STABILIZATION OF THE BLOOD PIGMENT FOR REPLACEMENT OF NITRITE—CURED—MEAT COLOUR IN THE SAUSAGE PRODUCTS.

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SUMMURY

CO, NO and $NaNO_2$ were used to stabilize the blood pigment from domestic animals. Results indicated that the blood pigment stabilized by NO or $NaNO_2$ can replace nitrite to provide the nitrite—cused—meat colour for the sausage products which have no the residus nitrite or little. The way of using the blood pigment not only make full use of domestic animal blood but also greatly decreace the formation of cascinogen from nitrite.

INTRODUCTION

There has been two difficult problems in meat research For long time. One is how to make full use of domestic animal blood, another is formation of cascinogen from residue nitrite in meat products.

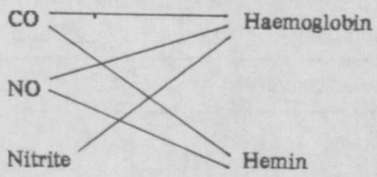
Domestic animal blood is an important, potential protein resource and annual yield of it is very large in the world. In 1989, it is about 5 hundred million kilogram in China. The blood contains 18% protein, its content is close to the lean meat. Therefore we sometimes regard the blood as liquid meat. Otherwise, it is at present that the utilization ratio of blood is not enough to 30%. It was only used for producting of blood sofu, blood puddings and blood powdes. Most of it was drained away as waste and caused the polution. The essential season that blood wasn't made full use is that only minute addition of blood pigment imparts a dark blownish colour to almost all cooked food products. An extensive research and development work has been done in various counties for many years. The main method is to remove the blood pigment and use its separated colourless globin. But its not satisfied.

Nitrite, the traditional meat—curing agent, plays a multifunctional role in producing the cooked cured—meat colour and preventing lipid oxidation and outgrowth of microbe, especially C. botulinum. Unfortunately it is now well known that residue nitrite can form carcinogen in meat. In the past years, the incidence of the carcinoma is obviously increacing, particularly alimentary canal cascinoma, which may be related to the nitrite—cured food. So all of the countries limited the addition of nitrite and were searching for a substitute.

In order to make full use of blood and replace nitrite, this paper stabilize the blood pigment using CO, NO and $NaNO_2$ according to the mechanism of nitrite—cused—meat. Thus we obtained the stabilized blood pigment without the residue nitrite and added it in the sausage products as red pigment to replase nitrite.

MATERIALS & METHODS

The schemes scabilizing blood pigment are as follows:



CO or NO was put in vacuume tube to stabilize blood pigment. $NaNO_2$ was added in haemoglobin to cure it and remove its residus nitrite from the haemoglobin by way of ultrafiteration. If the stabilized blood pigment replase nitrite to give colour to the sausage products depends on the following measure quota: (Ⅰ)the colour of the stabilized blood pigment. (Ⅱ)The colour of the stabilized blood pigment after cooked in vacuume (Ⅲ)The degree of conversion of blood pigment to stabilized blood pigment. (Ⅳ)The colour and flavour of the sausage products added the stabilized blood pigment, Comparing with the contrast sausage cured by nitrite applying the scheffe contrast method.

RESULT & DISCUSSION

CO Stabilizing Haemoglobin

CO was bubbled into the haemoglobin solution for different time. After completion, resultant was heated to 90℃ in vacuume for 30 min, haemoglobin denatured, its bright red colour faded.

Table 1 Effect of CO—bubbled time on various shades of red of the heated resultant.

CO—bubbled time (min)	Shades of red
5	grey brown
10	grey red
20	slight red
40	slight red
60	slight red
80	slight red

Bubbling for 5 min, the colour of the heated resultant was grey brown, which the consumer dislike. Bubbling more than 20 min, the colour developed little red, didn't deepen (Table 1). This shade of red is too light to replace colour of the nitrite—cured pigment. (DNFH).

CO stabilizing hemin.

CO was bubbled into the hemin solution for differrent time. After completion, resultant was centrifugalized.

Table 2. Effect of CO—bubbled time on quantity and colour of the precipitate of the resultant.

CO—bubbled time	Quantity and colour
5	no precipitate
10	little, slight red
15	a little, slight red
20	a little, slight red
40	a little, slight red
60	a little, slight red

Bubbling for 5 min, the precipitate was not found. Bubbling more than 10 min, the quantity of the precipitate was increacing a little more, but its colour is too ligth to replace colour of the DNFH.

Twe results above indicated that whether the combination force of hemin with CO is weak and the final stabilized pigment is little or its colour is itself slight. In addition the result indicated that the combination force of hemin with CO is stronger than that of haemoglobin. Combining CO with hemin, the bond of C—O meats iron porphyrin at right angles, but not with haemoglobin due to the effect of histidines at some position of the spherical structure of the protein globin.

NO stabilizing haemaglotin.

As above test program, NO was bubbled into the hemoglobin solution for dlifferent time.

Table 3 Effect of NO—bubbled time on the degree of conversion of haemoglobin to the stabilized haemoglobin and its colour after heated in vacuume

NO—bubbled time	Degree of conversion	colour
5	53.2	slight red
10	82.1	fairly red
15	93.7	good red
16	95.6	good red
17	94.1	good red
18	97.2	good red
19	98.2	good red
20	99.0	good red
25	98.3	good red

The heated stabilized pigment is DNFH, the nitrite—cured—meat pigment. So long as its degree of conversion reach to a high level, it can provide the characteristic colour with the sasage products.

No stabilizing hemin

The stabilized hemin by NO itself is the DNFH. The degree of conversion to the DNFH was increaced as lengthening NO—bubbled time. After 5 min of bubbling, the degree of conversion reached to 94.7% (Table 4). The combination force of NO with hemin is the strongest.

Table 4 Effect of NO—bubbleed time on the degree of conversion to the DNFH and the colour of the DNFH

NO—bubbled time	Degree of conversion	Colour
1	71.5	slight red
3	87.2	fairly red
5	94.7	good red
6	97.1	good red
7	99.6	good red
9	98.2	good red
11	99.3	good red

The degree of conversion to the DNFH was increaced as raising PH of the reaction solution (Table 5). However, PH>8, the DNFH was very unstable and became green after 30 hr in partial vacuume with a slight positive pressure of NO. The DNFH prepared in the PH range 6.0—7.0 can survive for several months and its degree of conversion reached to more than 90% (Table 5) Therefore solutions at PH range 6.0—7.0 can give at high degree of conversion and best quality of the DNFH. The DNFH is sensitive to the light and oxygen and this gives some additional difficuties to storage. L. J. Rubin (1990) proposed a approach to protecting the DNFH by use of microencapsulation.

Table 5 Effect of variety of PH on the degree of conversion to the DNFH and the stability of its colour after 30 min storage.

PH	Degree of Conversion	Stability
4.0	79.8	slight red with ppt
5.0	87.0	fainly red with ppt
6.0	94.3	good red with ppt
7.0	97.2	good red with ppt
8.0	98.6	green with ppt
10.0	99.8	green

$NaNO_2$ curing haemoglobin

As curing meat by $NaNO_2$, haemoglobin was cured by $NaNO_2$, its technological conditions such as, the amount of sodium nitrite and ascorbate acid, curing temperature and time, were determined by the orthogonal experiments. The curing temperature was the most effective factor among them, the second is nitrite. Unexpected the amount of nitrite is not the larger the better. According to the new theoretical sequence for the meat—curing reaction, the amount of nitrite raised, its oxidization to reducing agents such as, ascorbate acid, enhanced and resulted in the lack of the reducing agent. The reduction of nitrosyl haemoglobin radical cation to nitrosyl haemoglobin weakened, and the degree of conversion lowered.

After curing haemoglobin, it is certainly that there is residue nitrite in haemoglobin as in nitrite—cured meat products. Fortunately we can remove it by the use of ultrafiltering method but not in nitrite—cured meat products. We used plate ultrafilter. with the film which intercept molecular weight is 50,000.

After curing the residue nitrite in the cured haemoglobin is 21.28ppm, below the limit of the residue nitrite in the sausage products (30ppm)in China when the cured haemoglobin didn't add to the sausage products. The residue nitrite was lowened by a wide margin after unltrafiltering for three times. The ressdue nitrite was 1.10ppm after nine times, lowened by 95%. (Fig 1). It was very effective.

IF added by 3% the residus nitrite in the sausage products is 0. 033ppm.

The use of the stabilized blood pigmeat in the sausage products.

The use of the DNFH in the sausage products has been made successfully (L. J. Rubin, 1990).

Adding the stabilized haemoglobin by No or $NaNO_2$ to the sausage at the level of 3%, along with the right amount of the condiment, the colour and flavous between the sample and the contrast were regarded to have no outstanding distinction with 95% assurance.

CONCLUSION

The stabilized blood pigment by CO can not replace the nitrite to provide the cooked meat—cured colour for the sausage products, but can by NO and $NaNO_2$.

We obtained the minimun time and the optimun range of PH in the stabilizing test by NO. There is no residue nitrite in the sausage products added to the stabilized pigment by NO. Don't worry about the formation of carcinogen. But the cost in this way is very high.

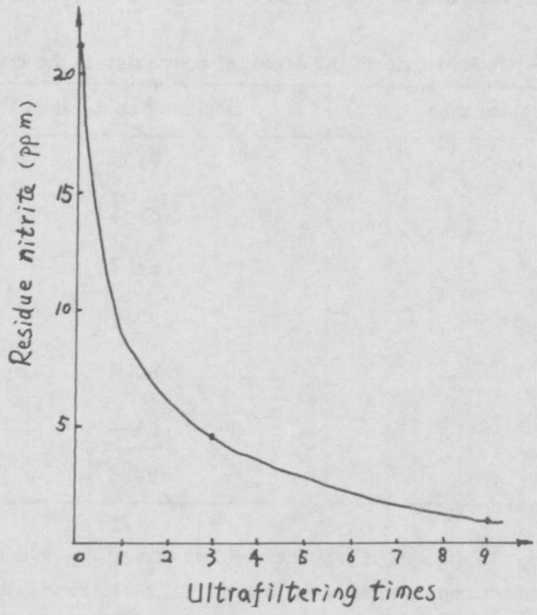


Fig 1. The relation between the ultrafiltering times and the amount of residue nitrite.

The technological conditions curing haemoglobin by nitrite were determined. The untrafiltration is very effective on removing the residue nitrite from the cured haemoglobin. Adding the cured ultrafiltered haemoglobin to the sausage at the level of 3% its residue nitrite is 0. 033ppm, far below the limit. The cost of this way is low, suitable for the developping countries such as our contry, China.

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