

Modeling and forecast of quality attributes for fresh fish Case study: Merluccius merluccius (hake)



M. R. García^a, C. Vilas^a, J. R. Herrera^b, M. Bernárdez^b, E. Balsa-Canto^a, A. A. Alonso^a ^a Bioprocess Engineering Group, IIM-CSIC, Vigo (Spain) ^b Microbiology and Technology of Marine Products, IIM-CSIC, Vigo (Spain)

Introduction

- Fish quality degradation leads to losses of around 30-50% of fish catches.
- Fish freshness has a direct impact on market price \rightarrow monitoring, prediction and control tools to prevent food wastage are important
- There exists a correlation between Specific Spoilage Organism (SSOs) concentration and freshness indicators (Quality Sensory Method "QSM" or the Quality Index Method "QIM")

Objective

To develop a methodology to forecast fish freshness during storage

Dynamic mathematical model describing SSO growth



Expression relating QSM and QIM with SSO concentration

Model predictive capabilities



Relation QIM / Bacterial concentration $QIM = \operatorname{nint}(10^{lQ}) - 1$ $lQ = \alpha log_{10}(N_{Ps}) + \beta log_{10}(N_{Sh})$

Quality predictions



Bacterial growth model [1]

Two spoilage bacterial groups: Pseudomonas (Ps), Shewanella (Sh)



Growth rate: square-root model [2]

Initial conditions

$$V(t=0) = N_0$$

Time [d]	QSM (Model)	QSM (Experts)
0	E	E
1	E	E
2	Α	Α
5	R	R



Parameters to be estimated

Experimental scheme

- Three experiments with constant storage temperature (1, 5 and 7 celsius) for initial parameter estimation
- One experiment (3 celsius) for validation
- Three-four specimen analyzed per sampling time
- After initial estiamtion, one optimally designed experiment (with variable temperature) was carried out

B-NA В 6 NA NA NA NA 8

Conclusions

- Development of a dynamic model for fish quality prediction including fish-to-fish variability
- Storage temperature is the only stress variable considered although others could be included in the methodology
- Different catching methods/effect of evisceration were analyzed [3]

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References:

[1] Baranyi and Roberts (1994). A dynamic approach to predicting bacterial growth in food. International Int. J. Food Microbiol., 23, 277–294. [2] Ratkowsky, Olley, McMeekin and Ball. (1982). Relationship between temperature and growth rate of bacterial cultures. J. Bacteriol., 149, 1-5. [3] García, Vilas, Herrera, Bernárdez, Balsa-Canto, Alonso (2015) Quality and Shelf-life Prediction for Retail Fresh Hake (Merluccius merluccius) Accepted in International Int. J. Food Microbiol.