Genotypic and phenotypic characterization of garlic-fermenting lactic acid bacteria isolated from som-fak, a Thai low-salt fermented fish product

AIMS: To evaluate the importance of garlic for fermentation of a Thai fish product, and to differentiate among garlic-/inulin-fermenting lactic acid bacteria (LAB) at strain level. METHODS AND RESULTS: Som-fak was prepared by fermentation of a mixture of fish, salt, rice, sucrose and garlic. pH decreased to 4.5 in 2 days, but omitting garlic resulted in a lack of acidification. LAB were predominant and approximately one third of 234 isolated strains fermented garlic and inulin (the carbohydrate reserve in garlic). These strains were identified as Lactobacillus pentosus and Lact. plantarum. Randomly Amplified Polymorphic DNA (RAPD) analysis revealed one major RAPD type (29 strains) isolated from all stages of fermentation. CONCLUSION: Garlic was essential for acidification of som-fak and garlic-fermenting strains constituted a significant, homogeneous part of the LAB flora. SIGNIFICANCE AND IMPACT OF THE STUDY: The present study indicates the role of fructans (garlic/inulin) as carbohydrate sources for LAB. Fructan fermenters may have several biotechnological applications, for example, as probiotics.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquatic Microbiology and Seafood Hygiene
Authors: Paludan-Müller, C. (Intern), Valyasevi, R. (Ekstern), Huss, H. H. (Intern), Gram, L. (Intern)
Pages: 307-314
Publication date: 2002
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Applied Microbiology
Volume: 92
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Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
One hundred and forty-eight Listeria monocytogenes isolates originating from vacuum packed cold-smoked salmon produced in 10 different Danish smokehouses were compared by Random Amplified Polymorphic DNA (RAPD) profiling. A total of 16 different reproducible RAPD profiles were obtained using a standardised RAPD analysis by four primers separately. The grouping of the 148 strains was exactly the same for the four primers used. For a sub-set of 20 strains typed by Pulsed Field Gel Electrophoresis (PFGE), only one strain was allocated into a different group as compared to the grouping by RAPD typing. Different RAPD types dominated in products from different smokehouses. Some identical RAPD types were isolated in several smokehouses. In each of four smokehouses, one particular RAPD type could be repeatedly isolated from products. Each smokehouse/product carried its own specific RAPD type and this may indicate a possible persistence of closely related strains of L. monocytogenes in smokehouses. (C) 2001 Elsevier Science B.V. All rights reserved.

Diversity of Listeria monocytogenes isolates from cold-smoked salmon produced in different smokehouses as assessed by Random Amplified Polymorphic DNA analyses

One hundred and forty-eight Listeria monocytogenes isolates originating from vacuum packed cold-smoked salmon produced in 10 different Danish smokehouses were compared by Random Amplified Polymorphic DNA (RAPD) profiling. A total of 16 different reproducible RAPD profiles were obtained using a standardised RAPD analysis by four primers separately. The grouping of the 148 strains was exactly the same for the four primers used. For a sub-set of 20 strains typed by Pulsed Field Gel Electrophoresis (PFGE), only one strain was allocated into a different group as compared to the grouping by RAPD typing. Different RAPD types dominated in products from different smokehouses. Some identical RAPD types were isolated in several smokehouses. In each of four smokehouses, one particular RAPD type could be repeatedly isolated from products. Each smokehouse/product carried its own specific RAPD type and this may indicate a possible persistence of closely related strains of L. monocytogenes in smokehouses. (C) 2001 Elsevier Science B.V. All rights reserved.
Elucidation of Listeria monocytogenes contamination routes in cold-smoked salmon processing plants detected by DNA-based typing methods

The contamination routes of Listeria monocytogenes in cold-smoked salmon processing plants were investigated by analyzing 3,585 samples from products (produced in 1995, 1996, 1998, and 1999) and processing environments (samples obtained in 1998 and 1999) of two Danish smokehouses. The level of product contamination in plant I varied from 31 to 85%, and no L. monocytogenes was found on raw fish (30 fish were sampled). In plant II, the levels of both raw fish and product contamination varied from 0 to 25% (16 of 185 raw fish samples and 59 of 1,000 product samples were positive for L. monocytogenes). A total of 429 strains of L. monocytogenes were subsequently compared by random amplified polymorphic DNA (RAPD) profiling, and 55 different RAPD types were found. The RAPD types detected on the products were identical to types found on the processing equipment and in the processing environment, suggesting that contamination of the final product (cold-smoked salmon) in both plants (but primarily in plant I) was due to contamination during processing rather than to contamination from raw fish. However, the possibility that raw fish was an important source of contamination of the processing equipment and environment could not be excluded. Contamination of the product occurred in specific areas (the brining and slicing areas). In plant I, the same RAPD type (RAPD type 12) was found over a 4-year period, indicating that an established in-house flora persisted and was not eliminated by routine hygienic procedures. In plant II, where the prevalence of L. monocytogenes was much lower, no RAPD type persisted over long periods of time, and several different L. monocytogenes RAPD types were isolated. This indicates that persistent strains may be avoided by rigorous cleaning and sanitation; however, due to the ubiquitous nature of the organism, sporadic contamination occurred. A subset of strains was also typed by using pulsed-field gel electrophoresis and amplified fragment length polymorphism profiling, and these methods confirmed the type division obtained by RAPD profiling.

General information
State: Published
Organisations: Section for Aquatic Microbiology and Seafood Hygiene, National Institute of Aquatic Resources, National Veterinary Institute
Authors: Vogel, B. F. (Intern), Huss, H. H. (Intern), Ojeniyi, B. (Ekstern), Ahrens, P. (Intern), Gram, L. (Intern)
Pages: 2586-2595
Publication date: 2001
Main Research Area: Technical/natural sciences

Publication information
Journal: Applied and Environmental Microbiology
Volume: 67
Issue number: 6
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Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 3.99
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4.08
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.891 SNIP 1.308 CiteScore 4.14
Web of Science (2015): Indexed yes
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.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquatic Microbiology and Seafood Hygiene
Authors: Jørgensen, L. V. (Intern), Huss, H. H. (Intern), Dalgaard, P. (Intern)
Pages: 2376-2381
Publication date: 2001
Main Research Area: Technical/natural sciences

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Journal: Journal of Agricultural and Food Chemistry
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BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 3.64 SJR 1.269 SNIP 1.343
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.45 SJR 1.305 SNIP 1.343
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.224 SNIP 1.245 CiteScore 3.23
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.267 SNIP 1.413 CiteScore 3.25
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.43 SNIP 1.47 CiteScore 3.44
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.408 SNIP 1.464 CiteScore 3.2
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.389 SNIP 1.441 CiteScore 3.1
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.42 SNIP 1.391
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.33 SNIP 1.306
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.327 SNIP 1.338
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.252 SNIP 1.44
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.367 SNIP 1.418
Web of Science (2006): Indexed yes
Use and misuse of microbiological criteria for seafood

General information
State: Published
Organisations: National Institute of Aquatic Resources
Authors: Huss, H. H. (Intern), Gudjonsson, A. (ed.) (Ekstern), Niclasen, O. (ed.) (Ekstern)
Pages: 63-73
Publication date: 2001
Conference: 30th West European Fish Technologist's Association Plenary Meeting, Torshavn, Faroe Islands, 19/06/2000 - 19/06/2000
Main Research Area: Technical/natural sciences

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Journal: Annales Societatis Scientiarum Færoensis Supplementum
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BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
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BFI (2015): BFI-level 1
BFI (2014): BFI-level 1
BFI (2013): BFI-level 1
ISI indexed (2013): ISI indexed no
BFI (2012): BFI-level 1
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BFI (2011): BFI-level 1
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BFI (2009): BFI-level 1
BFI (2008): BFI-level 1
Original language: English
Source: orbit
Source-ID: 225835
Publication: Research › Conference article – Annual report year: 2001
Carbon dioxide and nisin act synergistically on Listeria monocytogenes

This paper examines the synergistic action of carbon dioxide and nisin on Listeria monocytogenes Scott A wild-type and nisin-resistant (Nis(r)) cells grown in broth at 4 degrees C. Carbon dioxide extended the lag phase and decreased the specific growth rate of both strains, but to a greater degree in the Nis(r) cells. Wild-type cells grown in 100% CO2 were two to five times longer than cells grown in air. Nisin (2.5 μg/ml) did not decrease the viability of Nis(r) cells but for wild-type cells caused an immediate 2-log reduction of viability when they were grown in air and a 4-log reduction when they were grown in 100% CO2. There was a quantifiable synergistic action between nisin and CO2 in the wild-type strain. The MIC of nisin for the wild-type strain grown in the presence of 2.5 μg of nisin per ml increased from 3.1 to 12.5 μg/ml over 35 days, but this increase was markedly delayed for cultures in CO2. This synergism between nisin and CO2 was examined mechanistically by following the leakage of carboxyfluorescein (CF) from listerial liposomes. Carbon dioxide enhanced nisin-induced CF leakage, indicating that the synergistic action of CO2 and nisin occurs at the cytoplasmic membrane. Liposomes made from cells grown at 4 degrees C were dramatically more nisin sensitive than were liposomes derived from cells grown at 30 degrees C. Cells grown in the presence of 100% CO2 and those grown at 4 degrees C had a greater proportion of short-chain fatty acids. The synergistic action of nisin and CO2 is consistent with a model where membrane fluidity plays a role in the efficiency of nisin action.
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 (
Fresh and processed fish and shellfish

General information

State: Published
Organisations: Section for Aquatic Microbiology and Seafood Hygiene, National Institute of Aquatic Resources
Authors: Gram, L. (Intern), Huss, H. H. (Intern)
Host publication information
Title of host publication: The Microbiological Safety and Quality of Food
Place of publication: Gaithersburg, Md
Publisher: Aspen Publishers
Editors: Lund, B., Baird-Parker, T., Gould, G.
ISBN (Print): 0-8342-1323-0
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 225539
Publication: Research - peer-review › Book chapter – Annual report year: 2000

Mikrobiologiske analyser og mikrobiologiske kriterier

General information
State: Published
Organisations: National Institute of Aquatic Resources
Authors: Jakobsen, M. (Ekstern), Huss, H. H. (Intern)
Pages: 18-20
Publication date: 2000
Main Research Area: Technical/natural sciences

Publication information
Journal: Plus proces
Volume: 14
Issue number: 9
ISSN (Print): 0902-5057
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BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
BFI (2016): BFI-level 1
BFI (2015): BFI-level 1
BFI (2014): BFI-level 1
BFI (2013): BFI-level 1
ISI indexed (2013): ISI indexed no
BFI (2012): BFI-level 1
ISI indexed (2012): ISI indexed no
BFI (2011): BFI-level 1
ISI indexed (2011): ISI indexed no
BFI (2010): BFI-level 1
BFI (2009): BFI-level 1
BFI (2008): BFI-level 1
Original language: Danish
Source: orbit
Source-ID: 225949
Publication: Research › Journal article – Annual report year: 2000

Multiple Compound Quality Index for cold-smoked salmon (Salmo salar) developed by multivariate regression of biogenic amines and pH

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquatic Microbiology and Seafood Hygiene
Authors: Jørgensen, L. V. (Intern), Dalgaard, P. (Intern), Huss, H. H. (Intern)
Pages: 2448-2453
Publication date: 2000
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Agricultural and Food Chemistry
Prevention and control of hazards in seafood

Seafood is high on the list of foods transmitting disease. However, the food safety issues are highly focussed and more than 80% of all seafood-borne outbreaks are related to biotoxins (ciguatoxin, scombrotoxin or the consumption of raw molluscan shellfish. The safety hazards in seafood production are listed and discussed. It is pointed out that there are serious safety concerns related to the consumption of raw fish and shellfish due to the presence of biological (bacteria, virus, parasites) and chemical (biotoxins) hazards. These hazards are present in the fish and shellfish pre-harvest and are difficult or impossible to control by applying presently available preventive measures. In contrast, the hazards related to contamination, recontamination or survival of biological hazards during processing are well-defined and can be controlled by applying Good Manufacturing Practice (GMP), Good Hygiene Practice (GHP) and a well designed HACCP-programme. Similarly, the means to prevent the growth of pathogenic microorganisms during distribution and storage of the final products are - with a few exceptions - available. Proper application of well-known preservative parameters including temperature is able to control growth of most pathogens. When this is not the always case, for example inhibition of Listeria monocytogenes in lightly preserved fish products, it is recommended to limit the stated shelf-life of these products to a period of no-growth for the pathogen of concern. There is a good agreement between the trends shown in disease statistics, the hazard analysis and the qualitative risk assessment of the various fish products. It is recommended that consumers should be informed of the risk of eating raw seafood - particularly molluscan shellfish and certain freshwater fish. (C) 2000 Elsevier Science Ltd. All rights reserved.

General information
State: Published
Organisations: National Institute of Aquatic Resources
Authors: Huss, H. H. (Intern), Reilly, A. (Ekstern), Embarek, P. K. B. (Intern)
Pages: 149-156
Publication date: 2000
Main Research Area: Technical/natural sciences

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Journal: Food Control
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BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 4.06 SJR 1.502 SNIP 1.69
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.86 SJR 1.492 SNIP 1.709
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.498 SNIP 1.73 CiteScore 3.65
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.38 SNIP 1.717 CiteScore 3.27
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.278 SNIP 1.728 CiteScore 3.14
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
The effect of biogenic amine production by single bacterial cultures and metabiosis on cold-smoked salmon

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquatic Microbiology and Seafood Hygiene
Authors: Jørgensen, L. V. (Intern), Huss, H. H. (Intern), Dalgaard, P. (Intern)
Pages: 920-934
Publication date: 2000
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Applied Microbiology
Volume: 89
Issue number: 6
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Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.41
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.41
Characterization of lactic acid bacteria isolated from a Thai low-salt fermented fish product and the role of garlic as substrate for fermentation

Lactic acid bacteria (LAB) isolated from raw materials (fish, rice, garlic and banana leaves) and processed som-fak (a Thai low-salt fermented fish product) were characterized by API 50-CH and other phenotypic criteria. Lactococcus lactis subsp. lactis and Leuconostoc citreum were specifically associated with fish fillet and minced fish. Lactobacillus paracasei subsp. paracasei with boiled rice and Weisella confusa with garlic mix and banana leaves. In addition, Lactobacillus plantarum, Lactobacillus pentosus and Pediococcus pentosaceus were isolated from raw materials. A succession of aciduric, homofermentative lactobacillus species, dominated by Lb. plantarum/pentosus, was found during fermentation. In total, 9% of the strains fermented starch and 19% fermented garlic, the two main carbohydrate components in som-fak. The ability to ferment garlic was paralleled by a capacity to ferment inulin. An increased percentage of garlic fermenting strains was found during fermentation of som-fak, from 8% at day 1 to 40% at day 5. No starch fermenting strains were isolated during fermentation. Three mixed LAB cultures, composed of either starch fermenting Lc. lactis subsp. lactis and Lb. paracasei subsp. paracasei, or garlic fermenting Lb. plantarum and Pd. pentosaceus, or a combination of these strains were inoculated into laboratory prepared som-fak with or without garlic. In som-fak without garlic, pH was above 4.8 after three days, irrespective of addition of mixed LAB cultures. The starch fermenting LAB were unable to ferment som-fak and sensory spoilage occurred after three days. Fermentation with the combined mix of starch and garlic fermenting strains led to production of 2.5% acid and a decrease in pH to 4.5 in two days. The fermentation was slightly slower with the garlic fermenting strains alone. This is the first report describing the role of garlic as carbohydrate source for LAB in fermented fish products. (C) 1999 Elsevier Science B.V. All rights reserved
Control options for Listeria in seafoods

Góðskutrygging í fiskidnadinum

Growth control of Listeria monocytogenes on cold-smoked salmon using a competitive lactic acid bacteria flora

A Lactobacillus sake strain LKE5 and four strains of Carnobacterium piscicola were evaluated as biopreservation cultures to control the growth of Listeria monocytogenes on vacuum-packed, cold-smoked salmon stored at 5 degrees C. All five strains were antilisterial as live cultures in an agar diffusion assay. Cell-free supernatants of two strains of C. piscicola and L. sake LKE5 were also antilisterial because of the production of bacteriocins. The presence of high cell numbers of strains of C. piscicola had no influence on the sensory quality of cold-smoked salmon stored at 5 degrees C, but L. sake LKE5 caused strong sulfurous off-flavors and was rejected as a culture for biopreservation of cold-smoked salmon.
bacteriocin-producing strain of C. piscicola (A9b) initially caused a 7-day lag phase of L. monocytogenes, followed by a reduction in numbers of L. monocytogenes from 10(3) CFU/ml to below 10 CFU/ml after 32 days of incubation, coinciding with the detection of antilisterial compounds. The presence of a nonbacteriocin-producing strain of C. piscicola (A10a) prevented the growth of L. monocytogenes during the 32-day incubation. The growth of L. monocytogenes was strongly repressed on cold-smoked salmon in the presence of C. piscicola A9b and A10a, respectively. The initial cell numbers of L. monocytogenes that were found on Oxford plates incubated at 25 degrees C reached low maximum cell counts of 10(4) and 2 x 10(3) after 14 and 20 days of storage in mixed culture with C. piscicola A9b and A10a.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquatic Microbiology and Seafood Hygiene
Authors: Nilsson, L. (Intern), Gram, L. (Intern), Huss, H. H. (Intern)
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Publication date: 1999
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Food Protection
Volume: 62
Issue number: 4
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Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.63 SJR 0.761 SNIP 0.823
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.68 SJR 0.769 SNIP 0.811
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.954 SNIP 1.024 CiteScore 2.03
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.914 SNIP 0.953 CiteScore 1.94
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.101 SNIP 1.09 CiteScore 2.11
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.083 SNIP 0.981 CiteScore 2.03
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.994 SNIP 0.958 CiteScore 1.96
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.011 SNIP 0.949
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.119 SNIP 1.147
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.064 SNIP 0.996
Web of Science (2008): Indexed yes
Characterization of anti-listerial lactic acid bacteria isolated from Thai fermented fish products

Thai fermented fish products were screened for lactic acid bacteria capable of inhibiting Listeria sp. (Listeria innocua). Of 4150 assumed lactic acid bacteria colonies from MRS agar plates that were screened by an agar-overlay method 58 (1.4%) were positive. Forty four of these strains were further characterized and 43 strains were inhibitory against Listeria monocytogenes. The strains were inhibitory to other Gram- positive (lactic acid) bacteria probably because of production of bacteriocins. All 44 strains inhibited both Vibrio cholerae and Vibrio parahaemolyticus and 37 were inhibitory to a mesophilic fish spoilage bacterium tan Aeromonas sp.). Inhibition of Gram-negative bacteria was attributed to production of lactic acid. Most strains were identified as Lactobacillus spp., and all grew well at ambient temperatures (25-37 degrees C) and tolerated up to 6.5% NaCl. Glucose was fermented rapidly in laboratory media whereas pH decreased only very slowly in fish juice supplemented with 4% glucose and 3.5% NaCl or in a rice-fish mixture. Only four of 44 isolates could degrade and ferment complex carbohydrates such as rice, potatoes and maize starch. This indicates that other types of bacteria may be responsible for the rapid spontaneous fermentation of the products or that other yet-unknown factors ensure rapid fermentation. Overall anti-listerial lactic acid bacteria do occur in fermented fish products and the antibacterial activity against pathogenic bacteria indicates that they may be important in product safety. (C) 1998 Academic Press Limited
Characterization of the microflora of lightly salted lumpfish (Cyclopterus lumpus) roe stored at 5 C

Numeric taxonomy analysis of 70 lactic acid bacteria (LAB) and 30 Enterobacteriaceae from lightly salted lumpfish roe, showed that Enterobacteriaceae formed three subgroups: Morganella morganii presumptive Serratia liquefaciens and Serratia plymuthica. LAB formed three subgroups of presumptive Lactococcus spp. and Carnobacterium spp. Production of off-odors and volatile sulfur compounds by twelve selected strains and three Vibrio spp. of identical origin in pasteurized roe, and of three Enterobacteriaceae in sterile fresh roe, was examined. Morganella morganii produced off-odors and volatile sulfur compounds in both pasteurized and fresh roe. One Serratia liquefaciens produced strong off-odors but no volatile sulfur compounds in fresh roe.

General information
State: Published
Organisations: National Institute of Aquatic Resources
Authors: Basby, M. (Intern), Jeppesen, V. (Ekstern), Huss, H. H. (Intern)
Pages: 35-51
Publication date: 1998
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Journal: Journal of Aquatic Food Product Technology
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 0.386 SJR 0.309 CiteScore 0.64
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.59 SJR 0.266 SNIP 0.611
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.293 SNIP 0.621 CiteScore 0.65
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.273 SNIP 0.638 CiteScore 0.62
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.279 SNIP 0.548 CiteScore 0.59
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.419 SNIP 0.538 CiteScore 0.64
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.384 SNIP 0.62 CiteScore 0.68
ISI indexed (2011): ISI indexed no
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.294 SNIP 0.485
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Chemical composition of fresh and salted lumpfish (Cyclopterus lumpus) roe

**General information**

State: Published
Organisations: National Institute of Aquatic Resources
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.59 SJR 0.266 SNIP 0.611
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.293 SNIP 0.621 CiteScore 0.65
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.273 SNIP 0.638 CiteScore 0.62
Web of Science (2014): Indexed yes
Evaluation of the role of *Carnobacterium piscicola* in spoilage of vacuum- and modified-atmosphere-packed cold-smoked salmon stored at 5 degrees C

The microflora on spoiled cold-smoked salmon often consists of a mixture of lactic acid bacteria (LAB) and Gram-negative bacteria. To elucidate the role of the different groups, a storage trial was carried out in which nisin and CO2 were used for the selective inhibition of the two bacterial groups. The shelf-life of vacuum-packed cold-smoked salmon, recorded by sensory evaluation, was four weeks at 5 degrees C and the microflora was composed of LAB ($10^6$-$10^7$ cfu/g) with an associated Gram-negative flora in varying levels ($10^5$-$10^7$ cfu/g). The addition of nisin and/or a CO2-atmosphere increased the shelf-life to five or six weeks and limited the level of LAB to about $10^4$-$10^6$, $10^3$-$10^6$ and $10^2$-$10^4$ cfu/g, respectively. CO2-atmosphere+/-nisin inhibited the growth of Gram-negative bacteria, whereas nisin had no effect on these in vacuum packages. TheGram-negative flora on vacuum-packed salmon was dominated by a *Vibrio* sp., resembling *V. marinus*, Enterobacteriaceae (Enterobacter agglomerans, *Serratia liquefaciens* and *Rahnella aquatilis*) and occasionally *Aeromonas hydrophila*. Irrespective of the addition of nisin and/or CO2-atmosphere, the LAB microflora was dominated by *Carnobacterium piscicola*, which was found to account for 87% of the 255 LAB isolates characterized. Whole-cell-protein patterns analysed by SDS-PAGE confirmed the *Carnobacterium piscicola* species identification. The spoilage potential of *C. piscicola* isolates was further studied by inoculation of approx. $10^6$ cfu/g in cold-smoked salmon stored at 5 degrees C. The salmon did not spoil within 4 weeks of storage in vacuum-or CO2-atmosphere, and it is concluded that despite high levels (> $10^7$ cfu/g) of *C. piscicola*, sensory rejection was caused by autolytic changes. This was supported
by the development of soft texture and sour, rancid and bitter off-flavours at the point of spoilage, irrespective of the length of shelf-life and low or high total counts of LAB and Gram-negative bacteria. (C) 1998 Elsevier Science B.V
Fermentation and spoilage of som fak, a Thai low-salt fish product

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquatic Microbiology and Seafood Hygiene
Authors: Østergaard, A. (Intern), Embarek, P. K. B. (Intern), Yamprayoon, J. (Ekstern), Wedell-Neergaard, C. (Ekstern), Huss, H. H. (Intern), Gram, L. (Intern)
Pages: 105-112
Publication date: 1998
Main Research Area: Technical/natural sciences

Publication information
Journal: Tropical Science
Volume: 38
ISSN (Print): 0041-3291
Ratings:
Scopus rating (2010): SJR 0.129 SNIP 0.87
Scopus rating (2009): SJR 0.114 SNIP 0.247
Scopus rating (2008): SJR 0.115 SNIP 0.37
Scopus rating (2007): SJR 0.115 SNIP 0.097
Scopus rating (2006): SJR 0.205 SNIP 0.589
Scopus rating (2005): SJR 0.164 SNIP 0.428
Scopus rating (2004): SJR 0.15 SNIP 0.504
Scopus rating (2003): SJR 0.144 SNIP 0.693
Scopus rating (2002): SJR 0.25 SNIP 0.88
Scopus rating (2001): SJR 0.125 SNIP 0.265
Scopus rating (2000): SJR 0.17 SNIP 0.374
Scopus rating (1999): SJR 0.176 SNIP 0.539
Original language: English
Source: orbit
Source-ID: 227837
Publication: Research - peer-review › Journal article – Annual report year: 1998

Kimtal og kvalitet: Kvalitet af fisk og fiskeprodukter

General information
State: Published
Organisations: National Institute of Aquatic Resources
Authors: Huss, H. H. (Intern)
Publication date: 1998
Microbiological quality and shelf life of cold-smoked salmon from three different processing plants

General information
State: Published
Organisations: National Institute of Aquatic Resources
Authors: Hansen, L. T. (Intern), Rentved, S. (Ekstern), Huss, H. H. (Intern)
Pages: 137-150
Publication date: 1998
Main Research Area: Technical/natural sciences

Publication information
Journal: Food Microbiology
Volume: 15
Issue number: 2
ISSN (Print): 0740-0020
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 4.3 SJR 1.66 SNIP 1.674
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.31 SJR 1.723 SNIP 1.675
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.705 SNIP 1.765 CiteScore 4.24
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.535 SNIP 1.738 CiteScore 3.74
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.772 SNIP 1.845 CiteScore 3.81
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.597 SNIP 1.627 CiteScore 3.54
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.587 SNIP 1.874 CiteScore 3.72
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.678 SNIP 1.754
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.591 SNIP 1.734
Prevalence and growth of Listeria monocytogenes in naturally contaminated seafood

General information
State: Published
Organisations: National Institute of Aquatic Resources
Authors: Jørgensen, L. V. (Intern), Huss, H. H. (Intern)
Pages: 127-131
Publication date: 1998
Main Research Area: Technical/natural sciences

Publication information
Journal: International Journal of Food Microbiology
Volume: 42
Issue number: 1-2
ISSN (Print): 0168-1605
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 3.76 SJR 1.366 SNIP 1.436
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.97 SJR 1.481 SNIP 1.553
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.614 SNIP 1.683 CiteScore 4.02
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.493 SNIP 1.695 CiteScore 3.62
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.612 SNIP 1.841 CiteScore 3.8
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Risks presented by *Listeria monocytogenes* on cold smoked salmon

**General information**
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

**Host publication information**
Title of host publication: Containments of food-transmitted risks presented by emerging pathogens, Proceedings of Sixth International Symposium, Ispra (VA), 15th April 1997
Place of publication: Luxembourg
Publisher: European Commission
Editors: Marengo, G., Pastoni, F.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 225834
Publication: Research - peer-review › Journal article – Annual report year: 1998
Spoilage of lightly salted lumpfish (Cyclopterus lumpus) roe at 5°C

Lightly salted lumpfish roe (3.5–4.8% fw/w salt in the water-phase, pH 5.4, vacuum-packed) was stored at 5°C. After 2 1/2 or 3 months of storage, different degrees of spoilage, caused by bacterial activity, occurred in eleven roe batches. Off-odors ranged from no or very weak odors to strong sulphury, sour odors. The microflora consisted of lactic acid bacteria, Enterobacteriaceae and Vibrio spp. Concentration of lactic acid, acetic acid, trimethylamine and total volatile bases were unrelated to spoilage odors. Volatile sulfur compounds (H2S, probably CS2, CH3SH and CH3CH2S or CH3SCH3), produced during storage, appeared to be contributors to spoilage odors.

General information
State: Published
Organisations: National Institute of Aquatic Resources
Authors: Basby, M. (Intern), Jeppesen, V. (Ekstern), Huss, H. H. (Intern)
Pages: 23-34
Publication date: 1998
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Aquatic Food Product Technology
Volume: 7
Issue number: 4
ISSN (Print): 1049-8850
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 0.386 SJR 0.309 CiteScore 0.64
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.59 SJR 0.266 SNIP 0.611
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.293 SNIP 0.621 CiteScore 0.65
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.273 SNIP 0.638 CiteScore 0.62
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.279 SNIP 0.548 CiteScore 0.59
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.419 SNIP 0.538 CiteScore 0.64
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.384 SNIP 0.62 CiteScore 0.68
ISI indexed (2011): ISI indexed no
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.294 SNIP 0.485
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.207 SNIP 0.209
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.199 SNIP 0
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.259 SNIP 0.467
Web of Science (2007): Indexed yes
Application of an iterative approach for development of a microbial model predicting the shelf-life of packed fish

General information
State: Published
Organisations: National Institute of Aquatic Resources
Authors: Dalgaard, P. (Intern), Huss, H. H. (Intern)
Pages: 169-180
Publication date: 1997
Main Research Area: Technical/natural sciences

Publication information
Journal: International Journal of Food Microbiology
Volume: 18
Issue number: 2-3
ISSN (Print): 0168-1605
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 3.76 SJR 1.366 SNIP 1.436
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.97 SJR 1.481 SNIP 1.553
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.614 SNIP 1.683 CiteScore 4.02
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.493 SNIP 1.695 CiteScore 3.62
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.612 SNIP 1.841 CiteScore 3.8
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Control of indigenous pathogenic bacteria in seafood

The pathogenic bacteria indigenous to the aquatic and general environment are listed. Their distribution in nature, prevalence in seafood and the possibilities for growth of these organisms in various types of products are outlined. These data, combined with what is known regarding the epidemiology of disease, are used to place the various seafood products in risk categories and to identify areas of concern. It is concluded that the presence of pathogens in molluscs and the growth of Listeria monocytogenes in lightly preserved fish products are hazards which are presently not under control. In order to prevent growth and toxin production by Clostridium botulinum when products are stored at abuse temperature, it is recommended that additional barriers to growth are included in lightly preserved (e.g. cold smoked salmon) and low-heat treated (e.g. REPFEDS) products. It is finally pointed out that the Hazard Analysis Critical Control Point (HACCP) system is the preferred strategy in most quality assurance programmes and it is recommended that microbiological criteria are applied only as guidelines in the verification of the HACCP-system - and not for official control purposes. (C) 1997 Elsevier Science Ltd

General information
State: Published
Organisations: National Institute of Aquatic Resources
Authors: Huss, H. H. (Intern)
Pages: 91-98
Publication date: 1997
Importance of Photobacterium phosphoreum in relation to spoilage of modified atmosphere-packed fish products

Occurrence and growth of Photobacterium phosphoreum were studied in 20 experiments with fresh fish from Denmark, Iceland and Greece. The organism was detected in all marine fish species but not in fish from fresh water. Growth of P. phosphoreum to high levels (>10^7 cfu g^-1) was observed in most products and the organism is likely to be of importance for spoilage of several modified atmosphere-packed (MAP) marine fish species when stored at chill temperatures. Some microbiological methods recommended for control of fish products by national and international authorities are inappropriate for detection of psychrotolerant and heat-labile micro-organisms like P. phosphoreum. These methods have been used in many previous studies of MAP fish and this could explain why, contrary to the findings in the present study, P. phosphoreum in general was not detected previously in spoiled MAP fish.
Inhibition of *Listeria monocytogenes* on cold-smoked salmon by nisin and carbon dioxide atmosphere

The bacteriostatic and bactericidal effect of nisin in combination with carbon dioxide, NaCl and low temperature on the survival of *Listeria monocytogenes* was investigated in in vitro model studies and in trials with cold-smoked salmon. Addition of nisin caused various degrees of inhibition and sometimes death of *L. monocytogenes* in model experiments performed at 10 degrees C. The antilisterial effect of nisin was improved in the presence of 100% CO2 and increasing NaCl concentrations (0.5 to 5.0% w/v). Minimal bactericidal concentrations (MBC) of nisin varied from 30 to more than 500 IU/ml. The most pronounced effect of nisin was found when 10(2) cfu/ml was grown in media with 5.0% NaCl and incubated in CO2 atmosphere (MBC = 30 IU/ml). The bactericidal effect of nisin was reduced in air and vacuum, and did not increase systematically with increasing NaCl concentrations. In general, nisin concentration less than or equal to 50 IU/ml resulted in the survival and growth of *L. monocytogenes* in all combinations with other preservatives (NaCl, CO2). Addition of nisin (500 or 1000 IU/g) to cold-smoked salmon inoculated with *L. monocytogenes* and stored at 5 degrees C delayed, but did not prevent growth of *L. monocytogenes* in vacuum-packs. Numbers of *L. monocytogenes* increased to 10(8) cfu/g in vacuum packed cold-smoked salmon in 8 days, whereas CO2 packing of cold-smoked salmon resulted in an 8-day lag phase of *L. monocytogenes*, with numbers eventually reaching 10(6) cfu/g in 27 days. Addition of nisin to CO2 packed cold-smoked salmon resulted in a 1 to 2 log reduction of *L. monocytogenes* followed by a lag phase of 8 and 20 days in salmon with 500 and 1000 IU nisin/g, respectively. The levels of *L. monocytogenes* remained below 10(3) cfu/g during 27 days of storage at both concentrations of nisin. (C) 1997 Elsevier Science B.V.

**General information**

State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquatic Microbiology and Seafood Hygiene
Authors: Nilsson, L. (Intern), Huss, H. H. (Intern), Gram, L. (Intern)
Pages: 217-227
Publication date: 1997
Main Research Area: Technical/natural sciences

**Publication information**

Journal: International Journal of Food Microbiology
Volume: 38
Issue number: 2-3
ISSN (Print): 0168-1605
Ratings:
BFI (2018): BFI-level 2  
Web of Science (2018): Indexed yes  
BFI (2017): BFI-level 2  
Scopus rating (2017): CiteScore 3.76 SJR 1.366 SNIP 1.436  
Web of Science (2017): Indexed yes  
BFI (2016): BFI-level 2  
Scopus rating (2016): CiteScore 3.97 SJR 1.481 SNIP 1.553  
Web of Science (2016): Indexed yes  
BFI (2015): BFI-level 2  
Scopus rating (2015): SJR 1.614 SNIP 1.683 CiteScore 4.02
Mathematical modeling used for evaluation and prediction of microbial fish spoilage

General information
State: Published
Organisations: Section for Aquatic Microbiology and Seafood Hygiene, National Institute of Aquatic Resources
Authors: Dalgaard, P. (Intern), Huss, H. H. (Intern)
Pages: 73-89
Publication date: 1997
Microbiology of fish and fish products

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquatic Microbiology and Seafood Hygiene
Authors: Huss, H. H. (Intern), Dalgaard, P. (Intern), Gram, L. (Intern)
Pages: 413-430
Publication date: 1997

Occurrence of Listeria spp. in farmed salmon and during subsequent slaughter: Comparison of listertest TM lift and the USDA method
Salmon and environmental samples from a fish farm and a salmon slaughterhouse were analysed for Listeria spp. using the USDA method and the rapid quantitative Listertest(TM). Listeria spp. were not detected in any of 119 samples analysed. However, Corynebacterium spp. gave disturbing false-positive results with the USDA method. (C) 1997 Academic Press Limited.
Predicting shelf life in fish and meat products

General information
State: Published
Organisations: National Institute of Aquatic Resources
Authors: Huss, H. H. (Intern)
Publication date: 1997
Main Research Area: Technical/natural sciences

Publication information
Original language: English
Source: orbit
Source-ID: 166129

State: Published
Organisations: National Institute of Aquatic Resources
Authors: Huss, H. H. (Intern)
Publication date: 1997
Main Research Area: Technical/natural sciences

Publication information
Original language: English
Source: orbit
Source-ID: 225830
Conductance method for quantitative determination of Photobacterium phosphoreum in fish products

This paper presents the development of a sensitive and selective conductance method for quantitative determination of Photobacterium phosphoreum in fresh fish. A calibration curve with a correlation coefficient of -0.981 was established from conductance detection times (DT) for estimation of cell levels. Less than 50 cells g\(^{-1}\) of fish could be detected in less than 45 h. The selectivity of the method in relation to other Photobacteria or other bacteria isolated from spoiled fish was good. DTs for 10-100 cfu ml\(^{-1}\) of P. phosphoreum were shorter than DTs for 10^6 cells ml\(^{-1}\) of the other organisms tested. In naturally contaminated fresh fish, P. phosphoreum was specifically enumerated when it made up 0.1% of the total level of micro-organisms. The repeatability (S.D.%) of the conductance assay ranged from 2.9% to 7.3%

General information
State: Published
Organisations: Section for Aquatic Microbiology and Seafood Hygiene, National Institute of Aquatic Resources
Authors: Dalgaard, P. (Intern), Mejlholm, O. (Intern), Huss, H. H. (Intern)
Pages: 57-64
Publication date: 1996
Main Research Area: Technical/natural sciences

Journal: Journal of Bacteriology
Volume: 81
Issue number: 1
ISSN (Print): 0021-9193
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.94 SJR 1.885 SNIP 0.903
Web of Science (2017): Indexed yes
Growth of the fish parasite Ichthyophonus hoferi under food relevant conditions

The physical and chemical limits for growth of the internal fish parasite, Ichthyophonus hoferi, have been studied to understand better the ecology of I. hoferi both as a possible food contaminant and a fish pathogen. The effect of temperature (0 degrees-30 degrees C), pH (3-7) and NaCl (0%-10%w/v) on growth were tested in a multi-factorial experiment. Growth was observed at all pH-values, from 0 degrees to 25 degrees C and from 0% to 6% NaCl. No
significant differences (P > 0.05) were detected in the growth ability in the temperature range 0 degrees-25 degrees C and from pH 3 to 7. However, increasing the concentration of NaCl significantly decreased the growth of I. hoferi and it is therefore unlikely that I. hoferi will develop and spoil processed products (pickled or salted herring) by continued growth. Hyphal growth could be initiated by incubating spores under CO2, and this may be a potential problem in gas packed fish products.

**General information**

State: Published
Organisations: National Institute of Aquatic Resources
Authors: Spanggaard, B. (Intern), Huss, H. H. (Intern)
Pages: 427-432
Publication date: 1996
Main Research Area: Technical/natural sciences

**Publication information**

Journal: International Journal of Food Science and Technology
Volume: 31
Issue number: 5
ISSN (Print): 0950-5423
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.36
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.89
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.67
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.65
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.65
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.47
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.51
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Web of Science (2007): Indexed yes
Web of Science (2001): Indexed yes
Web of Science (2000): Indexed yes
Original language: English
Source: orbit
Source-ID: 227470
Publication: Research - peer-review › Journal article – Annual report year: 1996
Importance of autolysis and microbiological activity on quality of cold-smoked salmon

General information
State: Published
Organisations: National Institute of Aquatic Resources
Authors: Hansen, L. T. (Intern), Gill, T. (Ekstern), Drewes Røntved, S. (Ekstern), Huss, H. H. (Intern)
Pages: 181-188
Publication date: 1996
Main Research Area: Technical/natural sciences

Publication information
Journal: Food Research International
Volume: 29
ISSN (Print): 0963-9969
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 3.9 SJR 1.472 SNIP 1.467
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.87 SJR 1.612 SNIP 1.675
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.508 SNIP 1.629 CiteScore 3.66
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.487 SNIP 1.751 CiteScore 3.52
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.526 SNIP 1.802 CiteScore 3.68
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.563 SNIP 1.775 CiteScore 3.31
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.521 SNIP 1.697 CiteScore 3.42
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.365 SNIP 1.426
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.487 SNIP 1.522
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.29 SNIP 1.43
Scopus rating (2007): SJR 1.271 SNIP 1.671
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.018 SNIP 1.299
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.798 SNIP 1.338
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.846 SNIP 1.191
Web of Science (2004): Indexed yes
Microbiological safety of seafoods

General information
State: Published
Organisations: National Institute of Aquatic Resources
Authors: Huss, H. H. (Intern)
Pages: 175-187
Publication date: 1996

Host publication information
Title of host publication: Microbiology of food and cosmetics in Europe. The European Union’s innovative policy against food-transmitted diseases. Proceedings of Fifth International Symposium Milan, 24-25 October 1995
Editors: Marengo, G., Pastoni, F.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 225828
Publication: Research - Book chapter – Annual report year: 1996

Microbiological spoilage of fish and fish products
Spoilage of fresh and lightly preserved fish products is caused by microbial action. This paper reviews the current knowledge in terms of the microbiology of fish and fish products with particular emphasis on identification of specific spoilage bacteria and the qualitative and quantitative biochemical indicators of spoilage. Shewanella putrefaciens and Pseudomonas spp. are the specific spoilage bacteria of iced fresh fish regardless of the origin of the fish. Modified atmosphere stored marine fish from temperate waters are spoiled by the CO2 resistant Photobacterium phosphoreum whereas Gram- positive bacteria are likely spoilers of CO2 packed fish from fresh or tropical waters. Fish products with high salt contents may spoil due to growth of halophilic bacteria (salted fish) or growth of anaerobic bacteria and yeasts (barrel salted fish). Whilst the spoilage of fresh and highly salted fish is well understood, much less is known about spoilage of lightly preserved fish products. It is concluded that the spoilage is probably caused by lactic acid bacteria, certain psychrotrophic Enterobacteriaceae and/or Photobacterium phosphoreum. However, more work is needed in this area

General information
State: Published
Organisations: Section for Aquatic Microbiology and Seafood Hygiene, National Institute of Aquatic Resources
Authors: Gram, L. (Intern), Huss, H. H. (Intern)
Pages: 121-137
Publication date: 1996
Main Research Area: Technical/natural sciences

Publication information
Journal: International Journal of Food Microbiology
Volume: 33
Issue number: 1
ISSN (Print): 0168-1605
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 3.76 SJR 1.366 SNIP 1.436
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Suitability of Lactococcus lactis subsp lactis ATCC 11454 as a protective culture for lightly preserved fish products

This study is part of strategy to control the human pathogen Listeria monocytogenes in lightly preserved fish products by using food-grade lactic acid bacteria. When the nisin-producing Lactococcus lactis subsp lactis ATCC 11454 was cultured in the same vessel as L-monocytogenes Scott A in brain-heart infusion broth (BHI) at 30-degrees C, the pathogen declined from 5x10(5) to fewer than 5 cfu ml(-1) within 31 h. The effect was not due to lactic acid inhibition. Growth and nisin production by L-lactis ATCC 11454 were investigated under the conditions of temperature and salt used for light preservation. At 5-degrees C in M17 broth, the organism grew well and produced nisin. In an infusion of cold-smoked salmon the organism did not grow at 5-degrees C, although it did at 10-degrees C. NaCl up to 4% allowed for efficient growth and nisin production, while 5% NaCl resulted in very slow growth and no detectable nisin. On slices of commercial cold-smoked salmon at 10-degrees C, no net propagation of L-lactis ATCC 11454 could be detected within 21 days. However, when salmon slices were inoculated with L-monocytogenes at 10(4) cfu g(-1) and a 300-fold excess of washed lactococcus cells, the pathogen’s population declined a half log the first 1-5 days, then increased at a rate slightly lower than that of the control not inoculated with the lactococcus.
### General Information

**State:** Published  
**Organisations:** National Institute of Aquatic Resources  
**Authors:** Dalsgaard, A. (Ekstern), Echeverria, P. (Ekstern), Larsen, J. (Ekstern), Siebling, R. (Ekstern), Serichantalergs, O. (Ekstern), Huss, H. H. (Intern)  
**Pages:** 245-251  
**Publication date:** 1995  
**Main Research Area:** Technical/natural sciences

### Publication Information

**Journal:** Applied and Environmental Microbiology  
**Volume:** 61  
**ISSN (Print):** 0099-2240  
**Ratings:**  
BFI (2018): BFI-level 2

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**Application of ribotyping for differentiating Vibrio cholerae Non-O1 isolated from shrimp farms in Thailand**

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**Original language:** English  
**Source:** orbit  
**Source-ID:** 227778  
**Publication: Research - peer-review › Journal article – Annual report year: 1996**
Biopreservation of fish products - A review of recent approaches and results

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquatic Microbiology and Seafood Hygiene
Authors: Huss, H. H. (Intern), Jeppesen, V. (Ekstern), Johansen, C. (Intern), Gram, L. (Intern)
Pages: 5-26
Publication date: 1995
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Aquatic Food Product Technology
Volume: 4
Issue number: 2
ISSN (Print): 1049-8850
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 0.386 SJR 0.309 CiteScore 0.64
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.59 SJR 0.266 SNIP 0.611
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.293 SNIP 0.621 CiteScore 0.65
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.273 SNIP 0.638 CiteScore 0.62
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.279 SNIP 0.548 CiteScore 0.59
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.419 SNIP 0.538 CiteScore 0.64
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.384 SNIP 0.62 CiteScore 0.68
ISI indexed (2011): ISI indexed no
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.294 SNIP 0.485
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.207 SNIP 0.209
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.199 SNIP 0
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.259 SNIP 0.467
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.22 SNIP 0.764
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.203 SNIP 0
Web of Science (2005): Indexed yes
Control of biological hazards in cold smoked salmon production

An outline of the common processing technology for cold smoked salmon in Denmark is presented. The safety hazards related to pathogenic bacteria, parasites and biogenic amines are discussed with special emphasis on hazards related to Clostridium botulinum and Listeria monocytogenes. Critical control points are identified for all hazards except growth of L. monocytogenes. For this reason a limitation of shelf life to three weeks at +5 degrees C far cold smoked vacuum-packed salmon having greater than or equal to 3% water phase salt is recommended.

General information
State: Published
Organisations: National Institute of Aquatic Resources
Authors: Huss, H. H. (Intern), Embarek, P. K. B. (Intern), Jeppesen, V. (Ekstern)
Pages: 335-340
Publication date: 1995
Main Research Area: Technical/natural sciences

Publication information
Journal: Food Control
Volume: 6
Issue number: 6
ISSN (Print): 0956-7135
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 4.06 SJR 1.502 SNIP 1.69
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.86 SJR 1.492 SNIP 1.709
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.498 SNIP 1.73 CiteScore 3.65
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.38 SNIP 1.717 CiteScore 3.27
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.278 SNIP 1.728 CiteScore 3.14
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.245 SNIP 1.931 CiteScore 3.1
ISI indexed (2012): ISI indexed yes
Effects of salt and storage temperature on chemical microbiological and sensory changes in cold-smoked salmon

General information
State: Published
Organisations: National Institute of Aquatic Resources
Authors: Hansen, L. T. (Intern), Gill, T. (Ekstern), Huss, H. H. (Intern)
Pages: 123-130
Publication date: 1995
Main Research Area: Technical/natural sciences

Publication information
Journal: Food Research International
Volume: 28
Issue number: 2
ISSN (Print): 0963-9969
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 3.9 SJR 1.472 SNIP 1.467
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.87 SJR 1.612 SNIP 1.675
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.508 SNIP 1.629 CiteScore 3.66
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.487 SNIP 1.751 CiteScore 3.52
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.526 SNIP 1.802 CiteScore 3.68
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.563 SNIP 1.775 CiteScore 3.31
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.521 SNIP 1.697 CiteScore 3.42
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.365 SNIP 1.426
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.487 SNIP 1.522
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.29 SNIP 1.43
Scopus rating (2007): SJR 1.271 SNIP 1.671
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.018 SNIP 1.299
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.798 SNIP 1.338
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.846 SNIP 1.191
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.665 SNIP 1.095
Scopus rating (2002): SJR 0.714 SNIP 1.11
Scopus rating (2001): SJR 0.625 SNIP 0.801
Scopus rating (2000): SJR 0.615 SNIP 0.636
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 0.581 SNIP 0.647

Original language: English

Bibliographical note
J English Article QX125 HANSEN LT TECH UNIV DENMARK, DANISH MINIST FISHERIES, TECHNOL LAB, BLDG 221, DK-2800 LYNGBY, DENMARK FOOD RES INT
Source: orbit
Source-ID: 225627
Publication: Research - peer-review › Journal article – Annual report year: 1995

Globalization of fish products and processing standards: A microbiologist's point of view

General information
State: Published
Organisations: National Institute of Aquatic Resources
Authors: Huss, H. H. (Intern)
Pages: 15-20
Publication date: 1995
Main Research Area: Technical/natural sciences
Morphology of Ichthyophonus hoferi assessed by light and scanning electron microscopy

The morphology of Ichthyophonus hoferi in vitro at pH 3.5 and 7.0 is described using light and scanning electron microscopy. Only vegetative growth was observed. At pH 3.5, hyphal growth was seen. The hyphae of I. hoferi are characterized by evacuated hyphal walls with the cytoplasm migrating to the apex and no septation. In contrast, the growth at pH 7.0 is mainly seen as spherical bodies which vary in size and are uni- to multinucleate. Amoeboid bodies showing slow movements were observed within 3-6 h of transfer to pH 7.0. We propose a life-cycle involving the germination of thick-walled multinucleate spores in the fish stomach as a response to the low pH. The hyphae then penetrate the digestive tract and rupture when they reach a blood vessel (neutral pH), whereby uni- and binucleate bodies and/or amoeboid bodies are released. The small cells are transported in the blood vessels and spread in the organs richly supplied with blood (heart, kidney, spleen, liver and muscle tissue) where they grow to form multinucleate spores.
Prevalence of Vibrio cholerae and Salmonella in a major shrimp production area in Thailand

General information
State: Published
Organisations: National Institute of Aquatic Resources
Authors: Dalsgaard, A. (Ekstern), Huss, H. H. (Intern), H-Kittikun, A. (Ekstern), Larsen, J. (Ekstern)
Pages: 101-113
Publication date: 1995
Main Research Area: Technical/natural sciences

Publication information
Journal: International Journal of Food Microbiology
Volume: 28
Issue number: 1
ISSN (Print): 0168-1605
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 3.76 SJR 1.366 SNIP 1.436
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.97 SJR 1.481 SNIP 1.553
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.614 SNIP 1.683 CiteScore 4.02
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.493 SNIP 1.695 CiteScore 3.62
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.612 SNIP 1.841 CiteScore 3.8
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.603 SNIP 1.705 CiteScore 3.7
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.607 SNIP 1.713 CiteScore 3.63
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.61 SNIP 1.666
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.475 SNIP 1.539
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.442 SNIP 1.509
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.349 SNIP 1.692
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.541 SNIP 1.788
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.511 SNIP 1.834
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.502 SNIP 1.638
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.233 SNIP 1.612
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.226 SNIP 1.289
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.031 SNIP 1.506
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 1.043 SNIP 1.306
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 1.071 SNIP 1.2
Original language: English
Source: orbit
Source-ID: 225833
Publication: Research › Report – Annual report year: 1995

Quality and quality changes in fresh fish

General information
State: Published
Organisations: National Institute of Aquatic Resources
Authors: Huss, H. H. (Intern)
Number of pages: 195
Publication date: 1995

Publication information
Place of publication: Rome
Publisher: FAO
Original language: English
Series: FAO Fisheries Technical Paper
Number: 348
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 225217
Publication: Research - peer-review › Journal article – Annual report year: 1995
Survival of Anisakis larvae in marinated herring fillets

General information
State: Published
Organisations: National Institute of Aquatic Resources
Authors: Karl, H. (Ekstern), Roepstorff, A. (Ekstern), Huss, H. H. (Intern), Bloemsma, B. (Ekstern)
Pages: 661-670
Publication date: 1994
Main Research Area: Technical/natural sciences

Publication information
Journal: International Journal of Food Science and Technology
Volume: 29
Issue number: 6
ISSN (Print): 0950-5423
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.36
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.89
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.67
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.65
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.65
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.47
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.51
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Web of Science (2007): Indexed yes
Web of Science (2001): Indexed yes
Web of Science (2000): Indexed yes
Original language: English
Source: orbit
Source-ID: 226173
Publication: Research - peer-review › Journal article – Annual report year: 1995

Projects:

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

Lightly salted lumpfish roe. Composition, spoilage, safety and preservation
Traditional caviar products are often heavily salted and further preserved by addition of chemical preservatives. This industrial Ph.D. project has studied the problems associated with reducing the salt content and eliminating the chemical preservatives from the product. It was shown that Lactic Acid Bacteria (LAB) dominated the microbial flora after three months of storage at plus 5°C of this lightly salted product (approx. 4% water phase salt (WPS)), but also Enterobacteriaceae was found in high numbers, particularly when WPS was lower than 4%. A number of chemical indicators of spoilage were analysed, but only volatile sulphur compounds were related to sensory spoilage. The presence and growth of Listeria monocytogenes was identified as a possible health hazard. Experiments with biopreservation were unsuccessful, but the use of 2.8% (w/w) sodium lactate was found to be a possible alternative.

National Institute of Aquatic Resources
Abba Seafood A/S

Improved utilization of low-value fish
The specific objectives of this project were in three areas: 1. To examine and adapt traditional Asian preservation technologies for fish products. 2. To investigate and optimise the fermentation process used in traditional Asian fish products. 3. To study the composition and stability of lipids from low-value fish species. The results have identified potential new use of a large number of low-value fish species. The properties of Lactic Acid Bacteria (LAB) isolated from low salt fermented products have been studied and the capacity to ferment inulin from garlic was found to be an important criteria for selection of starter cultures, since garlic is added to most low-salt fermented products. The fatty acid profile from a great number of tropical fish has been determined. The stability of fish oil and the potential of spices as antioxidans has also been investigated.

National Institute of Aquatic Resources
Indian Council of Agricultural Research
Slipi Research Station for Marine Fisheries
**Biological and technological significance of the fish parasite Ichthyophonus hoferi**

In 1991 an epizootic of ichtyophoniasis in herring was recorded for the first time in waters around Denmark and Norway causing mass mortality. This Ph.D. study demonstrates how continuously successful subculturing of Ichthyophonus hoferi is possible only at alternating pH (between pH 3-4 and pH7). The morphology of I. hoferi at pH 3.5 and 7.0 was studied using light and scanning electron microscopy. At pH 3.5 only hyphal growth was seen while only growth of uni-to multinucleate spherical bodies was seen at pH 7. These findings were used to explain the lifecycle of this parasite. The phylogenetic position of the genus Ichthyophonus was investigated using a combination of molecular analysis of the genomic DNA encoding the small subunit ribosomal RNA, ultra-structural features and biochemical data. These studies indicated that I. hoferi is not a member of the Fungi, but belongs to the protist Kingdom. Feeding experiments with mice showed that I. hoferi is not a pathogen in mammals. However, the technological significance of I. hoferi infected fish fillets entering processing is severe due to soft texture, unfavourable flavour changes and discolorations of the fish products.