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S.B. Verbytskyi, Ph.D., Engineering

Institute of Food Resources of NAAS, Ukraine

SOME TECHNOLOGICAL FEATURES OF HYDRO-MECHANICAL PROCESSING OF BEEF

С.Б. Вербицький, канд. техн. наук

Інститут продовольчих ресурсів НААН, Україна

ДЕЯКІ ТЕХНОЛОГІЧНІ ОСОБЛИВОСТІ ГІДРОМЕХАНІЧНОГО ОБРОБЛЕННЯ М'ЯСА ЯЛОВИЧНИНИ

A necessary technological operation in the production of delicacy whole-muscle beef products is its softening or tenderization (from the Latin *tener* – soft, tender). For this purpose, fermentation, ultrasonic treatment, as well as various kinds of mechanical influences, such as beating, notching, piercing, processing on rollers, etc. are used. Now days, the main trend is the hydro-mechanical processing of raw materials using brine injectors [1, 2] and meat massagers or tumblers [3].

The hollow needles of the injectors, in addition to saturating the meat with curing brine, play the role of the working parts of a mechanical tenderizer operating on the principle of piercing. Thus, the injection salt promotes maceration of meat, acting on it mechanically, causing the destruction of muscle fibers, as well as chemically. The latter action is achieved by introducing ingredients that increase water retention or promote proteolysis of muscle fibers. In beef processing, relatively simpler brine and lower injection levels are used compared to the production of ham from pork hams, since in the first case the purpose of curing is to improve consistency, and not increase yields. The simplest brine consists of water, salt (2-3%), phosphates (1%) and other necessary ingredients such as antioxidants. For beef, recommended injection levels are 8% to 10%. At the indicated percentages of salt and phosphates and within this range of injection levels, the finished end product will contain approximately 0.2-0.3% salt and 0.1% phosphates [4, 5].

Technically, intensive salting is carried out by piercing the meat with hollow needles, through which curing brine is injected. Today, mainly automatic injectors are used, equipped with needle blocks that combine up to several dozen hollow perforated needles, as well as units for continuous supply of raw materials to the injection zone using push or plate conveyors. While piercing the meat with injection needles and injecting brine, the feed conveyor is in standby mode, and the introduction of brine into the needles is carried out continuously or dosed, depending on the type of feed pump used. Typically, multi-needle brine injectors are equipped with electromechanical drives for raw material supply mechanisms, brine injection and reciprocating motion of the injection needle block. Such a constructive scheme is not uncontested: the Food Resources Institute of the National Academy of Sciences of Ukraine has developed a line of mechanical brine injectors without the use of an electric drive, in particular, the Ya5-FSH1L automatic injector with 50 needles, equipped with two pneumatic drives. The said actuate the needle block, supply raw materials using a pushing conveyor with a transport comb, and also supply brine into the holes of the injection needles [5].

On the Ya5-FSH1L injector, the yield of beef ham was determined depending on the average feed rate of raw materials into the processing zone. The output has a maximum value in the range of comb speed of 0.01 - 0.0115 m/s (Table 1). At higher speeds, the output is reduced due to a decrease in the volume of muscle tissue with channels for the penetration of

brine. The decrease in yield at low speeds can be explained by the greater brine leakage at the heat treatment stage [6].

Table 1 Effect of the transporting rake speed upon the yield of beef ham [6]

Injecting		Transporting rake speed, m/s				
		0.0080	0.0095	0.0115	0.0140	0.0145
Test 1	Yield, %	135.0	137.0	138.5	131.0	127.0
Test 2		132.0	133.0	134.5	128.4	122.9
Test 3		126.0	128.0	129.0	126.0	121.0

Massaging beef is preferably carried out in an interval mode: during rest, the muscle tissue of the meat relaxes, and when the drum of the massager rotates, the brine is intensively absorbed by the tissues of the meat. Traditionally, domestic enterprises used the following modes of processing meat raw materials in massagers: single massaging of bone-in raw materials at a drum rotation speed of 8 rpm, work 10 - 20 min., rest 50 min., when processing boneless raw materials: massaging raw materials at a drum rotation speed of 16 rpm, work 20 - 30 min., rest 45 - 60 min., the cycle is repeated for 24 - 36 hours. There are recommendations to use such massaging mode for beef: 20 - 40 min., work, 20 - 40 min. rest, the total processing time is up to 16 hours. It is also recommended [7] to massage raw beef in the following mode: the drum is filled to 70 % capacity and 30 min. work / 30 min. rest are alternated, while the total processing time is 12 hours at a speed of 20 rpm, or 8 hours at a speed of 5 rpm. [8]. The Institute of Food Resources of NAAS conducted research and determined the optimal parameters for processing beef in paddle drums with a diameter of 1000 mm to 1200 mm: the total number of strikes of meat pieces is 3000 - 3500, the fill factor is up to 0.5; mode: 20 min. work / 25 min. rest, drum rotation speed is from 8 to 10 rpm.

So a conclusion can be drawn that it is possible producing delicacy whole-muscle products of beef when proper pickling brines are used as well as proper technological machines.

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