# Quality improvement of cooked brown shrimp *Crangon crangon* trough detailed kinetic studies of the major quality attributes.

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The brown shrimp (*Crangon crangon*) is in Europe amongst the top 5 species for the Dutch, German and Belgian fishery fleet and has a significant economic and social importance in the North Sea fisheries. Brown shrimp are traditionally cooked and cooled on board of the vessel by means of seawater (±3min, 80-100°C). As fishermen don't have a standard cooking process (considering cooking time, temperature and salt content), major quality differences and high yield losses can occur. Because by cooking, shelf-life is prolonged and a ready-to-eat product is created, changing the cooking parameters to optimize yield, holds the risk of losing other quality attributes. In this study, the thermal inactivation kinetics of the most important spoilage enzymes, proteases and polyphenoloxidase (PPO), were determined. The doneness of the product was determined by observing the heat-induced denaturation of muscle proteins. The denaturation kinetics of the muscle proteins were determined and protein stability was compared to cook loss and protein loss.

Enzyme inactivation kinetics and protein denaturation kinetics were determined by isothermal heating of enzyme extracts and muscle tissue, respectively. Cook loss and protein loss was determined by heating intact shrimp. Next to treatment time and temperature, influence of the salt content was determined on protein denaturation, cook loss and protein loss.

Enzyme activity was measured by adding the treated extracts to a substrate and by measuring the reaction products spectrophotometrically. Muscle protein denaturation was studied by differential scanning calorimetry (DSC), only actin was considered as most heat stable muscle protein. Cook loss will be determined by measuring mass differences and protein content will be determined according to the Kjeldahl method.

Both enzymes and muscle protein decay could be described by a first order model. The decimal reduction time for PPO was the lowest, indicating its low thermostability. For proteases, two stability fractions were found. Only actin denaturation was considered as it was the most heat stable muscle protein. All kinetic data show that, at high temperatures, proteolytic enzymes will be the most important boundary condition for further process optimization. Preliminary results show high cook losses when with increasing salt contents and cooking times.

The kinetic data presented, show that cooking parameters used by processors are higher than necessary for sufficient inactivation of proteases and PPO as well as for actin denaturation. For further process optimization, protease inactivation can be used as a boundary condition, reducing the total heat load of the process. In this way unnecessary yield losses can be avoided.

Key words: Quality, shrimp, enzymes, proteins, yield