Organic meat processing- non-nitrite alternatives to conventional meat curing

Name:	Christina Elslund Adamsen
University:	The Royal Veterinary and Agricultural University, Frederiksberg, Denmark.
Department:	Department of Dairy and Food Science, section for Food Chemistry
Supervisor:	Professor Leif H. Skibsted
Period:	1/6-2003-31/5-2006
E-mail/phone:	cep[a]kvl.dk / 35 28 32 90
Master's degree:	MSc degree in Food Science and Technology/Meat Science and Technology

Background

Nitrite-cured meat products, such as common sausages and hams, obtain their colour and their resistance against rancidity as the result of the reaction between nitrite and reducing components in the muscle or added ascorbate (vitamin C) in connection with the salting process. Nitrite oxide is formed and bound to myoglobin to give the well-known red colour of cured meat, or nitrite oxide is bound to the meat proteins and act as a chain braking antioxidant [1]. When nitrite oxide is bound to meat proteins it constitutes a reservoir of relatively stable radicals, which as antioxidants seem to protect the product during storage, a protection that is important for the oxidative stability and general quality of such meat products. In the absence of antioxidants, oxidation and rancidity becomes a problem for meat during heat-treatment and storage [1]. Nevertheless, nitrite is recognized as a potential cancer hazard, consequently it is of importance to develop alternatives to nitrite-curing meat [2]. Another factor is the general interest in foods produced without any additives such as nitrite, particular in relation to organic meat processing. Normally processed organic meat products are grey because no nitrite is added and are expected to be more vulnerable to oxidation and rancidity. Notably, lipid oxidation products are potentially toxic especially on long-term intake. Colours are one of the most important factors when consumers evaluate the quality of meat and choose between different meat products in retail trade [1]. Accordingly, natural methods to make organic meat products "red" are of interest, because the pigment behind the red colour protects the meat against rancidity resulting in more stable products and because of the possible profit to the organic meat producers.

The inspiration and the idea to this project were generated during the completion of a research project where the colour of the traditionally dry-cured Parma ham was studied. Parma hams have an alternative red colour and good resistance against oxidation [3], despite the fact that only salt without any nitrite and nitrate is added. The chemistry occurring in Parma hams during salting and maturation is therefore of interest in the search of an alternative to nitrite for organic meat production.

Objective

My PhD project, which is currently in an initial phase, concerns alternative meat processing methods and has the title "Organic meat processing – an alternative to nitrite curing of meat". The overall objective of the project is to find an alternative to nitrite curing of meat and the inspiration to the project is the traditional production of the world-wide known Parma ham (a special dried ham

from Italy, Parma). Parma ham is special, since it is produced in a unique process without other ingredients than salt from the Mediterranean sea.

The project will give special focus to:

1) The nature and protective functions of pigments (which are natural colorant) formed in Parma ham (the unknown structure of the pigment is to be established).
2) Mechanism and rate of formation of Parma pigment formed in model systems based only on organic meat components.
3) Description and understanding of the reactivity and stability of the Parma-typed pigments originating only from organic meat components together with subsequent development of production methods for Parma-type hams, which could be transferred to other countries like Denmark.

Progress 2003/Plans 2004

- Collecting and structuring of literature concerning Parma ham pigment and other alternatives to nitrite-curing of meat.
- Development of a size exclusion method to separate and characterize the Parma ham pigment on a "SMART" HPLC-system.
- Optimization of a SDS-page method for separation of Parma ham pigment.
- Collaboration with Dr. Giovanni Parolari, Statione Sperimentale per lÍndustria delle Conserve Alimentari, Parma, Italy about Parma ham samples is under initiated.
- Planning experiments:
    a) Follow the pigment formation during manufacturing of Parma ham based on extraction with aqueous phosphate buffer and acetone/water and as analyzed by "SMART" HPLC and SDS-page.
    b) Follow modification of myoglobin as natural proteolytic enzymes present in muscle/meat degrade it post mortem. The fractions will be analysed by "SMART" HPLC and SDS-page.

Courses in 2003

- Fundamentals of Fresh Meat Technology, Agricultural University of Norway, June 2003, point 5 ECTS.
- Values, Ideology, Science and Organic Farming, SOAR Summer school September 2003, point 4 ECTS.
- Food Chemistry. The Royal Veterinary and Agricultural University of Denmark, autumn 2003, point 12 ECTS.

References

1. Skibsted, LH. (1192) In: Johnston DE, Knight MK, Ledward DA (eds) The chemistry of muscle-based foods. The Royal Society of Chemistry, Cambridge, UK, pp 266-286.
2. Tricker, AR & Preussmann, R. (1991) Carcinogenic N-nitrosamines in the diet: occurrence, formation, mechanism and carcinogenic potential. Mutant. Res. 259:277-289.
3. Adamsen, CE, Hansen, ML, Møller, JKS & Skibsted LH (2003). Studies on the antioxidative activity of red pigments in Italian-type dry-cured ham. Eur Food Res Technol 217:201-206