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EXPERIENCE WITH FROZEN MEAT FOR DRY SAUSAGE PRODUCTION

ESPECIALLY WITH REGARD TO THE COLOUR FORMATION.

By

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*Luian luvra luvruin,
" alk. luvruin:
viri viruina !*

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During the last years there has in Norway been a trend towards increased use of frozen meat in the sausage manufacture. This refers to cooked items as well as dry sausages.

For our comparatively small plants with seasonal varying meat supplies, the use of frozen meat has considerable advantages. By means of the freezing technique it is possible to keep in stock all sorts of meat that is needed for the production. The cut meat is frozen into 25 - 30 kg's blocks and stored in cardboards or wrapped in film. The meat is used in the production without thawing.

Colour problems.

From a technical point of view the procedure works very well. But the passing over from the old well-experienced way to the new one, has in some cases caused problems concerning the colour formation in the products.

Regarding the dry sausages, the most common defect has been the grey discolouration in the center parts. Discolouration of the exterior is more seldom.

There is a complex of factors in the curing process that may influence upon the colour formation. One of these is the salting.

Salting.

By the formerly used method of manufacture, the pork fat was normally presalted and had a salt content of about 5%. This has to be

compensated for by extra salt addition, when using unsalted frozen fat.

After stuffing the cure is done in two ways. The one is brine cure; the other curing in climate rooms. In the last case 10 - 15 grams of extra salt has to be added per kilogram in order to get the same salt level in the finished product.

When brine-curing, the discolouration seems to start already in the salting vats. Some times it may be due to a too short salting period.

Analysis of finished sausages that had been brine-salted for only one week indicate that there may be a correlation between salt content and discolouration. Some figures from the analysis are given in table 1.

Table 1

Sample No.	S a l t		W a t e r		Salt/water		Colour center
	Center %	Outer %	Center %	Outer %	Center %	Outer %	
1	8.8	7.7	38.9	32.1	22.6	24.0	Good
2	11.6	8.0	34.5	24.7	35.6	32.4	"
3	8.1	6.4	22.8	21.1	35.5	30.4	"
4	7.5	5.6	26.3	19.0	28.5	29.4	"
5	7.8	5.4	26.7	18.0	29.2	30.0	"
6	7.2	5.6	28.4	19.9	25.0	28.2	"
7	9.1	6.6	36.9	23.7	24.8	27.9	"
8	8.7	6.7	28.0	19.6	31.1	34.2	"
9	6.3	4.3	22.3	14.8	28.4	29.1	Grey
10	6.5	4.3	28.7	19.0	22.6	22.6	"
11	6.3	4.5	22.2	18.5	28.4	24.4	"
12	4.1	2.7	34.9	19.6	11.7	13.8	"
13	7.1	4.6	23.9	14.4	29.7	32.0	"

The salt penetration is influenced by the way the sausages are stacked in the brine vats. If the stacks are too high, the sausages will be pressed into a compact block by the power of buoyancy. The sausages become mis-shaped, and the salt diffusion into the middle region is retarded, due to the fact that a major part of the salt will have to penetrate from the ends of the sausage.

Analyses of compact stacked sausages show the following figures for the salt concentration in the middle region and the ends:

Table 2

	S a l t		W a t e r		Salt/water	
	Center %	Outer %	Center %	Outer %	Center	Outer
Middle region	7.2	5.6	28.9	19.9	25.0	28.2
10 cm from end	7.6	6.2	21.0	16.1	36.2	38.8

It appears from the table that the proportion salt/water is much higher in the ends than in the center region.

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Nitrite/nitrate.

In our country the only legal addition of nitrite is in the form of a mixture with common salt that maximum contains 0.6% nitrite. This amount of nitrite is too small to give sufficient colour in dry sausages. Nitrate may be used in amounts up to 1% of the product, but not in combination with nitrite. Only one of the two nitrogen salts may be used at a time. The curing of dry sausages thus has to be based upon nitrate, which usually is added in amounts of 0,5 - 3 g per kg meat.

Analyses of the grey center from discoloured sausages show a less nitrite content compared with the normal coloured parts. For nitrate the conversed ratio was found. This is in good accordance with professor Niinivaaras previous statements.

pH-control.

Control of the pH at different stages of the production has afterwards been paid steady more attention. If the pH of the finished dry sausage is above 5.4, it is likely that parts of the production will be discoloured.

The pH of the dry sausage is regulated by the carbohydrate addition. If too little carbohydrate is added, the pH of the product will probably be high, and discolouration take place.

In one of our plants Kristallpur was used as a carbohydrate source. That is a dried, partly hydrolysed starch syrup consisting of dextrin, maltose and glucose. When used in quantities of 3-4 g per kg, the sausages got a final pH of about 6.0 and discolouration frequently occurred. By increasing the addition of Kristallpur to 7-8 g per kg, the pH fell to 5,2 - 5,4 and the colour of the product was improved.

Other sorts of carbohydrates used are glucose, glucose-syrup, saccarose and treacle.

Kuchling 4.5 g!

In table 3 is shown the pH of normal and discoloured sausages made with different quantities of carbohydrates.

T a b l e 3.

No.	pH Center	Outer	Colour	Kind of carbohydrate added g/kg
1	5.4	5.4	Good	7 g Kristallpur
2	5.3	5.3	"	3.5 g glucose
3	6.0	6.0	grey	1 g "
4	6.1	6.0	"	1 g "
5	6.0	5.8	"	1 g "
6	4.9	4.8	good	10 g glucose syrup

Addition of artificial colours is legal in our country. But this does not solve the colour problem. If the curing process fails, the colour of the added artificial dye is reduced too. The purpose of the artificial colour is only to brighten up the appearance of the proper made product.

The importance of the microflora has been studied by professor Niinivaara and other investigators. We have not in our laboratory yet done much research in this field, but we have a feeling, that when the manufacturing process is carried out in a correct way, the sausages get the proper colour and flavour, whether we care about the microflora or not. A reason for this may be that the necessary nitrate-reducing bacteria normally are present in sufficient numbers, and do their job if the growth conditions are favourable.

As an experiment in order to prove the importance of the microflora, we inoculated a batch of dry sausages with 15 % of a discoloured product that contained a very active colour-reducing micrococcus. In spite of this heavy infection, all the sausages got a good colour.

tion to low temperature. Hieno mikrobien kasvu ja
Vähän mikrobeja, Pitäisi käyttää Start.
Temperature. + 50. m.

The use of frozen meat gives a low temperature in the force-meats, and facilitates the cutting of the pork fat without smearing.

Also for the stuffing operation a low temperature is advantageous, especially when using the continuous vacuumstuffers. If the temperature in these stuffers arises to above + 2° C, the forcemeat is apt to smear.

In the case of brine salting however, the low temperature of the stuffed product is a disadvantage. When stacked in big brine-vats. temperatures below 0° C will keep for a very long time, if no special

steps are taken to raise the temperature.

Preheated brine may be used, but it will still be necessary to recirculate and heat the brine until the fixed temperature is reached. With no circulation, considerable temperature differences will occur between the top and the bottom of the vat. That again will influence upon the curing process, and result in an unequal product.

The low temperature after stuffing is no problem when using the other method where the curing is carried out in climate rooms.

Anti-mould treatment

In many countries the dry sausages are naturally covered with a thin layer of white mould. By us, this type is not common, and one of the problems in sausage manufacturing is therefore to prevent the growth of mould. That may to some extent be done by regulating the humidity of the stores. But the best results are obtained when in addition to the humidity control, the surface of the sausages is given an antimould treatment. That is done immediately after stuffing by dipping the sausages into a solution of preservatives, mainly based on sorbic acid.

Sausages that are to be stored for some length of time, are often covered with a thin layer of wax on the surface to prevent them from drying up. It is an effective and inexpensive process, but if the waxing is carried out on a too early stage of the production, some descolouration may take place.

Conclusion.

The preliminary conclusion of some practical investigations concerning the discolouration of dry sausages, is that this problem in the first place, is a question of temperature. When producing dry sausages from unthawed frozen meat, the temperature after stuffing normally is so low, that it is necessary to provide some heating of the curing brine in order to get the proper fermentation. Also during the smoking and ripening process the temperature, as well as the relative humidity, should be exactly controlled. Another important factor is the pH of the sausage. Regulation of the pH may to some extent be possible by means of the added amount of carbohydrates.

S U M M A R Y

The use of frozen meat for sausage production has in Norway considerable advantages seen from a technical point of view. But the new technique by using unthawed frozen meat, has in some cases caused

problems regarding the colour formation in the products. For dry sausages the most common defect has been the grey discolouration in the center. That may partly be due to the low temperature in the product after stuffing. By temperature control in the brine-vats and regulating the pH of the product, some of the discolouration has been eliminated.

ZUSAMMENFASSUNG.

Anwendung von gefrorenem Fleisch bei der Wurstherstellung hat in Norwegen bedeutende produktionstechnischen Vorteile. Das Fleisch wird in gefrorenem Stande verarbeitet. Dies neues Verfahren hat aber in einigen Fällen Probleme betreffs der Farbbildung der Produkte hervorgerufen.

Was der Rohwurst anbelangt, ist der gewöhnlichste Fehler der graue Kern. Dieser Farbfehler hängt teilweise mit der niedrigen Temperatur der gespritzten Würsten zusammen. Durch genaue Temperaturkontrolle beim Salzen und Regulieren des pH, ist es möglich ein Teil der Farbfehler zu vermeiden.

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Sp/rk.