



Confidential

Review of USB FFPW PhD Thesis

First name(s), surname, titles of the PhD student: Nima Hematyar, M.Sc.	First name(s), surname, titles of supervisor: Assoc. Prof. Dipl.-Ing. Jan Mráz, Ph.D.
Title of PhD thesis: Protein and lipid oxidation in fish: pathways, kinetics, products	
REVIEWER:	
Surname: Picková	Institution: Department of Molecular Sciences Swedish University of Agricultural Research Uppsala Sweden
Name: Jana	E-mail: jana.pickova@slu.se
Titles: prof.	
Please describe your professional relationship to the PhD student:	Please describe your field of expertise:

QUESTIONNAIRE

Originality, scientific importance, perspectives and impacts of results presented in the PhD thesis for basic and/or applied research

Evaluate competitiveness of the PhD thesis in the international context and compare its level with the current state of the art in the field (**extent ¼ – ½ page**):

The thesis is of relevance for the scientific field and more work is needed. The thesis is of international level of thesis in the field of food science and food quality. The papers are published in relevant international peer reviewed journals of high quality within the field. The scientific rational is high and the perspectives of the work in further applications is high. The scientific impact of the thesis work is very good. The fair mixture of basic/applied reserach in the presented thesis is interesting and needed. The theeoretical approach to the subject is very good and has some excellent findings.

Elaboration of the PhD thesis, objectives of the work and deliverables

Evaluate the overall level of elaboration of the PhD thesis (structuring of the main text, comprehensibility, logicity of the chapters and their ordering) and the originality of the selected approaches to solve the objectives; evaluate publications and whether the results described correspond to objectives of the PhD thesis (**extent ¼ – ½ page**):



The overall level of elaboration of the PhD thesis (structuring of the main text, comprehensibility, logicity of the chapters and their ordering) is very good. Originality of the selected approaches to solve the objectives are correct and well described. Publications are in the concept of the thesis justified and well written and the results described these correspond to objectives of the PhD thesis. Overall the results are interesting and the subject in general is in need of investigations. Right in time work.

OVERALL COMMENTARY ON THE PhD THESIS

Please write comments in extent of 1-2 pages:

Thank you for the opponent job on this thesis. It has been very valuable for me.

The thesis introduction is good, the English could be improved but does not make it difficult to understand the scientific findings and rationales.

The overall level of elaboration of the PhD thesis (structuring of the main text, comprehensibility, logicity of the chapters and their ordering) is very good. Originality of the selected approaches to solve the objectives are correct and well described. Publications are in the concept of the thesis justified and well written and the results described these correspond to objectives of the PhD thesis. Overall the results are interesting and the subject in general is in need of investigations. Right in time work.

This study investigated some chemical and physical methods for evaluating the fish muscle quality during long and short-term storage. The possible mechanisms and pathways of lipid-protein interactions and their influence on the final flesh quality was assessed. The evaluation of fish muscle quality was done in relation to effects on lipid and protein oxidation, fatty acid composition, colour, textural parameters, and protein changes by proteomic analyses. TBARS and PV were used as markers of lipid oxidation and carbonyls respectively, which indicates protein oxidation degree. In addition, firmness and liquid loss were analysed as indicators for fish muscle quality. The thesis contains a clear presentation of methods applied in freshness studies in fish. They seem to be well interpreted and the results are interesting and important.

On page 6, :On the other hand, to ensure that fish product quality and nutritional value are retained during production and storage, it is important to have insight into specific post-mortem changes happening in fish muscle. This sentence is partly misleading as it can be interpreted that post mortem changes are studied in fish muscle and also processed ready to eat fish products. Please make this more clear to make the understanding easier. In regard to the sensory quality in paper 2, this should be mentioned separately. Sensory quality was assessed in paper 2 ? chapter... ?

All analyses (except part of study 2) were performed on fresh/stored raw fish muscle, except the one sensory study together with raw quality. This could be highlighted better by including this wording into the objective of the thesis (p 10, last paragraph). This paragraph contains several measured compounds and several instrumentations. I suggest this is elaborated and divided to compounds and respectively method.

The studies are performed together with international co-authors and collaborators, which is an



excellent sign of outreach in the scientific community.

The importance of the different papers is good and the overall impression of the thesis is very good. I can only recommend that Nima is defending his thesis as planned.

FINAL RECOMMENDATION

- xx ☒ PhD Thesis can be recommended for defence
☐ PhD Thesis can be recommended with reservations for defence
☐ PhD Thesis can not be recommended for defence

Lysekil, 2019-07-01

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Date and place

Jana Pickova

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Name and signature

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First name(s), surname, titles of the PhD student: Nima Hematyar, M.Sc.	First name(s), surname, titles of supervisor: Assoc. Prof. Dipl.-Ing. Jan Mráz, Ph.D.
Title of PhD thesis: Protein and lipid oxidation in fish: pathways, kinetics, products	

REVIEWER:

Surname: Hajšlová	Institution: Ústav analýzy potravin a výživy (Department of Food Analysis and Nutrition) VŠCHT Praha (University of Chemistry and Technology, Prague)
Name: Jana	E-mail: jana.hajslova@vscht.cz
Titles: prof. Ing., CSc.	
Please describe your professional relationship to the PhD student: none	Please describe your field of expertise: Food chemistry and analysis, food safety, nutrition

QUESTIONNAIRE

Originality, scientific importance, perspectives and impacts of results presented in the PhD thesis for basic and/or applied research

The research performed within Mr. Hematyar's doctoral studies was focused on a very comprehensive problem, as protein and lipid oxidation occurring in fish muscle during storage are affected by multiple factors and number of reactions, largely differing in their pathways, takes place. These processes are of high concern, since oxidation results in a deterioration of both nutritive value and sensorial properties, specifically flavour and texture are impacted. As documented in this PhD thesis, the extent of oxidation alike the rate of adverse effects development are species-dependent, the content of polyunsaturated fatty acids, compounds highly prone to oxidation, being one of the key factors. In this context, an important information on a relatively good stability of common carp filets during 6 month storage at freezer was obtained in the first study. A more in-depth insight into the protein-lipid interactions induced by reactive oxygen species was provided by the second, proteomics-based study, which was performed on Eurasian perch filets stored at the same conditions. Interestingly, some relationship between fish rearing system and character of proteome changes was documented in this study. The last experimental study extended the research on Eurasian perch from different rearing systems, in this case, attention was paid to post-mortem quality changes in fish filets.

Worth to notice that the experimental research conducted within this thesis has generated authentic results, interesting both from theoretical point of view and practical application perspective.



Elaboration of the PhD thesis, objectives of the work and deliverables

The thesis is elaborated at a professional level, with a well-structured main text. In the first introductory Chapter 1, the subject of PhD student's research is introduced in a comprehensive way, a large number of references including the recent ones is quoted. Based on the critical analysis of the state-of-the-art in the field of interest and identification of existing gaps, six specific objectives are determined at the end of this chapter. Chapter 2 presents a review paper on a lipid and protein oxidation in fish, i.e. on the phenomenon which was investigated within experimental work. This paper is the outcome of PhD student's research stay in Denmark. The second published paper and two other manuscripts presenting the results of particular case studies are introduced in the next Chapters 3, 4 and 5. Chapter 6 involves the general discussion and research summaries, some key information about the author of this thesis are attached here, too. Besides of a well established laboratory approaches also advanced analytical strategy based on application of modern instrumentation (MALDI-TOF MS) were employed in experiments. In overall, it can be concluded that the presented results correspond to the objectives of the PhD thesis.

OVERALL COMMENTARY ON THE PhD THESIS

The history of a unique Czech fish pond aquaculture dates back to the 11th century. Nowadays, the production of carp (*Cyprinus carpio*), the main reared fish, is rapidly growing. The high demand for a 'healthy' food commodity, is associated with the need to support science-based intensification of fish production and further improvement of its processing / storage practices. Recently, 'South Bohemian Research Centre of Aquaculture and Biodiversity of Hydrocenoses' (CENAKVA) has been established in Vodňany, University of South Bohemia in České Budějovice, Faculty of Fisheries and Protection of Waters. This thesis has been performed within one of the running multidisciplinary research programs 'Sustainable aquaculture with a responsible water and nutrient management' chaired by PhD student's current supervisor. Attention was paid to mechanisms and products formed during lipid and protein oxidation processes that may result in a poor quality of frozen fish filets after a longer storage period. Changes of parameters impacting sensorial and nutritive quality were monitored within kinetic measurements of carp filet samples stored in freezer. Recommendation regarding maximum storage time, i.e. information enabling to guarantee a good quality of filets is undoubtedly an important research outcome applicable in practice. Another information important for a future choice and development of rearing strategies was obtained by assessment of muscle quality (firmness and liquid loss) of frozen muscle of Eurasian perch (*Perca fluviatilis* L.) from pond and recirculating aquaculture system. In the latter case, more cross-linked proteins were present what might influence their digestibility.

The future strategies and research tools in Czech aquaculture should be discussed during thesis defence. Following topics are suggested for PhD student's consideration.

- Besides of proteomics used in one of studies, mostly 'classic', some of them rather obsolete, analytical methods were used for frozen filets quality evaluation. The potential of other omics, such as lipidomics, that might provide more detailed information on changes occurring in filets due to oxidation should be mentioned.



- The example of feeding stuff that could contribute to a reduction of oxidation processes due to increase of antioxidants content in fish filets could be given.
- The storage stability of 'omega carps' could be compared with conventional ones.

Summary:

PhD candidate has published three papers in peer reviewed journals with IF (two of them are presented in this thesis), two manuscripts prepared for publishing. The choice of journals with a higher IF is proposed.

The research performed within this doctoral work was also presented on occasion of international conferences, abstracts were published in respective proceedings. To support PhD student's international networking, two research stays, first at the Department of Food Science, Faculty of Science and Technology, Aarhus University, Denmark and second in the Norwegian Institute of Food, Fisheries and Aquaculture Research, Nofima, in Ås, Norway, were organized by University.

Conclusion:

The author of the thesis has proved his ability to perform research and to achieve scientific results. I recommend the thesis for presentation with the aim of receiving the Degree of Ph.D.

Cience-based intensification of

FINAL RECOMMENDATION

☒ **PhD Thesis can be recommended for defence**

☐ **PhD Thesis can be recommended with reservations for defence**

☐ **PhD Thesis can not be recommended for defence**

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Date and place

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Name and signature

