Electrolyzed Water and its Influence on Quality of Poultry Meat

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Abstract
The aim of the research was to find out whether electrolyzed water used for densification of breeding halls and watering of chickens' influences selected indicators of the meat quality. The production system of electrolyzed water has been patented in the Czech Republic. The experiments were done in two breeding halls of chickens of the same breed; potable water without any additives was used for watering in one house, the other house was supplied with the Envirolyte water, i.e. technology whose principle is patent protected. After the chickens were slaughtered, samples of the chickens of the individual halls were taken and analysed. As regards the indicators observed, the most significant difference was determined for water loss through dripping, which might suggest an eventual development of PSE meat. However, the colour of the meat and its pH values did not confirm this

Keywords: poultry meat, electrolyzed water, water dripping.

1. Introduction

Electrolyzed water was tested as a disinfecting substance in the food industry [1].
It is an eventual alternative way of disinfection of breeding halls resulting in reduction of ammonia emissions up in the air from the stable environment and in suppressing pathogenic microorganisms, too. This is very important for breeding of laying hens being burdened with salmonella, in particular.
First, there is investment in the production system. Only potable water and kitchen salt are needed for producing a solution of electrolyzed water. Contrary to the traditional disinfecting agents, the main advantage is that it is safe to people, animals and environment. Even though it is a strong acid it does not cause any damage to the skin, membranes and organic substances.
Envirolyte is a technology of reactors (electrolysers) in which salt solution is converted into a sanitary solution. The production is done on site using saturated salt solution.
The foregoing system has been widely used in the food industry to eliminate pathogenic microorganisms. Ozer et al. [2] produced a study on influence of electrolyzed water on microorganisms of Escherichia coli and Listeria monocytogenes. Another application has been used against Campylobacter jejuni when washing poultry [3]. Applications for cleaning dairy rooms and milking houses have been published directly in the field of animal production [4].
PSE (pale, soft, exudative) was observed in terms of the meat quality in particular. This defect determined on the chicken breast muscle is a subject of a number of studies. A dependency between anomalies in colour of the chicken meat and the ways to reduce it as much as possible is being searched for. Consumers do not positively perceive a very light colour of the chicken meat and it is not suitable for the processing industry either. Various ways to reduce the share of occurrence of PSE – by adding vitamin E to feeding rations [5], chickens being slaughtered at slaughter houses calm down by being showered

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with lukewarm water [6], – were published. There is an increased share of PSE as a consequence of being exposed to thermal stress before being slaughtered [7, 8].
An abattoir analysis of the main meat parts was done on the samples taken. The slaughter bodies were slaughtered into main parts (thighs, breast muscle) and weighted.

2. Materials and methods

The experiments were done in two flocks of chickens stabled in masonry halls. The feeding rations were same for both halls, water troughs were used for watering. The chickens in the experiment hall were watered with the Envirolyte water. It is a solution different from the solution used for disinfection. The checking hall was supplied with common potable water.
When the chicken were slaughter mature, at the age of 35 days, they were taken to a large-capacity slaughter house where after the basic slaughter operations were done samples of the chickens from both halls were taken directly from the line. The samples were taken before entering the cooling tunnel.
The slaughter bodies were slaughtered into individual parts in the laboratory and pH was measured with a pH-meter with a needle electrode with automatic temperature correction on the skinless breast muscle in the interval of 60 min. from slaughtering to 24 hours after slaughtering.
Further, the colour of the meat was determined with ColorEye XTH Spectrophotometer (CIELAB colour system) in the values of L*, a*, b*, in the period of time of 24 hrs after slaughtering. The value of L* is decisive for defining the colour of meat. In order to determine water loss (dripping) the meat samples were stored in an airtight package in a cool place for a period of 24 hrs and then the difference in weight was determined.
The share of the breast muscle and thighs of the main meat parts was compared in %.
The samples were taken from the industrial slaughter line from the breeds of both halls, after reaching slaughtering maturity, during 2010.
After the chickens were taken out, the experiment hall was disinfected with electrolyzed water and the chickens were taken back again. The checking hall was disinfected with the traditional disinfecting agents.
PSE breast muscle is characterized with the value of pH and colour determined with the value of L* described in [5]. The values were measured 24 hrs post-mortem. The samples with the value of L* $\geq$ 53.0 and pH < 5.9 are classified as PSE meat, the samples with the value of L* between 44.0 and 53.0 and pH > 5.9 are classified as common meat.

3. Results and discussion

The values of pH and colour of L* determined, processed by the t-test did not confirm the hypothesis of assumed eventual differences in occurrence of critical values of both indicators in the groups observed.
The value of water loss (dripping) seems to be significant in terms of statistics ($P < 0.01$), which is one of the indicators leading to an eventual development of PSE. A higher share was observed in the experiment hall.

Table 1. Results and compare experimental samples

Indicator	Attempt (n=35)		Check (n=35)		t-test
	X	s	X	s	
pH_1	6.07	0.21	6.16	0.21	1.695
T_1 [°C]	31.22	1.90	30.58	2.24	1.284
pH_{24}	5.91	0.15	5.99	0.14	2.251*
T_{24} [°C]	9.01	1.55	10.63	1.89	3.922***
L*	46.66	2.84	47.76	3.02	1.564
a*	-1.89	0.64	-1.74	0.55	1.073
b*	3.77	0.80	3.31	0.92	2.205*
water loss [%]	1.35	0.50	1.01	0.23	3.671**
slaughtering body [g]	1567.30	104.80	1568.60	169.90	0.038
breast muscle [g]	431.30	47.20	440.50	71.60	0.633
breast muscle [%]	27.50	1.80	28.00	2.90	0.970
thigh [g]	550.00	36.00	566.40	59.90	1.394
thigh [%]	35.10	1.10	36.20	1.60	3.239

Further, the results suggest that the value of T_{24} is significant. This difference has been probably caused by imperfect cooling during storing before being measured in 24 hrs.
The values of the basic abattoir analysis do not show any differences between both breeding flocks. There is nearly identical share of both groups of the samples taken in the representation in %.

4. Conclusions

Nearly identical values of pH and colour of L* were determined, which suggests there is minimal influence
of electrolyzed water used for watering and disinfection
on the final quality of the poultry meat. There is also no difference in the percentage representation of both meat parts of the slaughtering body in both groups observed.
Usage of this system thus enables both safe usage and significant saving on costs on disinfection without any considerable influence on the qualitative signs of the meat observed.

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