

Research on Producing Goaty Odour Removed Sausage Using Cover Pickle From Pickled Cabbage

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SUMMARY: When the cabbage cover pickle PH is < 3.9 , the main microbe in it belongs to lactic acid bacteria group, Such as *Leuconostoc mesenteroides*, *L. brevis* and *L. plantarum*, the nitrite-content in it is between 6.5 and 9.5ppm, and the cover pickle contains various volatile acids, alcohols and esters which could improve sausage sweet flavour. When cover pickle was used as a starter, fermented goat meat sausages have quite good colour, taste and flavour, showing reliable goaty odour removal effect. A simple way to produce longer storage-life goat meat sausages has been found under the condition of PH being 4.53-4.75, and a_w being < 0.88 .

INTRODUCTION: Goat meat has a higher nutrient value and pharmaceutical function, but because mutton, particularly goat meat, has goaty odour, consumers dislike it, goat meat products have limited place on markets. In order to develop goat meat products, we have conducted the experiment on producing goat meat sausage with goaty odour removed using cabbage cover pickle.

Some reports say that the main components causing goaty odour in ewe milk have something to do with free fatty acids with short carbon chain, such as hexanoic acid, octoic acid, decanoic acid etc. These free fatty acids proportionally form some complex compound or associated compound, which is one of the components causing goaty odour. We infer that the goaty odour of goat meat may have something to do with above compounds. If you want to remove goaty odour, you should try to destroy or decompose the special form of these compounds. In order not to destroy nutrient value and special flavour during removing goaty odour, we, in 1989, produced fermented goat meat sausage by artificial inoculation of lactic acid bacteria, with various enzymes from bacteria metabolism to decompose components causing goaty odour, or to destroy its special existing form, removing goaty odour. However, it is quite difficult for us to prepare pure starter. In order to popularize the technique, we change over to producing goat meat sausage with goaty odour removed by use of cabbage cover pickle. When cover pickle PH is < 3.9 , the main microbe belongs to lactic acid bacteria group, such as *Leuconostoc mesenteroides*, *L. brevis* and *L. plantarum*.

After measuring, we know that nitrite-content in cover pickle is 6.5-9.5ppm, so we can add less amount of nitrite ingredient. There are various volatile acids, alcohols and esters etc in the cover pickle, which can improve sausage sweet flavour.

MATERIALS AND METHODS: 1. Preparing starter: After washing mature cabbage thoroughly, removing leafstalk, outer-layer leaves and spot leaves, cut cabbage into pieces which are put into pickling tank and pressed tightly, add 1% calcium chloride and 2.25% table salt solution into pickling tank, and seal it. After the cabbage pieces were pickled for 10 days from 10°C to 13°C (winter), We did some measurements: PH is about 3.7, the total bacteria-content is 300,000,000, *L. plantarum* and *L. brevis*-content is 200,000,000, *Leuconostoc mesenteroides* is 100,000,000, nitrite-content is 6.5-9.5 ppm, the cover pickle can be used as starter.

2. Pretreatment of goat meat sample and ingredient: The goaty odour removed sausage is made from local goat meat or frozen goat meat. The material meat is made up of 70% lean goat meat and 30% fat pork, ingredient includes table salt,

soy sause, cooking wine, spices, sucrose and glucose which are mixed proportionally.

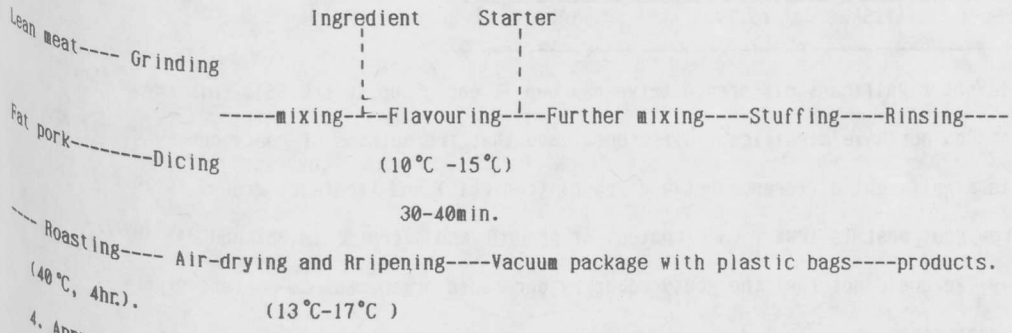
3. Method: Dividing the experiment into three groups.

Group II, 70% lean goat meat + 30% fat pork + 3% starter + ingredient + vinegar

Group III, 70% lean goat meat + 30% fat pork + 3% starter + ingredient.

Group I (control), goaty odour sausage, its formula is the same as group III's (in which goaty odour is not removed), but not adding starter.

Technologic process:



4. Appraising: After air-drying and ripening, the products were appraised by 10 persons who are very sensitive to goaty odour. According to 5 point system, they appraised the appearance, taste, goaty odour and rare delicacy, colour, consistency, and section-appearance of the products.

In order to make the effect of goaty odour removed countable, we have the materials and products measured in Meat Research Center of China to observe the change of peak area value of C_6 , C_8 and C_{10} , judging goaty odour removal degree of products. After measuring the PH and aw of final products, we can infer the change during product storage period.

RESULTS AND DISCUSSION: In order to compare the content of C_6 , C_8 and C_{10} in raw goat meat, determine their proportion and main component which is determinant in causing goaty odour, we first measured peak area value in pork and goat meat many times. The results are showed in table 1

Table 1 ---Peak area value of C_6 , C_8 and C_{10} in pork and goat meat

Meat kind	Repetition	C_6	C_8	C_{10}	Ratio	Relative percentage
Goat meat	10	883	1691	13354	0.5:1:8	100%
Pork	8	1014	1884	5811	0.5:1:3	44%

t-test shows that there are significant difference between tabled data ($p > 0.01$). From the results, we know there is some relationship between C_6 , C_8 and C_{10} , the ratio of $C_6 : C_8 : C_{10}$ in pork is 0.5:1:3, but 0.5:1:8 in goat meat, the main difference is due to C_{10} , because C_{10} -content in goat meat is 2.27 times as much as in pork, we can infer that C_{10} is the determinant component causing goaty odour, there is internal relation between C_{10} and goaty odour, this is consistent with our sense feeling.

In order further to prove that C_{10} is the determinant component for goaty odour, and compare the goaty odour removal effect of cabbage cover pickle on goat meat products, we also analysed the C_{10} -content in goaty odour removed and not

removed sausages and raw goat meat. Table 2 shows the results.

Table 2 --- C_{60} -peak area value in goaty odour removal sausage and raw meat

Item Group	1	2	3	Average	Relative percentage
Group II	10300	10991	12780	11357	70%
Group III	9657	11523	11001	10727	66%
Group I (control)	16162	15385	16243	15930	98.5%
Raw meat	15983	15298	17256	16179	100%

t-test shows that there is not significant difference between group III and group II ($p < 0.05$), this means that two goaty odour removal treatments do not have significant difference, and that the methods of goaty odour removal are dependable. However, there is significant difference between group I (control) and treatment groups ($p > 0.01$). If we suppose that C_{60} -content in raw goat meat is 100%, C_{60} -content of group II and group III is 30% and 34% lower than that in raw goat meat respectively, we could not feel the goaty odour by our sense organ. But C_{60} -content of group I is only 1.5% lower than that of raw goat meat.

Goaty odour removal products are appraised by sense organ, table 3 shows the results.

From table 3, we know that group III's points are the highest (25.36), the second is group II's (25.14), group I's is the lowest (19.08), this is consistent with the results measured with precision instrument, showing that C_{60} surely is one of the main components causing goaty odour, and that using cabbage cover pickle to remove goaty odour from goat meat products is feasible.

Table 3--- Sense organ appraisal results of goaty odour removal products

Item	Appearance	Section appearance	Taste	Goaty odour and rare delicacy	Colour	Consistency	Total points
Group II	4.19	4.38	4.32	4.11	4.13	4.01	25.14
Group III	4.22	4.41	4.28	4.15	4.25	4.05	25.36
Group I	3.61	3.58	3.12	1.52	3.5	3.75	19.08

Note: 6 item's total points is 30.

In comparison of apparent colour, we did not add chromogenic reagent (nitrite) to group III and group II, but because there is 6.5-9.5ppm nitrite in the cover pickle, further more, lactic acid has chromogenic, colour-keeping and oxidation proof function, group II and group III are superior to group I in colour.

We measured the PH-change during the product ripening period and aw of final product so as to calculate the product shelf-life. The results are showed in table 4 and table 5.

Table 4 ---The PH-change during the product ripening period

Group	Stuffed	Toasted	The 7th day	The 12th day	The 21st day	The 30th day
Group II	5.48	4.73	4.59	4.48	4.50	4.53
Group III	5.51	4.15	4.95	4.92	4.73	4.75
Group I (control)	6.10	5.52	5.41	5.38	5.39	5.37

Table 5--- aw value after ripening for 30 days

Group	Group II	Group III	Group I (control)
aw value	0.88	0.87	0.81

From table 4 and table 5, we know that after being stuffed, PH is 5.48 in group II and 5.51 in group III, PH is changing during toasting and air-drying, tending to become lower. After ripening for 30 days, PH of group II is 4.53, PH of group III is 4.75, because of not adding starter to group I, its PH decreases slowly, being 5.37. According to storage requirement for meat products when their PH is < 5.0 or $aw < 0.91$, the products belong to "easy storage" foods and can be stored without freezing, our products are such ones.

CONCLUSION: Through experiment we could prove that cabbage cover pickle can no doubt take the place of pure lactic acid bacteria starter in producing goaty odour removal sausage.

The goaty odour removal effect is obvious, C_{10} -content in goaty odour removal sausage is 30-34% lower than that in raw goat meat.

The colour, flavour, taste and appearance of goaty odour removal products all are attractive. Providing a simple and feasible way for producing goaty odour removal products in industry.

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