PROCEEDINGS OF THE 11th WORLD RABBIT CONGRESS

Qingdao (China) - June 15-18, 2016
ISSN 2308-1910

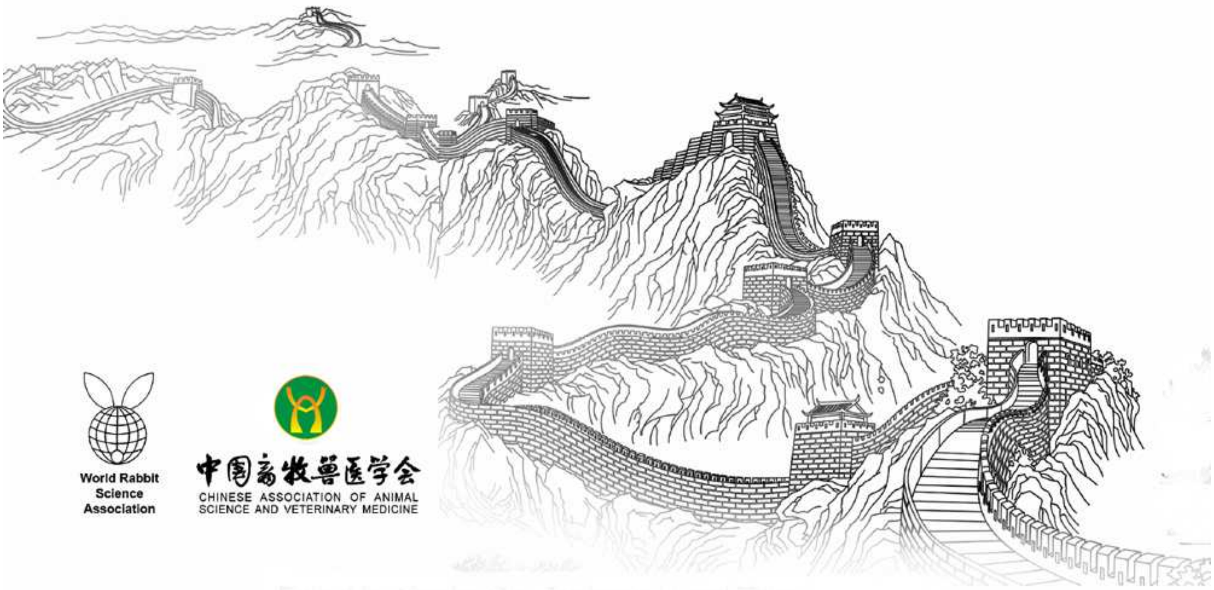
Session
Quality of products

Wang Z.M., He Z.F., Li H.J.

MASS TRANSFER DYNAMICS DURING SALT BRINING OF RABBIT MEAT

Full text of the communication

How to cite this paper :
Wang Z.M., He Z.F., Li H.J., 2016 - Mass transfer dynamics during salt brining of rabbit meat. *Proceedings 11th World Rabbit Congress - June 15-18, 2016 - Qingdao - China, 799-802*
.



World Rabbit Science Association

中国畜牧兽医学会
CHINESE ASSOCIATION OF ANIMAL SCIENCE AND VETERINARY MEDICINE

MASS TRANSFER DYNAMICS DURING SALT BRINING OF RABBIT MEAT

Wang Zhaoming, He Zhifei, Li Hongjun *

College of Food Science, Southwest university, Chongqing, 400716, PR China

ABSTRACT

The objectives of this work were to investigate the changes in mass transfer, myofibril proteins structure, textural properties and water holding capacity of rabbit meat salting in different brine concentration. Rabbit meat were wet-cured for 24 h in five brine solutions having concentrations, i.e. 5%,10%, 15%, 20%and 25% NaCl (w/w). Results show that the weight gain and water content decreased and the sodium chloride content in meat samples increased with increasing brine concentration.

Key words: rabbit meat, mass transfer, brine concentration.

INTRODUCTION

In the last 50 years, the world production of rabbit meat has increased by 3.4 fold to 1.78 million tons in 2013. China is currently the leading producer of rabbit meat (727000 t in 2013) in the world (FAOSTAT). Because of its high digestibility, medium-low juiciness, low-calories, low cholesterol, high degree of unsaturated fatty acids, lowest fatty feeling in the mouth and tenderness, rabbit meat fits well the contemporary consumer (Nakyinsige et al. 2015). Rabbit meat products, such as *chansi*-cured rabbit, water-boiled salted rabbit and cold rabbit, are traditional meat products in southwest china. The saying ‘no rabbit, no feast’ was used to describe the important role of rabbit meat for the diet of this part.

In the present study, mass transfer and sodium chloride diffusion of rabbit meat during wet-curing in different brine concentrations were studied.

MATERIALS AND METHODS

Raw material

Two hundreds and forty frozen *longissimus dorsi* (LD) from *Hyla* rabbit were obtained from Chongqing College Research Center for Animal.

Curing and sampling

The frozen meat samples were thawed at +4° C for 18h before use. they were cut into 5±0.5g units (2cm×1cm×1cm), individually weighed, and then immersed in five brine solutions (5%, 10%, 15%, 20% and 25% NaCl (w/w)) at the ratio of 1:3(meat: brine) for wet-curing at 4° C.

Analytical determinations

The salt content of brine and rabbit meat was measured using the titration method of silver nitrate solution (National Standard of China (GB/T5009.44-2003). Water content was determined by oven drying the samples to constant weight at 104±1° C (Deumier et al., (2003).

RESULT AND DISCUSSION

In the present study, the total weight, water and sodium chloride weight changes can be calculated by means of following equations (Du et al., 2010).

$$\Delta M_t^o = \frac{M_t^o - M_0^o}{M_0^o} \times 100(\%) \qquad (1)$$

$$\Delta M_t^w = \frac{M_t^o \cdot x_t^w - M_0^o \cdot x_0^w}{M_0^o} \times 100(\%) \qquad (2)$$

$$\Delta M_t^{NaCl} = \frac{M_t^o \cdot x_0^{NaCl} - M_0^o \cdot x_0^{NaCl}}{M_0^o} \times 100(\%) \qquad (3)$$

M_t^o and M_0^o are the rabbit meat weight at sampling time t and 0. x_t^{NaCl} and x_0^{NaCl} are the sodium chloride contents in the samples, and x_t^w and x0w are the water contents in the samples, at sampling times t and 0, respectively.

As shown in Fig. 1, the brine concentration significantly affected the total weight changes of the rabbit meat during the salting process. The weight increase of the rabbit meat increased with decreasing brine concentration, and the rabbit meat brined in the saturated brine (25% NaCl w/w) produced the lowest process yield.

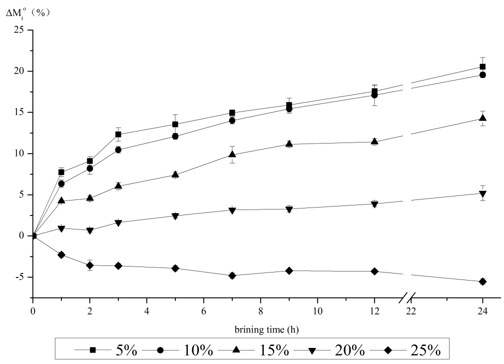
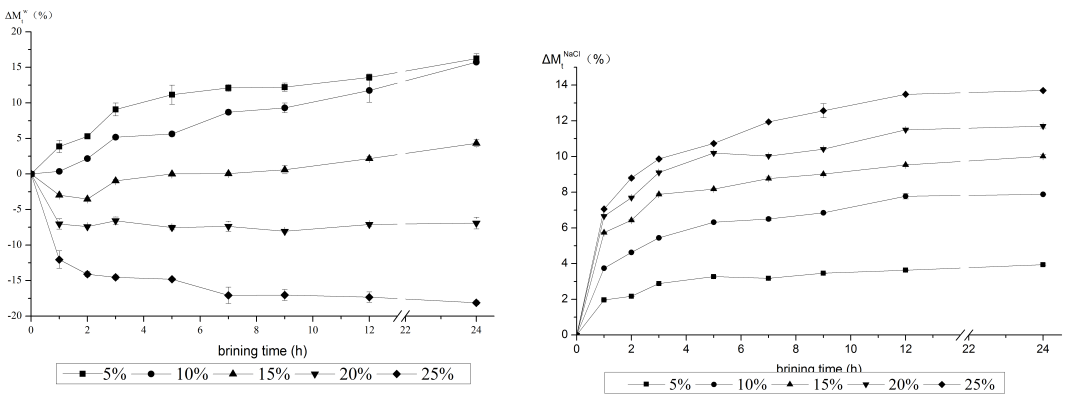


Figure 1: Overall weight changes in the five brines during salting

The water and sodium chloride weight changes of samples are shown in Figs. 2. The higher brine concentration was the higher sodium chloride content and the lower water content in rabbit meat was. The sodium chloride content increase with increasing brine concentration, while the water content of meat decreased with increasing brine concentration. For each of the five brines, sodium chloride content increased with the increasing brining time. The water content in meat increased in low brine concentrations with the increase of brining time, while it decreased in high brine concentrations.



A B

Figure 2: Changes of water (A) and sodium chloride (B) in rabbit meat in the five brines

According to Leng et al. (2012), a pseudo-diffusional transportation was assumed where the weight changes were related to the square root of time. Following equation for the weight changes throughout brining time was fitted to the experimental data.

$$\Delta M_t^i = 1 + k_1 + k_2 \times t^{0.5} \qquad (4)$$

The slope term (k_2) is concerned to the kinetics of the total weight changes in terms of process yield. The independent term, k_1, describes what happens at the beginning of the brining process, affected by pressure gradients and called HDM (hydrodynamic mechanisms) (Andrés et al., 2002).

Figure 3 shows the yield (ΔM_t^o) as a function of the square root of brining time. The equation coefficients, period of time fitted and the fitting correlation factors are shown in Table 1.

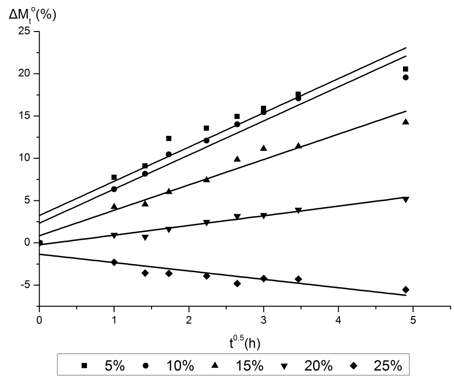


Figure 3: Plot of sample overall weight changes (ΔM_t^o) vs the square root of time $t^{0.5}$ (h)

Table 1: Dynamics parameters for total, water and NaCl weight changes adjusted to Eq. (4) (k_1 and k_2), and fitting correlation factors ($p < 0.05$).

	Brine concentration	k_1	k_2	R^2
ΔM_t^o	5%	2.2419	4.0481	0.9187
	10%	1.3347	4.0321	0.9434
	15%	-0.1447	3.004	0.9639
	20%	-1.2251	1.1457	0.9678
	25%	-2.3343	-0.9907	0.7919
ΔM_t^w	5%	0.4572	3.4546	0.9181
	10%	-2.6134	3.5966	0.9586
	15%	-3.966	1.2937	0.6114
	20%	-5.222	-0.9814	0.3359
	25%	-7.8793	-3.0964	0.6511
ΔM_t^{NaCl}	5%	2.8593	2.6193	0.7868
	10%	2.7431	2.1372	0.7334
	15%	2.164	1.8184	0.7404
	20%	0.9801	1.5351	0.8182
	25%	0.0348	0.7448	0.7974

Regarding the total weight changes (ΔM_t^o), k_2 values gradually increased with decreasing brine concentration. The same tendency for k_2 values was also obtained in water weight changes (ΔM_t^w) and sodium chloride weight changes (ΔM_t^{NaCl}), respectively. With regard to k_1 values, they had the same trend as $k_2$values. Moreover, higher values of R^2 calculated from Eq. (4) revealed that the linear relation of the equation of five brine concentrations were good. Significant correlations ($p < 0.05$) were got for every sample.

CONCLUSION

The brine concentration significantly affected the total weight, water and sodium chloride changes of the rabbit meat during salting process. The weight gain and water content decreased and the sodium chloride content in meat samples increased with increasing brine concentration. The experimental data for brining of rabbit meat closely fitted the model previously proposed.

ACKNOWLEDGMENTS

The study was supported by National Rabbit Industry Technology System Program (Grant No. CARS-44-D-1) , China Specialized Fund for the Basic Research Program of College(Grant No. 2120133197) Ministry of Agriculture Public Welfare Industry Science and Technology Research Program (Grant No.201303144) and was aid financially by National Science and Technology Supporting Project (Grant No. 2011BAD36B03).

REFERENCES

Du L., Zhou G. H., Xu X. L., Li C. B. 2010. Study on kinetics of mass transfer in water-boiled salted duck during wet-curing. *J. Food Eng., 100(4), 578-584.*

FAOSTAT, 2015. http://faostat.fao.org/site/291/default.aspx

Gallart-Jornet L., Barat J. M., Rustad T., Erikson U., Escriche I., Fito P. 2007. Influence of brine concentration on Atlantic salmon fillet salting. *J. Food Eng., 80(1), 267-275.*

Graiver, N., Pinotti, A., Califano, A., & Zaritzky, N. 2009. Mathematical modeling of the uptake of curing salts in pork meat. *J. Food Eng., 95(4), 533-540.*

Goli T., Bohuon P., Ricci J., Trystram G., Collignan A. 2011. Mass transfer dynamics during the acidic marination of turkey meat. *J. Food Eng., 104(1), 161-168.*

Leng X., Zhang L., Huang M., Xu X., Zhou, G. 2013. Mass transfer dynamics during high pressure brining of chicken breast. *J. Food Eng., 118(3), 296-301.*

Nakyinsige K., Sazili A. Q., Aghwan Z. A., Zulkifli I., Goh Y. M., Bakar F. A., Sarah S. A. 2015. Development of microbial spoilage and lipid and protein oxidation in rabbit meat. *Meat Sci., 108, 125-131.*

Deumier, F., Trystram, G., Collignan, A., Guedider, L., Bohuon, P., 2003. Pulsed vacuum brining of poultry meat: interpretation of mass transfer mechanisms. J.Food Eng. 58 (1), 85－93.

=================