

PROJECT PROGRESS SUMMARY

1ST YEAR

TITLE OF THE PROJECT: Development and application of a TTI based Safety Monitoring and Assurance System for Chilled Meat Products

PROJECT N° : QLK1-2002-02545

ACRONYM OF THE PROJECT: TTI-MEAT SAFETY SMAS

TYPE OF CONTRACT: Research and Technology Development Project

CONTRACT N° : QLK1-2002-02545

TOTAL PROJECT COST (in euro): 2,210,597 €

EU CONTRIBUTION (in euro): 1,416,772 €

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KEYWORDS (5 maximum - Please include specific keywords that best describe the project.):
Meat, Safety, Chill chain management, TTI

World wide web address: <http://smas.chemeng.ntua.gr>

List of Participants:

- 1 National Technical University of Athens, Greece
- 2 Swedish Institute for Food & Biotechnology, Sweden
- 3 Agricultural University of Athens, Greece
- 4 National Food Center, Ireland
- 5 TNO Nutrition and Food Research Institute, The Netherlands
- 6 Institute of Food Research, UK
- 7 Creta Farm SA, Latzimas, Greece

Period covered by the progress report: 1-1-2003 to 31-12-2003

Commencement DATE : 1-1-2003

DURATION : 36 months



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LIST OF PARTICIPANTS

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Section 2: Project Progress Report

Objectives:

The main tangible goal of the SMAS project is to develop a reliable and practical decision and management tool for an optimized handling of meat products in terms of both safety and quality. The aim of this research project is to study reliable and practical Time Temperature Integrator (TTI) systems. The project will build on the scientific state of the art approach of mathematical modelling of dominating meat pathogens and translate this knowledge to TTI. TTIs will be applied as quality and safety monitors of meat products from manufacture to consumption.

The major expected achievements of the project will be:

- Accurate, validated mathematical models for safety and quality related microorganisms of ready to cook meat products. They will provide the meat industry with a tool for product development and safety assurance. The European authorities will have quantitative means for meat product risk evaluation.
- The development and study of Time Temperature Integrators (TTI) suitable for meat safety monitoring. These TTI will provide the meat industry and retail business with tools to monitor the chill chain.
- Improved distribution logistics and management of the meat chill chain from the application of the *Safety Monitoring and Assurance System (SMAS)*. SMAS could replace the current “First In First Out” (FIFO) practice and lead to risk minimization and quality optimization.
- Increased ability of the meat sector to control its weak link, the chill chain
- Fulfilment of consumer expectations that extra efforts and state of the art technology, represented by the use of TTI active labels and SMAS, have been employed to guarantee high low risk-high quality meat products.

Wide availability of state of the art information, from the project and other reliable sources (i.e. validated mathematical models for pathogen growth, data for pathogen prevalence and concentration, distribution temperature profiles, dose response data, inactivation models, TTI and SMAS application) for Risk Assessment of specific meat products, through the establishment of an effective Internet site

Results and Milestones:

Modelling and model validation for growth of meat spoilage bacteria was systematically carried out with a series of experiments on meat products. The products included pork, beef and lamb products. The growth of spoilage bacteria i.e. pseudomonads, *Brochothrix thermosphacta*, lactic acid bacteria and *Enterobacteriaceae* on products in aerobic or modified atmosphere packaging was measured. It was correlated with sensory analysis to shelf-life. The effect of temperature and/or pH of meat on the growth of the different spoilage bacteria was modelled using the appropriate equations. Models were challenged and confirmed for variable temperature conditions. The work on the microbial spoilage of meat sets the standards for the information required for the development of effective TTI for meat spoilage.

Based on the wide microbial data base that is worked out by a Participant of the project new models were developed for the effects of temperature (0-15°C) and CO₂ (0-30%) on the specific growth rate of major meat pathogens (*L. monocytogenes*, *E. coli* and *Salmonella* spp) under study. Weaknesses of these will be resolved with further experimental work.

Data on prevalence and concentration of *L. monocytogenes*, *Salmonella* and *E. coli* O157 on meat products by literature search was collected and tabulated from the participants own countries as well as worldwide. This was complemented by laboratory testing that comprised an ongoing survey on the prevalence and concentration of *Listeria*, *Salmonella* and *Escherichia coli* in ground pork and beef from the open retail market and in a variety of ready to cook products at the manufacturing level.

The ongoing work on the chill chain conditions is building a valuable database. Data showed the importance of the retail and domestic level.

The Meat Microbial Risk Assessment Site, was established and is constantly updated. It serves as a practical tool for the scientific community, meat industry, regulators, inspection authorities but also non-specialist laboratories, SME's and consumers. The site address is: <http://smas.chemeng.ntua.gr/MIRAM>. MIRAM contains published material relevant to Microbial Risk Assessment and material resulted from the SMAS project.

During the first reporting period work also focused on the development, evaluation and modelling of TTI devices that have the required response characteristics and accuracy to serve as monitors of temperature history and controllers of quality state and microbiological safety of meat products. Different designs of enzymatic Time Temperature Integrators of various kinetic characteristics were kinetically modelled and validated under variable temperature conditions. The TTI temperature sensitivity ranged in terms of activation energy values from 70 to 165 kJ/mol covering the range of kinetic behaviour of bacteria growth in meat products. In order to assess the

Overall, work during the 1st Reporting Period progressed satisfactorily and in line with the targeted milestones.

Benefits and Beneficiaries:

The SMAS project and the achieved progress and obtained results will benefit meat industry, regulators, inspection authorities but also non-specialist laboratories, SME's and consumers.

Future Actions :

Work will continue focusing on modelling growth of pathogenic on various meat products. The objective of these studies is to evaluate and express quantitatively the effect of intrinsic or extrinsic factors (e.g temperature, CO₂, pH, level of initial microflora) on microbial growth. Studies on the growth/no growth of meat pathogens as affected by temperature, CO₂, pH, inoculum size and level of initial meat microflora. Validation and improvement of existing mathematical models for meat pathogens will be achieved.

Based on the ongoing collection of microbial prevalence and concentration data and the chill chain condition information, combined with dose-response data risk assessment of specific meat products will be conducted. The established Meat Microbial Risk Assessment Site, will be enriched and constantly updated.

Further refinement of the TTI models, optimisation of their design and the development of the TTI application software will be delivered

Surveys will be conducted aiming at obtaining information on the attitude of consumers towards current food labelling and the concept and use of TTI, and the conduct of consumer surveys.