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REGULAR ARTICLE

USE OF ELECTROLYZED WATER IN ANIMAL PRODUCTION

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ABSTRACT

The paper deals with the possibility to use the properties of electrolyzed water to disinfect breeding halls and to water animals. The aim of the research was to find out whether elektrolyzed water used for desinfication of breedings hall and watering of animals influences selected indicators of the meat quality.

Electrolyzed water is produced in a patent-protected device Envirolyte that produces biocide solution using potable water with added NaCl. The technology of production guarantees the product is entirely ecological, biologically fully degradable, non-toxic that can replace traditional chemical agents.

Possibilities of disinfection using this solution have been verified directly in stables at the interval of 20, 40, 60 min. after application. Staphylococci and streptococci and enterococci were inactive always after 60 minutes of effect. There was significant decrease in the number of total number of microorganisms.

Further, the solution of electrolyzed water was used to water poultry; and the affect on some of the properties of poultry meat, changes in pH, colour and loss of water (dripping) in particular, was observed.

Testing was carried out under working conditions in two breeding halls at a time and the technology of electrolyzed water to disinfect premises and to water chickens was used in one

of the halls. When the chickens were slaughter mature, the poultry was slaughtered at the standard slaughterhouse and samples (127 pieces) were taken in order to measure pH, colour and loss of water (dripping). The values of pH, colour and loss of water (dripping) ascertained, processed by the T-test did not confirm the hypothesis of the assumed possible differences in occurrence of critical values of these indicators in both groups observed.

Keywords: poultry meat, electrolyzed water, water dripping

INTRODUCTION

The issue of electrolyzed water used as a disinfecting agent in food industry was already published **(Yu-Ru hunag et al., 2008)**. The system is used to eliminate pathogenic microorganisms. **Otzer et al. (2005)** 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 **(Park et al., 2002)**.

This alternative way of disinfection can be introduced in animal production, too, provided conditions for suppressing the growth of pathogenic microorganisms are met. The initial investment in the production system is the basis. Potable water, kitchen salt and electricity are needed to produce a solution of electrolyzed water only. Contrary to the traditional disinfecting agents, the main advantage is that it is safe to people, animals and environment. Envirolyte is a technology of reactors (electrolysers) in which salt solution is converted into a sanitary solution. Production using saturated salt solution (NaCl) is carried out on site. As for animal production, applications of electrolyzed water to clean dairy rooms and milking houses were published **(Walker et al., 2005)**.

Electrolyzed water was applied onto the walls in the stables in order to find out what the decrease in pathogenic microorganisms was. It was directly sprayed and then samples were smeared at the interval of 20, 40, 60 minutes after application.

Indicators of possible occurrence of PSE (pale, soft, exudative) – i.e. pH, meat colour and loss of water (dripping) – were observed in terms of the meat quality.

The PSE defect defined on the chicken breast muscle is a subject of a number of studies. A dependency between anomalies in colour of chicken meat and the ways to reduce it as much as possible is being searched for. Consumers do not positively perceive the light colour

of chicken meat and it is not suitable for the processing industry either. Decrease in the defect occurrence is also supported by measures taken before slaughter such as showering chickens with lukewarm water **(Guarnieri et al., 2004)** and transport conditions **(Simones et al., 2009)**. Direct affect of the thermal stress during transport on the occurrence of the PSE defect was proved by the study published by **Barbut, 1998**.

MATERIAL AND METHODS

The experiment was conducted during 2010, 2011 and 2012 in two brick breeding halls. The chicken hybrid COBB 500, the most common combination nowadays, was used. In total, samples of 127 pieces of hybrids were tested.

The chickens were fed with standard feed mixture BR1 C at the age of 0-10 days, further with BR2 C (10 – 29 days) and with BR3 C (29 – 34 days). Water troughs were used for watering. The chickens were watered with the 3% solution of Envirolyte water in the experiment hall. The checking hall was supplied with common potable water.

When the chicken were slaughter mature, at the age of 34 days, they were slaughtered at the large-capacity slaughterhouses 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 and taken to the laboratory. pH was measured within 45 minutes after slaughtering and another value of pH and colour were measured after 24 hours. It was measured with a pH-meter with a needle electrode with automatic temperature correction on the skinless breast muscle. Further, the colour of the meat was determined with ColorEye XTH Spectrophotometer (CIELAB colour system) in the values of L*, a*, b*, 24 hours after slaughtering. To determine water loss (dripping) the weighted meat samples were stored in an airtight package in a cool place for a period of 24 hrs and afterwards the difference in weight caused by released water was determined. According to Olivio et al. (2001), PSE breast muscle is characterized with the value of pH (24 post mortem) and colour measured and determined with the value of L*.

The samples with the value of $L^* > 53.0$ and pH (24) < 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. The slaughter bodies were stored at the temperature of 4 °C for a period of 24 hours.

Application onto walls – electrolyzed water was sprayed with a portable pressure sprayer (Gloria prima 5 type 39 TE - 3 bars) in 2010 and 2011. Microbiological examination

was done in accordance with the quantitative microbiological methods in compliance with ČSN, in accordance with ISO and EN within the international context. Microbiological examination in accordance with Decree No. 375/2003 Coll. on total number of aerobe microorganisms (ČSN ISO 2293 560 12') was done on samples taken from the walls in the stables. The samples were smeared. The smears were taken on the day of sanitation. The samples were taken with a cotton pad from the surface of size of 20 cm^2.

Samples taken after exposition (disinfection): 30g/l of tween 80 and 3g/l of lecithin were added to the solution after the pad was wet. You could use dry pads for wet places. The pads were held with sterile pincers and surface from which the sample was taken was to be smeared 10 times up down. The pads were put into a bottle containing 40 ml of buffer peptone water and 0.1 % solution of salt agar.

The samples for microbiological check of disinfection efficiency of the electrolyzed water were smeared from the walls in the breeding halls without using disinfection right after application and further after 20, 40 and 60 minutes of the effect of the agent.

The examination of the smears was carried out in the accredited laboratory of the State Veterinary Institute in České Budějovice. In total, 6 sessions of smears were done in 2010 and 2011.

RESULTS AND DISCUSSION

The values of pH, colour and loss of water (dripping) ascertained, processed by the t-test did not confirm the hypothesis of the assumed possible differences in occurrence of critical values of these indicators in both groups observed. The value of water loss (dripping) (%) seems to be significant in terms of statistics ($p < 0.05$), which is one of the indicators leading to a possible development of the PSE defect. The experiment hall shows higher percentage of water loss. According to **Barbut (1997)** is this indicator important in function properties of the meat.

The results of pH measured 45 minutes after slaughtering do not show any differences between the observed halls; the affect of water drinking on the result acidity of the chicken meat has not been proved. pH value measured 24 hours after slaughter confirms this.

Typical for PSE meat is lower pH , $pH < 5.9$.**(Barbut, 1997b)**

The measured values of L* colour do not show any significant differences between both groups observed. The values of indicators of our observation don't reach value as described in **Olivio et al.(2001)**.

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.

Table 1 Results in summary (acidity of the chicken meat, water loss, L* colour)

Indicator	Attempt (n=70)		Check (n=59)		t-test
	X (average)	s (det.deviation)	X	s	
pH_1	6,16	0,23	6,16	0,19	-0,197
pH_{24}	5,97	0,18	5,95	0,13	0,469
L*	47,61	3,09	48,65	3,14	1,564
a*	-1,57	0,82	-1,78	0,56	-1,890
b*	3,92	1,10	3,63	1,08	1,526
water loss [%]	1,09	0,50	0,94	0,30	2,069*

The total number of aerobe microorganisms, the number of yeasts and moulds and evidence of Enterococcus sp., Staphylococcus sp. and Streptococcus sp. bacteria presence were determined on the samples smeared from the walls in the stables. Staphylococci and streptococci and enterococci were inactive always after 60 minutes of effect. Yeasts and moulds were determined in 4 sessions of the samples. A decrease in yeasts was noticed in one of the series of the samples taken after 40 minutes of the effect; yeasts were not found in one of the series of the samples and the number of yeasts did not decrease in two cases. There was a significant decrease in the number of moulds in three out of four sessions of the samples taken and the significant disinfection effect occurred during determination of the total number of microorganisms; the result disinfection efficiency of electrolyzed water was 82%. A certain effect of the electrolyzed water as disinfection was proved. Another study performed on these same pathogens using electrolyzed water indicated significant log reductions, as well as total elimination in some cases **(Horiba et al., 1999)**, **(Kiura et al., 2002)**, **(Kim et al., 2000)** etc. Disinfection effect on the walls in the stables was comparable with another surfaces

(Park et al., 2002). Electrolyzed water was successfully tested as disinfecting substance in the food industry **(Yu-Ru Huang et al.,2008)**, **(Fabrizio et al., 2002)**.

It is suitable to use the system of the electrolyzed water, as it is efficient disinfection without any significant impact on the quality of the result raw materials in particular.

CONCLUSION

Nearly identical values of the observed values of the qualitative indicators of meat quality, i.e. pH and colour of L* colour of the meat, were determined in both breeds, which suggests the affect of electrolyzed water used to water and disinfect on the final quality of the poultry meat is only little. An evidential difference between both observed groups was noticed only as for the value of water dripping in meat. To use electrolyzed water to disinfect breeding halls can be recommended especially due to its biological degradability and non-toxicity.

First, there is investment in the production system. Only potable water and kitchen salt are needed for production a solution of electrolyzed water. Contrary to the traditional disinfecting agents, the main advantage is that it is safe to people, animals and environment. The system is technology of reactors (electrolysers) in which salt solution is converted into a sanitary solution.

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. Usage of this system thus enables save usage and significant saving on cost on disinfection.

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