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**Frosch, Stina; Pedersen, Søren Juhl; Feyissa, Aberham Hailu**

*Published in:*
TAFT 2015 - Program Book

*Publication date:*
2015

*Document Version*
Publisher's PDF, also known as Version of record

# TAFT 2015

5th Trans-Atlantic Fisheries
Technology conference
(45th WEFTA meeting)

# Program Book

# Investigation of ohmic heating for seafood processing

Presenting author: Stina Frosch

Co-authors: Søren Juhl Pedersen, Aberham Hailu Feyissa

National Food Institute, Division of Food Technology, Technical University of Denmark, Søltofts Plads 227, DK-2800 Lyngby, Denmark

Steam cooking is one of the main process steps in production of cooked shrimps. The natural variation in size and composition of shrimps within one batch pose a challenge to the traditional cooking process, as the small shrimps are overcooked to comply with legislation for the big shrimps. In short, the traditional thermal processing is far from optimal when treating food pieces of varying size in the same batch. Ohmic heating (OH) is one of the technologies potentially solving this problem by allowing volumetric heating of the product and thereby reducing or eliminating the effect of size. The application of OH has been studied for a wide range of foods (Kaur & Singh, 2015; Knirsch et al. 2010; Sastry, 2008; Vargheseet al. 2012). However, the research in relation to seafood processing is sparse and restricted to the use of OH for thawing of shrimps (Roberts et al. 1996). In this study the effect of different process parameters during OH of shrimps has been investigated. The measured responses were: 1) the heating time until the set core temperature (72 $^{o}$C) of the shrimps were reached, 2) weight loss and 3) texture profile.

A batch ohmic heater was used for the experments which was built by BCH ltd. (UK). The OH unit consists of a holding cell with variable size adjustment and mountings for temperature loggers. Raw frozen shrimps (*Pandalus Borelias)* were supplied by Royal Greenland A/S (DK). Different mass ratios (mass of shrimps/mass of water) were used. The shrimps were cooked in brine with varying salt conc. and at different voltages, and the time to reach a core temperature of 72 °C were measured. Texture profile analysis and press juice (PJ) were performed with a Texture Analyzer XT.Plus (Stable Micro Systems Ltd. UK). The yield was calculated as the difference of the weight of the shrimps before and after cooking.

It was found that both salt conc. and voltage were significant for the processing time ($P < 0.05$) and there was no interaction between the two process parameters. In the statistical data analysis it was found that salt conc. were of significance ($P < 0.05$) for the PJ. Improved water-holding capacity and thereby lower weight loss seems to be influenced mostly by the content of salt in brine rather than the application of voltage ($P_{salt} < P_{voltage}$). When fixing the voltage and varying the mass ratio and salt conc. it was observed that the mass ratio had no effect ($P > 0.05$) on the processing time, only the salt conc. did. No major differences in the textural parameters were observed when comparing with varying process parameters. However, the textural measurements showed a comparable texture of the shrimps to that of conventionally cooked shrimps reported in other studies (Erdoğdu & Balaban, 2000).

The findings show a promising utilization of OH as a unit operation for the shrimp processing industries.

Key words : ohmic heating, cooking, shrimps, yield, texture