G1. NITRITES AND NITROSAMINES IN PROCESSED MEATS

INDUSTRIAL APPLICATION OF STRAIN P_4 IN THE PRODUCTION OF RAW-DRIED SAUSAGES IN THE PEOPLE'S REPUBLIC OF BULGARIA

Stoyan Djevizov

Summary

Observations have been made for two years on the application of the strain P_4 starter on an industrial scale. As a result of the technology applied in four different items it has been observed that the drying period is reduced by 40-45% compared to the production where the starter was not applied. Moisture loss, pH, microflora, and organoleptic indices have been followed in the process of drying. The application of strain P_4 as a starter results in the reduction of technological processing, the elimination of a number of technological processes, and the unification of production in terms of organoleptic indices, pH, and microflora.

L'APPLICATION INDUSTRIELLE DE LA SOUCHE P_4 DANS LA FABRICATION DE SAUCISSONS SECS EN BULGARIE

St. Djevizov

Résumé

Pendant deux années ont été effectuées des observations sur l'application d'une culture starter de la souche P_4 à l'échelle industrielle. Par suite de la technologie, appliquée sur quatre assortiments différents, on peut observer un raccourcissement du délai de séchage de 40-45% par rapport à la fabrication, à laquelle on n'a pas appliquée de culture starter. Lors du procès de séchage on étudie la perte d'humidité, le pH, la microflore et les indices organoleptiques. Par suite de l'application de la souche P_4 en tant qu'une culture starter, on observe une réduction du traitement technologique, une élimination de toute une série de procès technologiques, une égalisation de la production en ce qui concerne les indices organoleptiques, le pH et la microflore.

ANWENDUNG DES STAMMES P_4 BEI DER INDUSTRIELLEN HERSTELLUNG VON ROHWURST IN DER VR BULGARIEN

Stojan Dshevisov

Zusammenfassung

Im Laufe von zwei Jahren wurden Beobachtungen über die Anwendung von Starterkulturen des Stammes P_4 in der Industrie durchgeführt. Als Ergebnis der bei vier verschiedenen Produkten angewandten Technologie wird eine Verkürzung der Trocknungszeit um 40 - 45 % im Vergleich zur Herstellung ohne Anwendung von Starterkulturen beobachtet. Während des Trocknungsprozesses werden der Feuchteverlust, der pH-Wert, die Mikroflora und die sensorischen Eigenschaften überprüft.

Bei der Anwendung des Stammes P_4 als Starterkultur wird die technologische Verarbeitung verkürzt infolge des Ausfalls einer Anzahl technologischer Prozesse, indem eine Vereinheitlichung der Produktion hinsichtlich der sensorischen Merkmale, des pH-Wertes und der Mikroflora erreicht wird.

ПРОМЫШЛЕННОЕ ПРИМЕНЕНИЕ ШТАММА P_4 ПРИ ПРОИЗВОДСТВЕ СЫРО-ВЯЛЕНЫХ КОЛБАС В НРБ

Ст.Хр.Джевизов

Аннотация

В течение двв года проводятся наблюдения при применении закваски из штамма P_4 в промышленном масштабе. В результате примененной технологии в четырех различных ассортиментах наблюдается сокращение срока сушки на 40-45% по сравнению с производством, которому не применена закваска. В процессе сушки прослеживают потерю влаги, pH, микрофлору и органолептические показатели. В результате применения штамма P_4 в качестве закваски, сокращается технологическая обработка, выходит из состава ряд технологических процессов, унифицируется продукция по органолептическим показателям, pH, микрофлоре.

INDUSTRIAL APPLICATION OF STRAIN P_4 IN THE PRODUCTION OF RAW-DRIED SAUSAGES IN THE PEOPLE'S REPUBLIC OF BULGARIA

Stoyan Djevizov

Meat Technology Research Institute, Sofia

The application of strain P_4 as a starter in the industrial production of raw-dried sausages imposed some changes in the accepted technological processes. The latter had to be adjusted so that to provide optimum conditions for the growth and action of the starter culture introduced, without having a negative effect on ready product quality. The preliminary experimental work (2, 3, 4, 5) with strain P_4 in laboratory, semi-industrial and industrial conditions allowed us to apply such a technology, which was used for two years in daily industrial production. Observations during that period aimed at ascertaining, on industrial basis, the expediency of the technological parameters applied and their impact on the growth of the introduced strain P_4, the drying period, and the organoleptic indices of the ready product.

METHODS

1. Technological methods

1.1. Assortment. The following article types of raw-dried sausages were covered in the experimental work:

Article 1.- Beef and pork Loukanka, BDS (Bulgarian State Standard) 2589. Composition: beef, 60%, and pork, 40%.

Article 2. Pork Loukanka, BDS 2589. Composition: 100% pork.

Article 3. Ambaritsa sausage, BDS 1851907. Composition: pork, 80%, and beef, 20%.

Article 4. Moussala sausage, BDS 10690. Composition: 100% pork.

Articles 1 and 2 are typical national products, they are not smoked and, during drying, they are subjected to repeated pressing. The casing diameter is 47 mm. Articles 3 and 4 are round smoked sausages with a casing diameter of 58 mm.

1.2. Preparation of raw materials. After slaughter, products are cooled for 24-48 hours, with a view to temperatures below $10^{o}C$ deep into the ham. The deboned and sorted meat is cooled: beef and red pork, down to $-1^{o}C$ or $-1,5^{o}C$ (usually in 20 hours). Fatty pork meat, and the fat are cooled down to minus $5^{o}C$ (usually in 36-48 hours).

1.3. Machine processing. Machine processing was effected on the Krämer-Grebe line. Fatty pork or the fat are cut at several revolutions in a cutter, then beef or red pork, spices, salting materials and the starter, in the form of broth culture, are added. Cutting is continued till the desired particle size is obtained. Vacuumizing and filling is effected immediately according to the Krämer-Grebe line. "Fibros" artificial casings were used.

1.4. Drying. The whole production cycle was accomplished in Italian type climatic driers that provided for the realization of the straining, smoking, and drying processes.

1.4.1. Straining. It took place in the straining chambers, with an automatic regime, to the stage of semi-drying of casings (for about 48 hours). Straining was applied for articles 1 and 2. The following parameters were applied: temperature, 13^{o}-$15^{o}C$, and relative humidity, 75-80%.

1.4.2. Smoking. It took place in the straining chambers. It was applied for articles 3 and 4. Filled production strained in those chambers for about 20 hours. Then the chamber was amply satiated with smoke obtained directly in the chamber. During the straining and smoking process, an automatic regime was maintained with the following parameters: temperature, 15^{o}-$20^{o}C$, and relative humidity, 80-85%. The smoking process was realized in 6 or 7 days.

1.4.3. Drying. It took place in the drying chambers. An automatic regime with parameters of temperature, 13^{o}-$15^{o}C$, and relative humidity, 78-82%, was maintained for articles 1 and 2 in the first twenty days. Then, to the state of ready product, the ranges were 16^{o}-$18^{o}C$ for temperature and 74-78% for humidity. During drying, the product was pressed periodically: on the 10th or 12th day, on the 17th or 18th day, on the 23rd or 24th day after filling.

With article 3: temperature, 12-$14^{o}C$, humidity, 80-82%; during the last week of drying: temperature, 16^{o}-$18^{o}C$, and humidity 74-78%.

With article 4: temperature, 12^{o}-$14^{o}C$, humidity, 80-85%; during the last fortnight of drying: temperature, 13^{o}-$15^{o}C$, and humidity, 78-82%.

2. Preparation of starters

Strain P_4 (1, 6) was used as a starter. Preparation was made in the plant laboratory, according to an official instruction (6). 20-hour broth culture (5, 6) was used at the rate of 5 ccm per kg of filling, according to the instruction (6, 7).

3. Laboratory observations

Observations were made on production lots. Analyses were made: immediately after filling, after straining, after smoking and in the process of drying, at 7-day intervals. The following observations and analyses were carried out.

3.1. Moisture loss. After filling the lots, some 10 pieces were set aside and weight loss was followed by weighing during the whole technological process and was expressed in %.

3.2. Determination of pH. This was done using an electric pH-meter SP.

3.3. Microbiological investigations. From each lot, a contact preparation was made on yeast-glucose agar (2, 3, 7). The presence of strain P_4 colonies was determined visually, and using the small magnification of a microscope.

3.4. Organoleptic evaluation. Organoleptic evaluation was made of each sample during its analysis for other indices by the laboratory staff. Each lot of ready product was evaluated in the organoleptic laboratory of the plant.

RESULTS

Data about production without a starter (Table 1) refer to 1971, when no starter was used in the same plant. Technological processing and adopted parameters were in accordance with existing official instructions. The data indicate that the drying period varies considerably in each article. An explanation to that can be sought for predominatingly in the ununified microbiological processes during the drying and ageing period (3, 4). The absence or the retardation in the growth of a microflora capable of reducing product pH, delay drying processes.

Data about production with a starter (Table 1) refer to 1972-73, when the whole production in the same plant was processed using strain P_4 according to a technology indicated under "Methods". Conditions and the casings used were the same as those in the production without a starter. The data point to a considerable reduction in the drying period: by 43 to 45% in comparison with the production without a starter; with no significant variation in the individual lots of articles produced. That speaks of a correct, unified ageing process, with appropriate technological parameters confirmed by the results obtained for moisture loss (Table 2). The insignificant diversions from M confirm a unified drying process. Microbiological results indicate that strain P_4 gains a preponderance over the remaining microflora already in the first days after its introduction and is retained during the whole drying process. As a result, product pH is rapidly reduced, while diversions in M are insignificant (Table 3). Further, organoleptic indices followed periodically through the drying process, are characteristic. The improvement in sausage binding progresses parallel to pH reduction. Binding is pronounced already within 4 or 5 days after filling, and it is retained during the whole drying period. Also, colouring processes begin on the 4th or 5th day. Filling acquires intensive colouring with a raspberry tint, which after the 10th or 12th day acquires the typical rosy colour that does not change on cutting, for 4 or 5 days. Changes in flavour and aroma are detectable on the 7th or 8th day, a manifest smack of ready product appearing after the 10th or 12th day. Recurrent organoleptic indices in every lot point to a correct, unified ageing process on the basis of the introduces cultures of strain P_4. The data obtained from industrial production confirm the results of other observations of ours (2, 3, 4).

DISCUSSION

The technological processes after the filling of raw-dried sausages are essential in the technology of the latter. Two basic processes take place here: preservation by moisture release (drying), and ageing predominatingly on microbiological basis. Those two processes are interdependent: thus the set parameters (temperature, humidity and velocity of the air), apart from having vir-

tually the task to take away moisture from the product, must also provide the most favourable conditions for microflora growth in the sausage. On the other hand, microbiological processes, apart from being the basis of ageing itself, must reduce product pH and create good binding, so that to favour drying processes. In the processes of drying, modern technique provides for a correct and guiding intervention of the technologist. In the ageing process, however, in the presence of most varied microflora, the technologist is inefficient. Hence the failures with the parameters applied, the poor and varied quality of production. This basic problem in the production of raw-dried sausages can be solved by the application of suitable pure cultures. In this country, the problem was solved by the application of strain P_4 (2). An expedient technology for the industrial application of strain P_4 was arrived at in the course of a series of laboratory, semi-industrial, and industrial observations (1, 2, 3, 4, 6, 7). The two years' application of that technology in four basic enterprises gave good results in two respects: curtailing the period of technological processes, and the unification and sharp improvement of quality. Curtailing the period of technological processes by 43-45% is obtained for two reasons. In the first place, a number of technological processes are eliminated: straining of raw materials, preliminary ageing of the filling, the period of obligatory green mould coating, etc., and the pressing of Loukanka sausages is reduced to 2 or 3 times, instead of 5 or 7 times. In the second place, due to the starter introduced, the growth of other saprophytic microflora stops (3, 4), and production pH falls rapidly. This makes it possible to apply such drying parameters, as would favour that process (a higher temperature, a lower humidity, a higher air velocity).

Parallel to the reduction of technological terms in the manufacture of raw-dried sausages, the production obtained has stable unified quality indices, expressed in the whole yearly production. Binding and colour formation begin already after the 4th or 5th day, and the formation of flavour and aroma qualities, on the 10th or 12th day. Ready production has well formed quality indices, stable colour on cutting, and a long storage life, what makes it a product with good commercial indices.

The application of a starter in raw-dried sausages, with well selected technological parameters, offers possibilities for a wide industrial manufacture of raw-dried sausages with unified and stable quality indices.

CONCLUSIONS

1. The application of strain P_4 as a starter contributes to the reduction of the period of technological processing, by eliminating a number of technological processes and using such parameters as will accelerate drying processes.

2. The application of strain P_4 as a starter in raw-dried sausages unifies and improves the quality of ready production.

R E F E R E N C E S

1. Джевизов Ст. - Технология за приготовляване на заквасна от щам P_4 за индустриално приложение. Информационен бюлетин бр. 5/1969 г.
2. Джевизов Ст. - Технология за производство на луканка с влагане на заквасна от щам P_4. Информационен бюлетин бр.6/1969 г.
3. Джевизов Ст. - Върху взаимоотношенията между сапрофитна микрофлора и микрококус щам P_4 в условията на сурово-сушени колбаси. Информационен бюлетин бр.4/1972 г.
4. Джевизов Ст. - Влияние на някои температурни режими върху сапрофитната микрофлора в сурово-сушените колбаси през процеса на сушенето. Информационен бюлетин бр.3-4/1973 г.
5. Джевизов Ст. - Сравнителни проучвания от приложението на щам P_4 като заквасна в бульонна култура и лиофилизиран вид при производството на сурово-сушени колбаси. Информационен бюлетин бр. 1-2/1973 г.
6. Инструкция - За производство и контрол на чисти култури от щам P_4, предназначени за производство на сурово-сушени колбаси. ДСО "Родопа" - София, 1972 г.
7. Инструкция - За производство на сурово-сушени колбаси с чисти бактериални култури от щам P_4. ДСО "Родопа" - София, 1972 г.

Table 1.

Article	Production with starters				Production without starters			
	Number of lots n	Amount in tons	Drying period, days M	±m	Number of lots	Amount in tons	Drying period, days M	±m
Article 1	172	163,1	25	1,1	39	48,3	44	4,3
Article 2	114	63,2	26	1,13	22	26,3	45	4,2
Article 3	118	169,3	27	1,2	43	64,4	55	5,1
Article 4	15	18,2	43	2,05	8	12,3	72	5,8

Table 2.

Article	n	Weight loss, %, by days											
		7		14		21		28		35		42		49	
		M	±m	M	±m	M	±m	M	±m	M	±m	M	±m	M	±m
Article 1	11	19,6	1,14	30,2	1,26	37,3	1,47	41,1	1,21	-	-	-	-	-	-
Article 2	11	17,5	1,15	29,1	1,02	34,5	1,36	38,8	1,34	-	-	-	-	-	-
Article 3	11	17,2	0,9	22,1	0,96	25,5	0,69	31,2	1,04	-	-	-	-	-	-
Article 4	7	15,1	1,04	24,1	1,01	27,3	1,07	31,1	1,10	34,7	1,04	37,3	1,34	39,5	1,70

Table 3.

Article	n	Change in pH, by days													
		0		7		14		21		28		35		42		49	
		M	±m	M	±m	M	±m	M	±m	M	±m	M	±m	M	±m	M	±m
Article 1	11	5,9	0,13	5,35	0,12	5,3	0,11	5,35	0,08	5,45	0,13	-	-	-	-	-	-
Article 2	11	5,86	0,14	5,35	0,11	5,25	0,10	5,35	0,07	5,4	0,12	-	-	-	-	-	-
Article 3	11	5,8	0,10	5,3	0,09	5,2	0,09	5,3	0,09	5,35	0,10	-	-	-	-	-	-
Article 4	7	5,85	0,11	5,3	0,08	5,2	0,09	5,15	0,07	5,1	0,09	5,25	0,08	5,3	0,09	5,3	0,08