

The effect of curing on cooked-and-smoked beef products

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The volume of cured beef products as a part of total meat products manufacturing is considerably lower comparatively to pork. This restriction is due to the fact that beef is tougher than pork, thus weakening the consuming properties of the end product particularly in the case of the shortened technological process.

In the process of meat ripening and tough cuts softening for cured meat products manufacturing the curing of meat raw material is of major importance. It's a lasting and complex diffusio-osmotic process of meat and brine components interaction resulting in modifying of colloido-chemical state and physico-chemical properties of proteins. The product acquires tender and juicy consistency and a special agreeable flavour.

Several curing procedures are known: dry curing, wet curing, and mixed curing. The most widespread is wet curing since it gives high quality of products. At present they use mixed curing, i.e. brine injecting and salt rubbing of meat followed by allowance in the curing brine. This procedure is more advantageous in comparison to wet curing. However this technique permits partial losses of water-soluble proteins, salt-soluble proteins, extracts and minerals either.

To intensify the curing process we developed a number of multicomponent brines and the curing technology.

The brine formulation contains some components accelerating the curing process, softening intermuscular tissues and rendering denitrifying and antibiotic effects that improve the food and biological value of the end product.

Apart of salt, sugar, phosphates, and nitrite some beef-curing brine formulations contain diacetyl, mustard, lactic acid; the other include whey or special bacterial concentrates made in the Ukrainian Meat and Dairy Research Institute.

Recently the Soviet and foreign scientists developed the technologies, equipment and know-how that improved considerably the product quality, intensified productivity and lowered raw material and labour costs.

The most efficient way to mass the curing agents is to inject brine into the meat thickness. But subjecting to the shortened terms of beef curing in the brine this technique can't assure the even brine components distribution.

The injected primarily occupy the lowest resistance regions. In order to penetrate the complex structure of muscular tissue the brine formulation must overcome the resistance of the interfibrillar bonds and connective tissues, which could be achieved by massaging. It was established experimentally that even brine distribution could be obtained after 30 min massaging.

The brine being introduced into the meat thickness in quantities of 20 - 35% of the raw material weight assures the meat ripening in two days and gives the end product of high quality.

To accelerate the curing process the pieces of meat after brine injection are being massaged by slow mixing with light slapping. This careful massaging causes no damage to the tissue integrity.

The technology providing two-fold raw material massaging in the manufacture of cooked-and-smoked products of lower grade beef meat with much of connective tissue has been worked out.

After tenderisation meat pieces of 1 to 5 kg are cured in the brine for two days at 2 - 4°C. At the end of curing process meat cross-section is uniformly coloured bright red, with no grey stains. The meat is moderately salted and possesses flavour of the brine components. After curing in the brine the raw material is formed, corded, and sent to the heat processing.

Product smoking takes place in the smoke-air atmosphere at 90 - 100°C for 2 - 2,5 hours. Then the product is cooked in the steam-cooking chambers at 78 - 80°C or in the water boilers at 88°C until the temperature inside the product reaches 70 - 74°C. The cooked product is cooled in chamber until the temperature of the core of the product does not exceed 8°C.

New types of smoked beef products ("Posolskaya" top grade ham, cooked-and-smoked products, "Desnyanskaya" beef roll, and others) feature dry and evenly coloured surface. Their shape is either cylindrical, or oval and rectangular, depending on muscle shape used as raw material for smoked products manufacture.

The end product is evenly coloured rosy-red, juicy, with well expressed flavour of ham. The end products of five production batches were examined to give the proper evaluation of the new products quality. The experiments were reproduced three times. The cured products manufactured without application of the above formulations served for controls.

The data obtained proved that the new formulations influenced favourably the end product quality.

By their protein quality the pilot products can be regarded as the products of high protein content. Concerning the composition and content of amino acids, especially the essential ones, the pilot products approximate physiological needs of a human body.

The fat - protein ratio makes about from 1:4 to 1:7. Hydrogen ion concentration of pilot products is reduced in comparison to that of control samples, which is of a great importance for obtaining proper colouring of cured meat products.

Water-holding capacity of the new products is considerably higher than that of controls, and the output makes more than 90% (70% - for control samples). Tryptophan - oxiprolin ratio equals 1, and that of the control samples - 0,65. Oxiprolin reduction in the pilot products can be explained by the fact that the new formulation softened connective tissue.

New types of cooked-and-smoked products were analysed for bacteriological indices on 3, 4, 5, and 10th day of storage at 4°C. None of pathogenic microorganisms were found in all these cases, and total amount of microorganisms did not exceed 1500 cells after 10 days of storage.

New types of cured products can be preserved well. Insignificant appearance changes only were found after 15 days of storage at 5 - 6°C. During this period acid and peroxide numbers increased slightly: from 1,9 mg KOH after one day of storing up to 2,48 mg after 15 days of storing.

Economic efficiency of the new technology introduction for cured beef products manufacture utilising the special formulations makes averagely 250 - 400 roubles per one ton of raw material.

Meat processing plants of the USSR master successfully the technology of the new types of beef products manufacture.

The first aspect of the study is devoted to the study of the effect of the size of the particles of the inclusion on the quality of the product. It was found that the 1:10 ratio of particles was most suitable in products organoleptically and do not reduce the organoleptical parameters of the product quality. When the size of these inclusions, added to sausage and ground meat products, increase over 30 μm, their organoleptical parameters reduce considerably because of the appeared "sandy" taste.

Table 2. The ratio of groups of fractions (I - to 30 μm and II over 30 μm), obtained in HMI is determined (Table 2).

Number of inclusions	Pressure in press operation, MPa				
	10	15	20	25	30
Inclusions are undetectable	25.1	37.1	41.7	44.5	45.1
Inclusions are detectable organoleptically	10.7	16.1	17.8	17.4	15.2

The analysis of the data given in Table 2 allowed to determine that pressure of 20 MPa is optimum from group II (over 30 μm) in HMI do not permit the utilization for the production of sausage and ground meat products. The results got allow to give foundations for the possibility of finely dispersed grinding. The main constructive and operating characteristics of the apparatus for re-grinding of these inclusions, contained in HMI over 30 μm, are satisfactorily listed. The re-grinder of these inclusions has been designed and commercially implemented. The design of the re-grinder is recognized as an invention. It consists of two grinding blocks. The first block includes a driving pair shaft - shaft where the initial grinding of these inclusions and cutting of long fibre structure of sausage and meat products takes place. The second block is for unaggregated coarse particles and fibrous, between which grinding of these inclusions with the formation of finely dispersed meat-bone matter takes place. The parameters of the re-grinder operation are studied experimentally (Table 3).

Table 3. Number of water removal, HMI inclusions content, and temperature of HMI products.

Number of water removal, g/kg	HMI inclusions content, %		Temperature of HMI products, °C
	From 10 to 30 μm	From 30 to 100 μm	
400	20.1	20.7	15.0
300	17.2	17.1	15.0
200	15.1	15.1	15.0
100	12.1	12.1	15.0
50	10.1	10.1	15.0
20	8.1	8.1	15.0

Available of data given in Table 3 allow to note that the best results for operation are obtained at the pressure of 20 MPa. The results of the study show that the HMI products are stable over 30 μm in size, the percentage of HMI products by weight is comparable with the initial temperature and the productivity is proved. The process of finely dispersed meat-bone matter structure formation of producing HMI by HMI and its further re-grinding by the re-grinder are studied. The results of the study show that the HMI products are stable over 30 μm in size, the percentage of HMI products by weight is comparable with the initial temperature and the productivity is proved.