Modelling the effect of temperature on shelf-life and on the interaction between the spoilage microflora and Listeria monocytogenes in cold-smoked salmon

Diversity of Listeria monocytogenes isolates from cold-smoked salmon produced in different smokehouses as assessed by Random Amplified Polymorphic DNA analyses
Significance of volatile compounds produced by spoilage bacteria in vacuum-packed cold-smoked salmon (Salmo salar) analyzed by GC-MS and multivariate regression
Changes were studied in the concentration of 38 volatile compounds during chilled storage at 5 degreesC of six lots of commercially produced vacuum-packed cold-smoked salmon and sterile cold-smoked salmon. The majority of volatile compounds produced during spoilage of cold-smoked salmon were alcohols, which were produced by microbial activity. Partial least- squares regression of volatile compounds and sensory results allowed for a multiple compound quality index to be developed. This index was based on volatile bacterial metabolites, 1- propanol and 2-butanone, and 2-furan-carboxaldehyde produced by autolytic activity. Only a few of the volatile compounds produced during spoilage of cold-smoked salmon had an aroma value high enough to indicate contribution to the spoilage off- flavor of cold-smoked salmon. These were trimethylamine, 3- methylbutanal, 2-methyl-1-butanol, 3-methyl-1-butanol, 1- penten-3-ol, and 1-propanol. The potency and importance of these compounds was confirmed by gas chromatography- olfactometry. The present study provides valuable information on the bacterial reactions responsible for spoilage off-flavors of cold-smoked salmon, which can be used to develop biosensors for on-pack shelf-life determinations.
Control options for Listeria monocytogenes in seafoods

At least three outbreaks of listeriosis associated with seafood have been reported. Listeria monocytogenes is widely distributed in the general environment including fresh water, coastal water and live fish from these areas. Contamination or recontamination of seafood may also take place during processing and low levels (}
Cooked and brined shrimps packed in modified atmosphere have a shelf-life of >7 months at 0 °C, but spoil in 4-6 days at 25 °C.

**General information**

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Organisations: Section for Aquatic Microbiology and Seafood Hygiene, National Institute of Aquatic Resources
Authors: Dalgaard, P. (Intern), Jørgensen, L. V. (Intern)
Pages: 431-442
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Volume: 35
Multiple Compound Quality Index for cold-smoked salmon (Salmo salar) developed by multivariate regression of biogenic amines and pH

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Authors: Jørgensen, L. V. (Intern), Dalgaard, P. (Intern), Huss, H. H. (Intern)
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Spoilage and safety of cold-smoked salmon

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Authors: Jørgensen, L. V. (Intern)
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The effect of biogenic amine production by single bacterial cultures and metabiosis on cold-smoked salmon

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Scopus rating (2015): CiteScore 2.57
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BFI (2014): BFI-level 1
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BFI (2013): BFI-level 1
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Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.51
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.55
Quality index for vacuum-packed cold-smoked salmon developed by multivariate regression of biogenic amines and pH

An interlaboratory study to find an alternative to the MPN technique for enumerating Escherichia coli in shellfish

Nine laboratories in eight countries tested 16 batches of common mussels (Mytilus edulis) over a 32 week period in order to find an alternative to the Most Probable Number (MPN) technique to enumerate E. coli. The alternatives investigated included the 3M Petrifilm system, the Merck Chromocult agar method and a Malthus conductance technique. The Petrifilm was found to be unsuitable and was subsequently dropped from the trial. After 669 analyses, a correlation of 0.83 was observed for log E. coli counts between the MPN and Chromocult methods and there was no significant evidence that either method tended to give higher readings than the other. The MPN was slightly better than the Chromocult method for repeatability but the Chromocult was slightly better for reproducibility. However, the observed differences are probably too small to be of practical importance. On the basis of these data therefore, the two methods appear equally suitable for E. coli enumeration in shellfish. There were poor correlations between these methods and the Malthus technique. A small but significant number of samples tested positive on the Malthus instrument but were recorded negative on the MPN and Chromocult tests. Subsequent analysis positively identified E. coli from these Malthus assays. After statistical analysis, errors were noted in both the MPN and Chromocult methods but it was found that there would be no statistical differences if the Chromocult agar were used as an alternative to the MPN technique. Published by Elsevier Science B.V
Predicted and observed growth of Listeria monocytogenes in seafood challenge tests and in naturally contaminated cold smoked salmon

The performance of the Pathogen Modelling Program, the Food MicroModel, the Murphy-model and the Ross-model for growth of L. monocytogenes was evaluated by comparison with data from 100 seafood challenge tests and data from 13 storage trials with naturally contaminated sliced vacuum-packed cold-smoked salmon. Challenge tests with both cured and noncured products were studied, and graphs as well as the bias-and the accuracy factors were used for comparison of the observed and predicted growth. The Pathogen Modelling Program could not be successfully validated in seafood challenge tests. Growth rates were markedly overestimated and the μ(max)-bias factor was as high as 3.9 in challenge tests with cured products. On the basis of the effect of temperature, NaCl/a(w) and pH, the μ(max)-bias factor of the other three models studied, varied between 1.0 and 2.3 in the challenge tests with cured and noncured seafoods. None of
the models accurately predicted the growth in both cured and noncured seafoods. However, the results indicated that a new expanded model, including the additional effect of lactate and phenol, may provide accurate predictions of the growth of L. monocytogenes in challenge tests with various types of seafoods. Storage trials clearly showed the growth of L. monocytogenes in naturally contaminated cold-smoked salmon to be markedly slower than growth in inoculated challenge tests. Consequently, all four models substantially overestimated growth in the naturally contaminated products. Temperature, pH, NaCl/a(w) and lactate were measured in the storage trials and on the basis of these parameters, the Food MicroModel μ(max)-bias factor was 5.2. Clearly, the model could not be successfully validated with naturally contaminated cold-smoked salmon. To improve the applicability of predictive models to fish products, it is suggested to include studies with naturally contaminated products in the development and validation of models with seafood pathogens.

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Prevalence and growth of Listeria monocytogenes in naturally contaminated seafood

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Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.628 SNIP 1.694 CiteScore 4.02
Web of Science (2015): Indexed yes
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Risks presented by Listeria monocytogenes on cold smoked salmon

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State: Published
Organisations: National Institute of Aquatic Resources
Authors: Huss, H. H. (Intern), Nilsson, L. (Intern), Jørgensen, L. V. (Intern)
Pages: 142-151
Publication date: 1998

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Title of host publication: Containments of food-transmitted risks presented by emerging pathogens, Proceedings of Sixth International Symposium, Ispra (VA), 15th April 1997
Prevalence and characterization of Vibrio cholerae isolated from shrimp products imported into Denmark

A total of 3,555 metric tonnes of warm water shrimp were imported into Denmark from December 1994 to July 1995. V. cholerae O1 was not detected in any of the 748 samples analyzed. Non-O1 V. cholerae was found in a single (0.1%) cooked frozen shrimp product and in five (0.7%) raw frozen products, all originating from shrimp produced in aquaculture. Six isolated strains agglutinated in polyvalent O antisera, but did not agglutinate in Ogawa or Inaba antisera. The six strains were resistant to colistin and sulfisoxazole; three strains also showed resistance to ampicillin. None of the strains contained plasmids or genes encoding cholera toxin (CT) or heat-stable enterotoxin (NAG-ST). The absence of V. cholerae O1 and the low number of samples containing CT and NAG-ST negative non-O1 strains in imported shrimp suggest that V. cholerae in such products may not constitute a public health problem.

General information
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Organisations: National Institute of Aquatic Resources, Section for Fish Diseases, Technical University of Denmark
Authors: Dalsgaard, A. (Ekstern), Bjergskov, T. (Ekstern), Jeppesen, V. (Ekstern), Jørgensen, L. V. (Intern), Echeverria, P. (Ekstern), Dalsgaard, I. (Intern)
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Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.96 SNIP 1.031 CiteScore 2.03
Web of Science (2015): Indexed yes
Spoilage and safety of cold-smoked fish (EU-FAIR CT95-1207)

In DK the annual export value of cold-smoked salmon is in the order of 150 mill. US $. It is a major problem for the industry that large amounts of products are rejected on the basis of microbiological counts that do not show any relation to the organoleptic quality of the product. The primary objective of the project is to identify indices of quality of cold-smoked salmon. Secondly methods to measure the indices of quality will be developed and validated on a European basis. Identification of indices of quality will be based on an approach where specific spoilage organisms (SSO) and individual chemical compounds that can be related to product shelf life are studied. At the same time a non-specific approach based on measurements of profiles of volatile compounds and other metabolites will be used in combination with multivariate statistical methods for identification of indices of quality.
National Institute of Aquatic Resources

Escola Superior de Biotechnologia

IFREMER

DLO.RIVO, Ijmuiden

Leatherhead Food Research
Period: 01/11/1996 → 28/02/2000
Number of participants: 3
Project participant:
Jørgensen, Lasse Vigel (Intern)
Huss, Hans Henrik (Intern)
Project Manager, organisational:
Dalgaard, Paw (Intern)

Financing sources
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Name of research programme: Ukendt
Amount: 2,200,000.00 Danish Kroner

Prevalence and growth of Listeria monocytogenes

National Institute of Aquatic Resources
Period: 01/09/1995 → 31/08/1997
Number of participants: 1
Project Manager, organisational:
Jørgensen, Lasse Vigel (Intern)

Quality of water for the production of bivalve molluscs

National Institute of Aquatic Resources
Period: 01/09/1995 → 31/08/1997
Number of participants: 1
Project Manager, organisational:
Jørgensen, Lasse Vigel (Intern)

Financing sources
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