MODELLING INACTIVATION KINETICS OF MICROORGANISMS IN FOODS

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OBJECTIVE:

Analysis on the inactivation kinetics modelling of food microorganisms

INTRODUCTION

Kinetic models are mathematical expressions that relate the number of microorganisms with time, under particular environmental conditions.

The development of accurate and precise models able to predict the behaviour of pathogens under stress factors is a relatively young discipline, that is gaining considerable importance in the food processing domain. However, a relatively low number of research works approach this subject, and those usually deal with the growth behaviour.

This work intends to show the most commonly models used in inactivation and to propose a new model with two phases.

KINETIC MODELS

Models found in literature (modified in order to describe inactivation behaviour)

- First order kinetics

$$\log N = a - kt$$

- Logistic function

$$\log N = \frac{C}{1+\exp(k(t-l))}$$

- Gompertz modified function

$$\log N = b \times \left(1 - \exp\left(-\exp\left(k(L-t)+1\right)\right)\right)$$

Model suggested

- First order with two phases

$$\log N = c_1 \exp(-k_1 t) + c_2 \exp(-k_2 t)$$

Where:

	N	population size (number of organisms/unit volume or mass)
	t	processing time (min)
	l	lag time (min)
	k, k_1, k_2	reaction rate constant (min^{-1})
	L	time of the maximum slope (min)

CASE STUDY

Development of bacteria death model using data from literature.

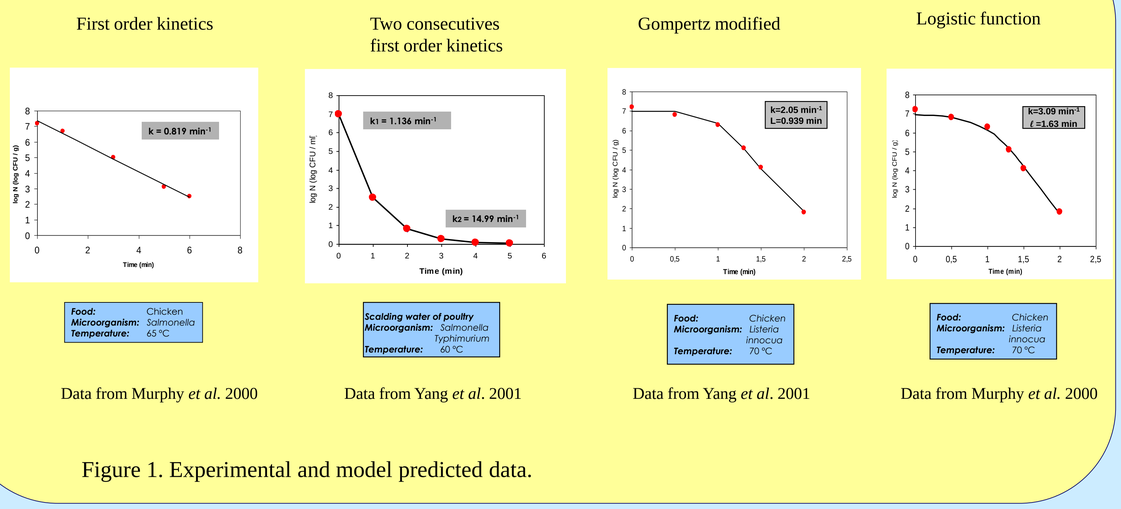

Figure 1. Experimental and model predicted data.

Cases studies were carried out using published data of inactivation of *Listeria* and *Salmonella* in chicken under pasteurization conditions.

RESULTS AND DISCUSSION

- Significant deviations from the log-linear behaviour, with: 1) a characteristic lag periods or shoulders before any death occurs, and 2) a tailing or a subpopulation of more resistant bacteria, that present a slower inactivation rate, have been observed.

- The first order model is restrictive, since the shoulder and/or tail behaviour are not described. The Gompertz and Logistic models overcome these limitation.

- In the Logistic function the *lag* parameter represents an inflexion point of the curve.

- The referred models were sucessfully fitted to the experimental data and kinetic parameters were estimated.

- A model with two phases was proposed, since it describes inactivation behaviour with a tail pattern.

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