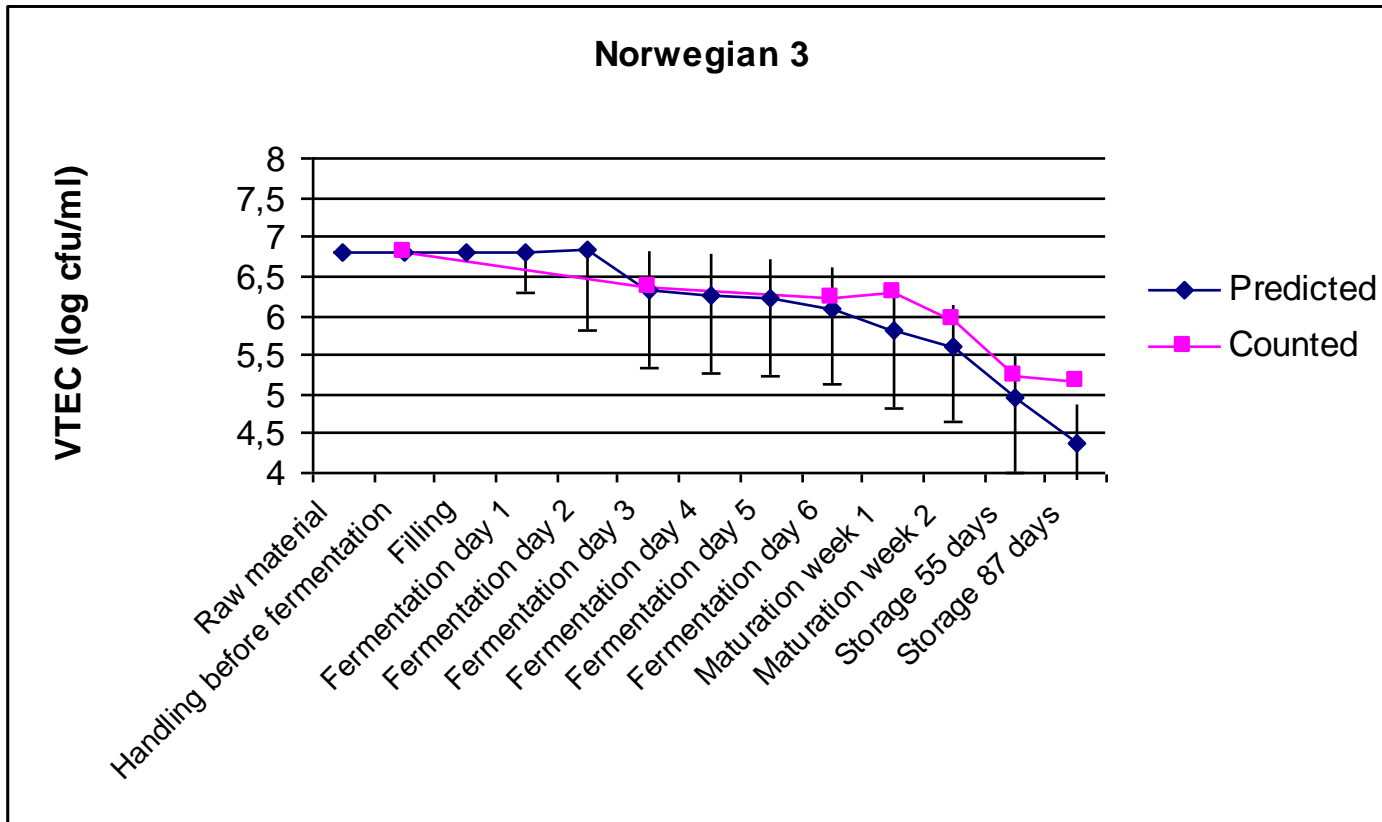


Challenge test

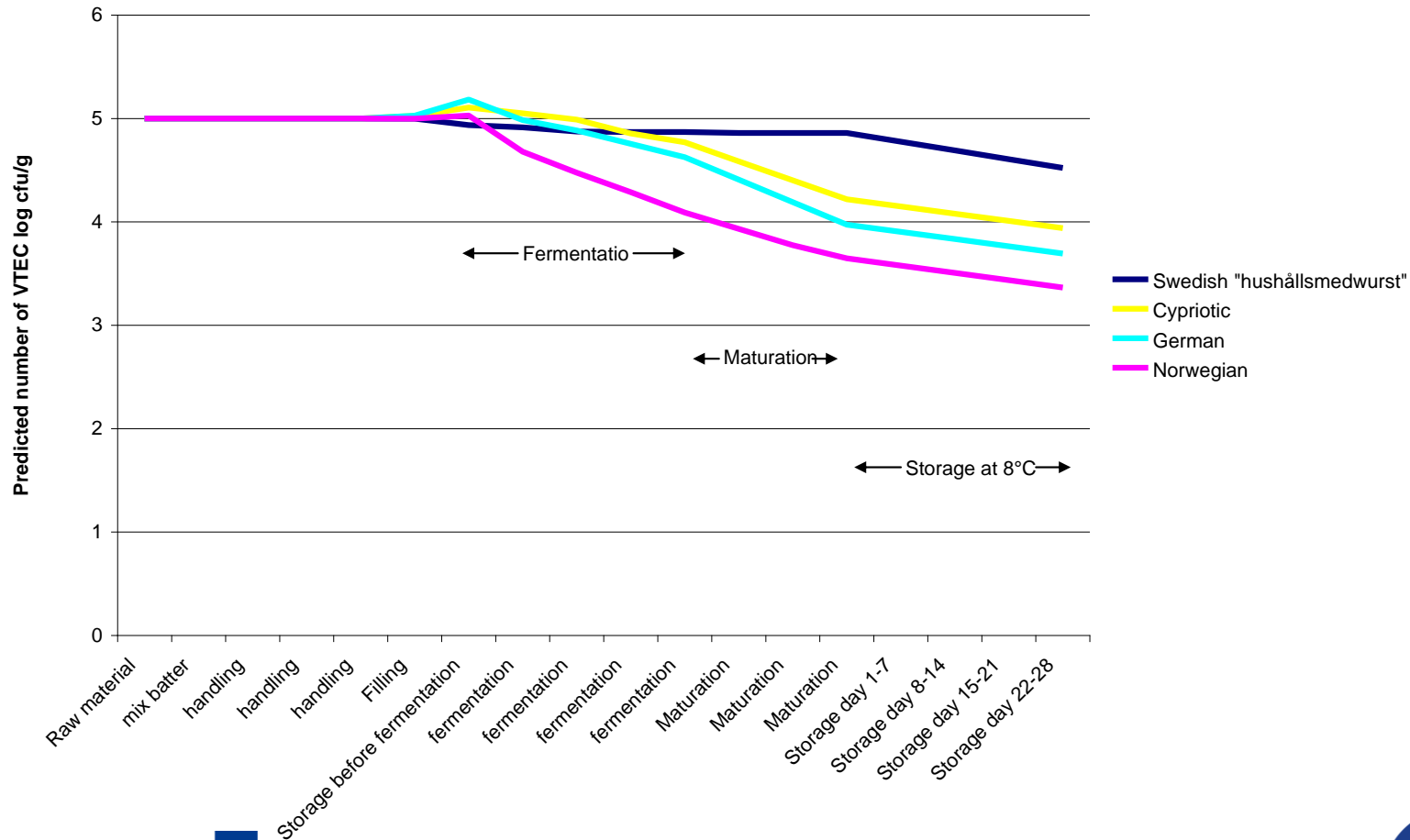








Predicted number of VTEC along the process chain for 4 type of sausages



HACCP

- VTEC survives the production of the sausage and are a hazard to control.
- Prevalence of VTEC in raw material important.
- Temperature, water activity, pH, and lactic acid are important factors to control that VTEC does not grow.
- Temperature and process time are important factors to control that VTEC is inactivated.

VTEC och *Z. bailii* i juice



Proces

Effect on microbial hazard

Raw material

Contamination 


Wash

Contamination 

Unshell/press

Contamination 


Storage
Mixing

Contamination 
Growth



Pasteurisation

Inactivation 

Storage
Pour into bottles

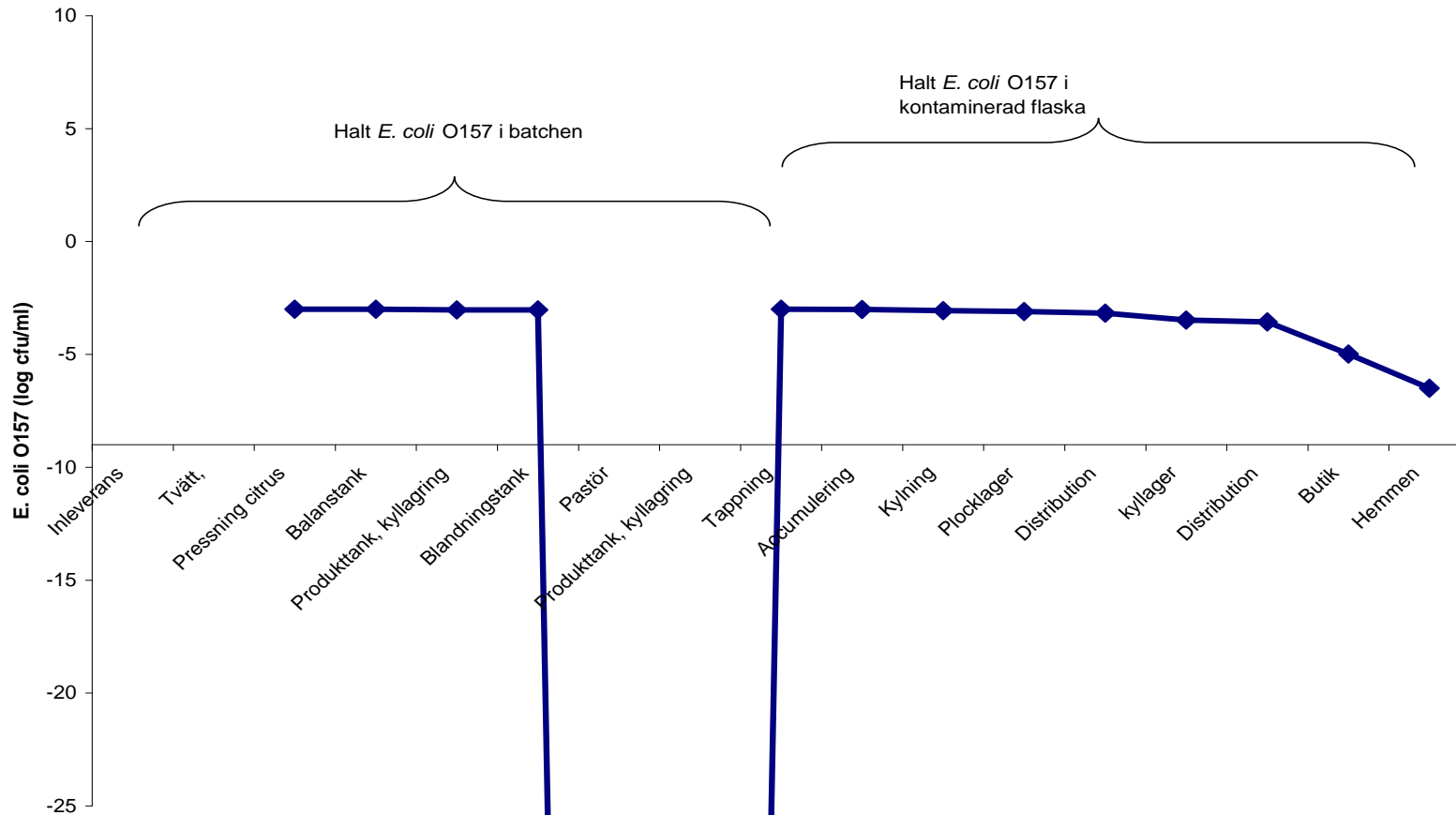
Contamination 
Growth

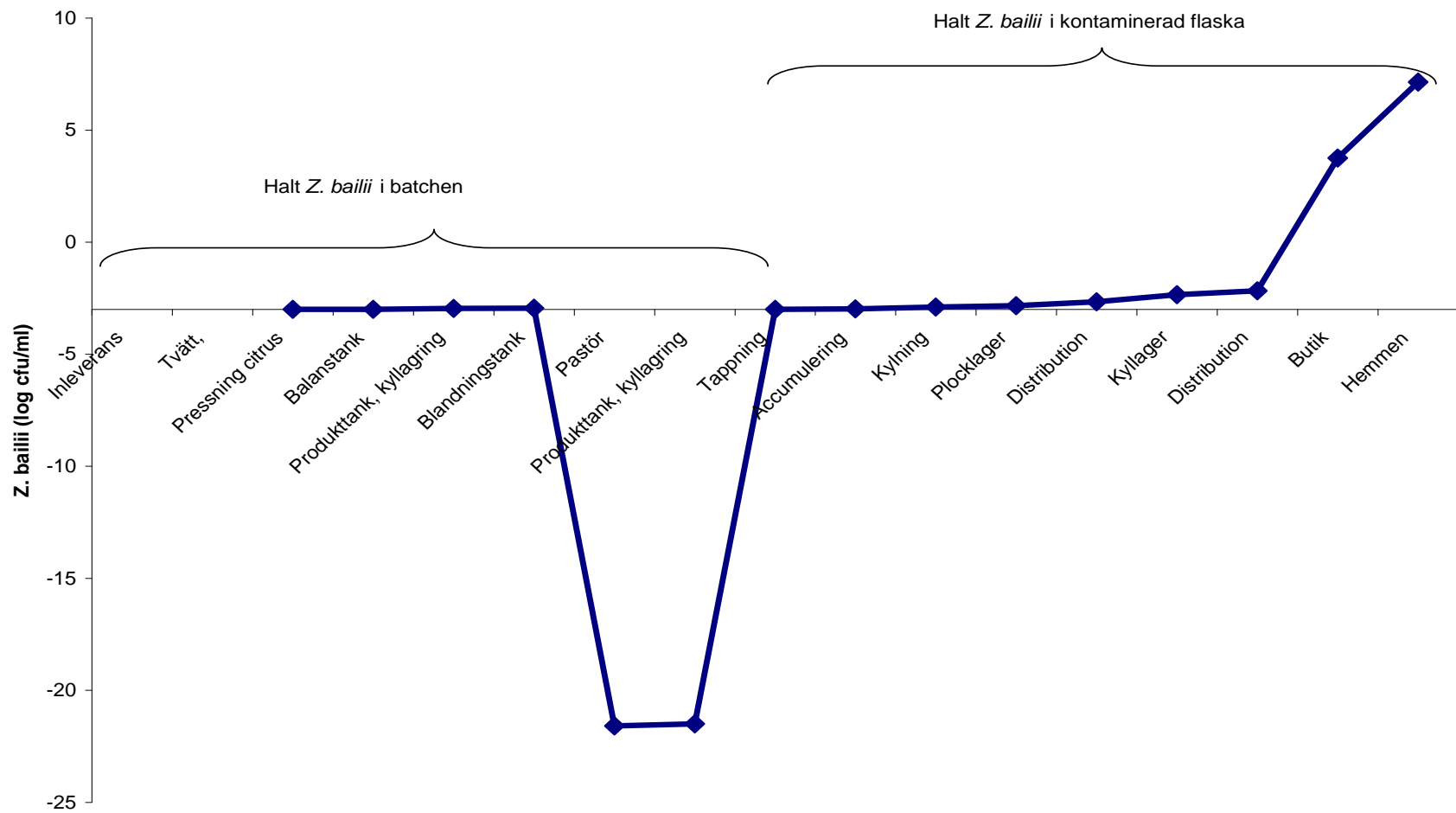
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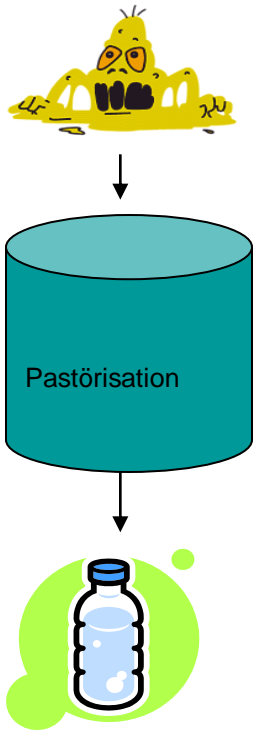
Growth and or inactivation  

Modeller

- Survival of *E. coli*
 - PMP
- Growth of *Z. bailii*
 - Braun & Sutherland 2004
- Probability of growth of *Z. bailii*
 - Cole et al. 1987
- Heat inactivation
 - Predicting using D-value and z-value







Heat



All bottles
contaminated

1% of the
bottles are
contaminated

$<1/10^{12}$ of the
bottles are
contaminated

Why use predictive microbiology?

- Efficient way to study the effect of a change in one or more parameters. Saves many challenge tests.
- Fast and cost efficient in product development and risk assessment.

But

- A model is only a model and gives indications, there is variations in microbiological flora, food etc.
- Models are often developed from data origin from a simplified system and the reality is more complex.

Thank you!

The studies referred to has been funded by SAFEFOODERA
and VINNOVA