UTILIZATION OF ERYTHROCYTE OF PIG BLOOD

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China is one of the largest pig raiser. On average , 250-300 million pigs are slaughtered each year, which produces about 500 million kilograms of blood which needs to be utilized. Blood is composed of plasma and blood cells. Erythrocyte is the major component of blood cell. Because erythrocyte is red , it can be made into red pigment through some treatment .Erythrocyte is hydrolysed by pancreas, decolored by active carbon, spray-dried into ligh yellow powder which can be used in food industry.

Materials and Methods

1. Materials:

1>.Erythrocyte: fresh pig blood ,add 0.5% sodium citrate, centrifuged
2>.Enzyme: fresh pig pancreas, grounded and used directly.

2.Methods:

1>. Protein content:Kjeldahl nitrogen determining method
2>. Amino nitrogen content: neutral formaldehyde method
3>. Analysis of mineral elements: method of plasma body
4>. Bacteria: Coliform flora and total number of bacteria

3.Processing pathway:

1>.Manufacture of blood red pigment(BRP):

Fresh pig blood $\xrightarrow{\text{anti-gel agent}}$ centrifugation $\xrightarrow{\text{plasma}}$ erythrocyte→ adding same volume of water→ adjust pH

→ adding NO, NaNO2, Vc→ heating→ adjust pH $\xrightarrow{\text{enzyme}}$ hydrolyzation → inactiving enzyme → red pigment

spray dry solution → pigment powder

2>.Decolored protein powder(DPP):

Fresh pig blood → centrifugation $\xrightarrow{\text{plasma}}$ erythrocyte → adding same volume of water →

heat to gel → curd breaking → adding enzyme → adjust pH , temp.→ hydrolyzation → filter → decoloration →

condension → spray-drying.

Result and Discussion

1.Choosing processing conditions for manufacturing BRP

1>.Adding of nitrite and Vc

From table 1, the more Vc,nitrite was added the deeper the color of red is . Vc has the ability of antioxidation, prevents the forming of Metmyoglobin. Vc also can accelerated the forming of NO-hemoglobin. The optional amount of nitrite and Vc addition is 0.25% respectively.

2>. The adoption of time for hydrolysation.
Hydrolysation can change the color of NO-hemoglobin. The relation of color of change and hydrolysing time is tested. Result see table 2.

We can see , The "a" value has little change during 8-10 hrs ,but large after 10 hrs. In the whole hydrolysing treatment , "b" value drops constantly. Thus, 8-10hrs is chosen for hydrolysing duration.

2. Quality analysis of BRP:

1>.Red pigment powder :bright red, without off-flavor.
2>.component analysis:
The total protein content of red pigment powder is 86.64%, including Amino acids 40.2% and peptone , peptide. Using this pigment in meat and food processing can improve color and also inhance protein content.

3>.Bacteria Test
Total bacteria number: 4600 counts /g using pour-plate method in agar medium.
Coliform flora : no tested.
Pathogenic bacteria: no tested.

3.Effect of adding amount of BRP on sausage color and water- holding capacity (WHP).
In this test , BRP was added into sausage at ratios of 2%,
3% and 4% . The results are specified in table 3 and 4.

Table 4 shows that the WHC of sausage added with BRP is significantly higher than that of the control. In Table 3 ,the sausage with BRP addition indicated both higher coloration ability and slower color fading speed. GroupIII displayed the best results based on sensory evaluation and nitrite residue shown in Table 3, that is , the adding amount of BRP should be 2-3% in solution from or 0.2-0.3% in dried from .

3. Preparation of DPP:

1>.Determination of hydrolysis time
The heat denaturated red cells were hydrolyzed and then the amino nitrogen content was measured in order to analysis their hydrolysis degree. The results are shown in Fig 1.

Fig 1. show that the content of amino nitrogen increases with hydrolysis time. The hydrolysis speed increases rapidly during the first 8 hours and afterwards slows down . Therefore the optional hydrolysis time are 16-17 hours.

2>.Determination of decolorant conditions.
The hydrolyzate need to be decolored because its color of hydrolytic solution became deeper after hydrolysis . After a series of test on pH, humidity, decolorant time and the amount of active carbon addition , It is concluded that the optional conditions for decolorant processing are pH 4, active carbon addition:10%, time: 30min and temperature: 50°C.

3>.Rate of protein recovery:
The rate of protein recovery is determined by the hydrolysis degree of erythrocyte. The higher hydrolysis degree of erythrocyte, the higher content of soluble hydrolysate (insoluble material is disposed by filtering), the higher rate of protein recovery . Therefore, the rate of protein recovering can be used to determine the effectivity of hydrolysing. Result as table 5

4>.Quality of DPP
From Table 6, It is obvious the eight necessary Amino acid aren't balanced and Lys content is high . So, DPP is fit to be used as additive.

Conclusion

In this experiment, NO-hemoglobin is hydrolyzed by enzyme into solution, fit for spray dring and application . At the sametime the rate of protein digestion was increased and the blood flavor was improved . Adding NO-hemoglobin into blood got the same color improvement as nitrite . The product of hydrolysed and decolred protein powder has an unacceptable flavor, which we assume comes grom phenolic compounds and requires further research . The powder contain over 80% protein and its Amino acid content isn't balance , which can be solved by mixing with other proteins to achieve maximal compensation.

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