

EFFECT OF HIGH PRESSURE PROCESSING ON RAW PORK COLOUR AND WATER HOLDING CAPACITY

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Abstract – High pressure processing is typically used for inactivation of microorganisms, but it can also cause changes in meat texture and colour, which might be unacceptable for consumer. The aim of this study was to evaluate colour, pH and water holding capacity in pork *Musculus longissimus lumborum* depending on applied pressure (50, 100, 200, 300, 400, and 500 MPa) and treatment time (1, 5, and 15 min). The study indicated that meat treatment at 50–100 MPa didn't cause visible changes in meat colour component L*. However higher pressure induced an increase in lightness of the samples. The L* value increased for all samples treated at 100–500 MPa ($P < 0.05$), but it was not significantly affected by treatment time (1–15 minutes).

Key Words – meat colour, pH, pressurization conditions.

I. INTRODUCTION

Consumers are demanding minimally processed – fresh-like foods with increased safety and shelf life [1]. Preference is given to the products with high nutrition value and high safety level [2]. Application of high pressure treatment (HPP) allows inactivation of pathogenic microorganisms, thus extending meat shelf-life, while majority of meat properties are well preserved [3]. However for meat and meat products elevated pressure treatment may induce significant changes in the quality attributes as it has been shown to induce protein denaturation and acceleration of lipid oxidation during subsequent storage. This is due to the relatively high sensitivities to pressure of muscle glycolytic processes and of the associations between myofibrillar proteins [4]. Such modifications of meat matrix lead to colour, texture and water holding capacity changes and decreased sensory acceptability [5], although it does not have a negative effect on nutrition value, thus giving new options for non-thermal treatment of meat. The aim of this research was to evaluate the effects of HPP on the fresh porcine *Musculus longissimus lumborum* colour and water holding capacity.

II. MATERIALS AND METHODS

Chilled pork obtained from *Musculus longissimus lumborum* (Latvia) has been purchased from the local store Ltd. 'Maxima Latvia.' Chilled pork meat was cut in 1 ± 0.2 cm thick slices across the muscle fibre and packed (200 ± 0.2 g) in the vacuum pouches made from polyamide/polyethylene film, thickness 60 ± 3 μ m. Samples of pork meat were treated in a high-pressure processor ISO-Lab S-FL-100-250-09-W (Stansted Fluid Power Ltd., UK). Vacuum-packed samples were randomly assigned to one of the six treatment pressures (50, 100, 200, 300, 400, and 500 MPa), while untreated sample served as the control. The HPP treatment for vacuum-packed samples at each pressure level was applied for three meat samples for duration of 1, 5, and 15 min respectively. pH was measured with a pH meter Jenway 3520, according to LVS ISO 2917:2004. pH was measured for five repeats of each high pressure treated pork meat sample as well as for control sample. Water holding capacity (WHC) was measured according to the method described by Januskeviciene et al. [6], which is based on the measurement of the stain area left by moisture expelled from piece of meat under certain pressure. Meat colour was analysed using colorimeter *Color Tec PCM/PSM*. Each time two meat samples were analysed, measuring colour at least in 10 different places on each sample surface.

III. RESULTS AND DISCUSSION

HPP treatment of pork at pressures 50–100 MPa for 1–15 min slightly increased its pH. Higher increase of pH was observed for samples treated for 15 min comparing to ones treated for 1 min. In meat, the most significant effect of pressure is detected for sarcoplasmic (mainly enzymes and heme pigments) and myofibrillar proteins, which are very susceptible to denaturation when undergo HPP above 200 MPa, during which water holding capacity and colour of the

meat changes [7]. Analysis of WHC demonstrated that an increase of treatment time from 1 min to 15 min resulted in increased WHC in the pressure range 50–300 MPa (Fig. 1).

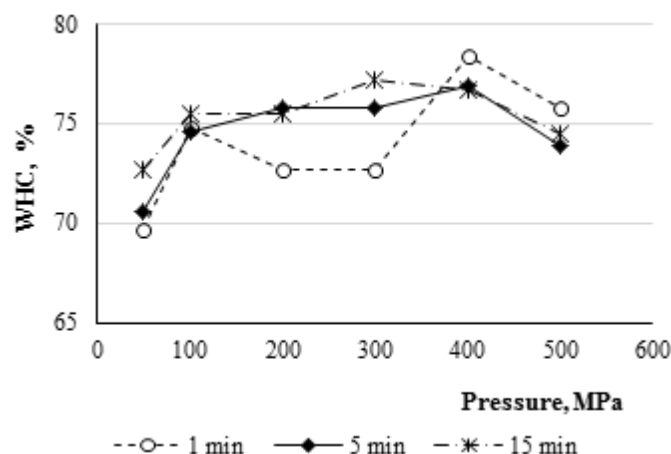


Figure 1. Pork water holding capacity depending on the applied HPP parameters

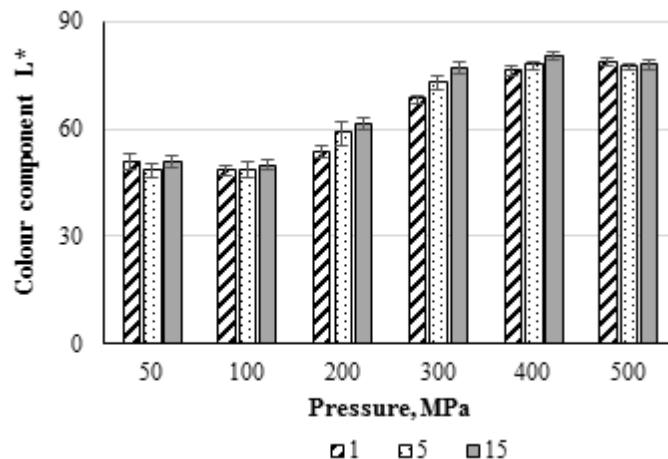


Figure 2. Pork colour component L* value depending on the applied HPP parameters

The HPP treatment at 50–100 MPa did not change pork colour irrespective of time (Fig. 2). However an increase in pressure between 100 and 400 MPa, was followed by increased colour component L*. Thus L* value did not depend on treatment time, while it was affected by pressure ($P < 0.05$). Lighter colour of HPP samples can be due to both the myofibril shrinkage and reduced fibre diameter which could allow for more light scattering and hence a lighter appearance [8]. Other researchers noted that muscle fibre shrinkage creates large gaps between fibres. In addition, myofibrils appear to shrink, which would create a more dense protein structure [9].

IV. CONCLUSION

High pressure treatment at 50–300 MPa resulted in increased water holding capacity, while treatment at 100–500 MPa significantly changed colour component L*, but it was not affected by the studied treatment time.

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