Taking into account variability and uncertainty in models for assessing the microbiological shelf-life in foods

Application to Sym'Previus probabilistic module

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Introduction

- Integrating variability and uncertainty, in models for shelf-life evaluation of food products, represents the main element for the reliability of results,
- The aim of this research is to quantify the impact of both variability and uncertainty in the microbiological shelf-life estimation of food products,
- Non Linear Mixed Effect Models were used based on the Stochastic version of Expectation-Maximisation Algorithm (SAEM) to characterize variability and uncertainty associated to growth parameter estimation,
- The estimates were used for simulation, using 2D Monte Carlo method, in Sym'Previus probabilistic module to estimate with precision the probability to exceed a critical value at the end of food shelf-life.

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Probabilistic approach

- **Quantify the probability to exceed a criterion level at the end of shelf-life :**

  For example : 100 UFC/g for *Listeria monocytogenes.*

- **Probabilistic approach allows to estimate the probability to exceed the criterion level with a credible interval.**

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Probabilistic simulation

Microbiological and food variability ⇨ **Food-related behavior** ⇨ **Initial contamination** ⇨ **Storage conditions**

Probabilistic Simulation

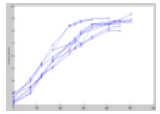
Variability and Uncertainty

Growth parameters

μ_{max} : Growth rate

lag : Lag time

N_{max} : Maximal contamination



Initial contamination

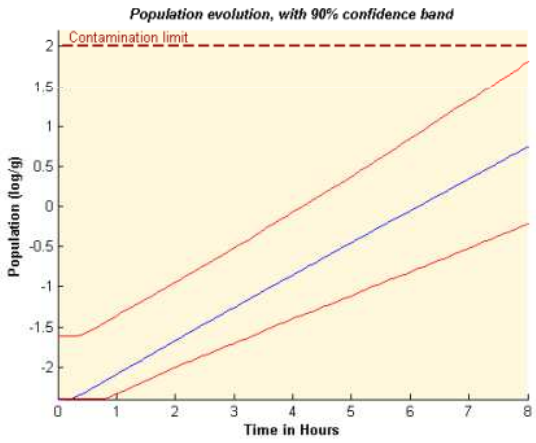
n : Number of analysed samples

r : Number of positive samples

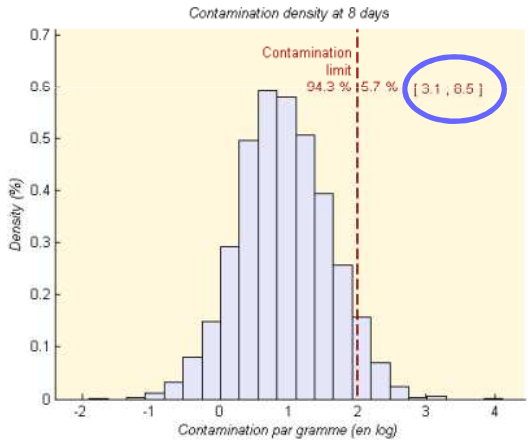
m: m-gram sample

Storage conditions and product charasteristics

Temperature, pH, water activity



Growth simulation in Contaminated Sales Units (CSU)



Probability to exceed a criterion level at the end of shelf-life (CSU)

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Conclusion

- Quantify the probability to exceed a criterion level taking into account both variability and uncertainty, allows to evaluate the impact of each factors and contributes to identify the key factors on wich efforts should be made to make product safer (initial contamination, aw, pH…) ,
- Sym'Previus is a decision making tool that allows a reliable evaluation of contamination throughout the shelf-life of food.

RMT "expertise for determining the microbiological shelf-life of foods"

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