The role of protein-fat emulsions in ham structure formation

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Among the meat products hams are in special demand. These must be of high taste qualities. From old for ham production the best parts of young animals (usually pigs) carcasses are used. But in recent years the industrial development has acquired the production of hams from beef, lamb, poultry meat. It became possible due to improvements in ham technology and development of rather effective technical facilities able to improve the taste qualities of hams especially meat juiceness and tenderness. However, in many cases the taste qualities of beef, lamb or poultry hams are markedly worse than those of pork ones. Pork includes less connective tissue, whose proteins are more labil, as compared with those in the connective tissue of beef or lamb; the pork also contains more intramuscular fat that ensures the specific taste of hams, their tenderness and juiceness.

As experience shows, using meat with higher fat content for ham manufacture or direct stuffing of fat into the muscle tissue has no positive technological effects on ham as during its cooking or smoking this fat is rendered forming the objectionable spots. Large fat depositions formed result in the unpleasant taste of ham. These disadvantages may be avoided by adding fat in the form of a stabil protein-fat emulsion. For preparing such an emulsion of "oil-in-water" type rendered chicken or pork fat or vegetable oil, stabilizers (sodium caseinate, soluble soy protein, edible gelatin) and mechanically deboned chicken meat were used. The emulsions were prepared using an experimental hydrodynamic unit and a laboratory tissue grinder at the knives rotation rate of 3000 rpm. As in all cases for preparing emulsions mechanically deboned poultry meat was used, what results in a comparatively high viscosity, it was impossible to determine the emulsion stability as a inverse value to the coalescence rate: $\frac{1}{\mu} = \frac{\tau}{v}$, where τ is the existence time of a definite volume or a unit column of the system, since there was no fat separation at room temperature and at 2-4°C before the beginning of emulsion microbial spoilage. That's why the emulsion stability was studied by heating it in test tubes, 4 mm in diameter and 100-120 mm long, in a water bath at 85°C for 30 min. The emulsion heated was centrifuged at 6000g for 30 min and its stability was determined by a column height of fat separated, assuming that less fat was separated in more stable emulsion.

The beef and poultry hams were produced. The formulations included beef pre-ground through a plate with 25 mm diameter holes or non-ground breast or thigh muscles of broilers (80 %) and emulsions which contained 50 % of mechanically deboned meat, 20 % of rendered pork or poultry fat, 4 % of sodium caseinate, 26 % of water. Meat and emulsions were pre-salted. For comparing purposes hams from only beef and from only broiler meat were produced. Pieces of the muscle tissue were cured using the brine with sodium chloride concentration 24 %, sodium nitrite - 0,05 % in a blade mixer for 15 min (broiler meat) or 30 min (beef). The emulsion was added to cured meat before its massaging. After massaging the meat was stuffed into an artificial protein casing, 60 mm in diameter, and cooked in water at 80-85°C to the temperature of 72°C in the centre of the product. The finished ham was cooled to 8°C.

It was found that the stability of emulsions prepared with sodium caseinate, gelatin and soy protein depended on protein and fat content, the different fat content being a necessary condition for preparing the most stable emulsions with different protein content. Fig.1 shows the stability of emulsions containing 50 % of mechanically deboned meat, 20 % of rendered chicken fat, 30 % in total of sodium caseinate and water as a function of sodium caseinate content and the stability of emulsions containing 50 % of mechanically deboned meat, 40 % of sodium caseinate, 46 % of rendered chicken fat and water in total as a function of fat content. Dependence of the emulsion stability from the different protein and fat content is more defined in case of protein and less in case of fat.

It is known that salt has a destabilizing effect on the emulsion. However, in emulsions studied the influence of the salt content (from 0 to 10 %) on their stability was rather weak. At the salt content of more than 2,5 % the emulsion stability decreases (Fig.2). Apparently at the high content of mechanically deboned meat (50 %) the structural net, being formed during heat treatment, tends to smooth over fat separating effect under the salt action.

One of the main technological problems in the production of ham in casings, i.e. from comparatively small meat pieces, is to manufacture the product with intact (monolithic) structure which is kept even during ham slicing. Objectively, forming the dense monolithic structure may be determined by a force necessary for breaking a sample of a specific shape. From the well-known processing techniques (curing, massaging, using emulsions, heat treatment, cooling) massaging has the greatest influence. After 1-2 min of massaging the meat a viscous protein solution appears on its surface, its quantity being increased with continued massaging (when the meat was pre-salted with dry table salt). During cured meat massaging the complete absorption of brine takes place within 3-5 min, then the surface of meat pieces becomes sticky. Massaging broiler meat is limited by 10-20 min, as it tends to comparatively quick splitting of muscle fibres and loses its integrity. Therefore, strengthening the intact structure of ham is observed only during the first 10-20 min of massaging (Fig.2).

At the 5-score evaluation ham prepared with emulsion added had a higher score for its tenderness (4,4) and integrity (4,5) as compared with ham samples prepared without emulsions (4,0 and 4,1 respectively).

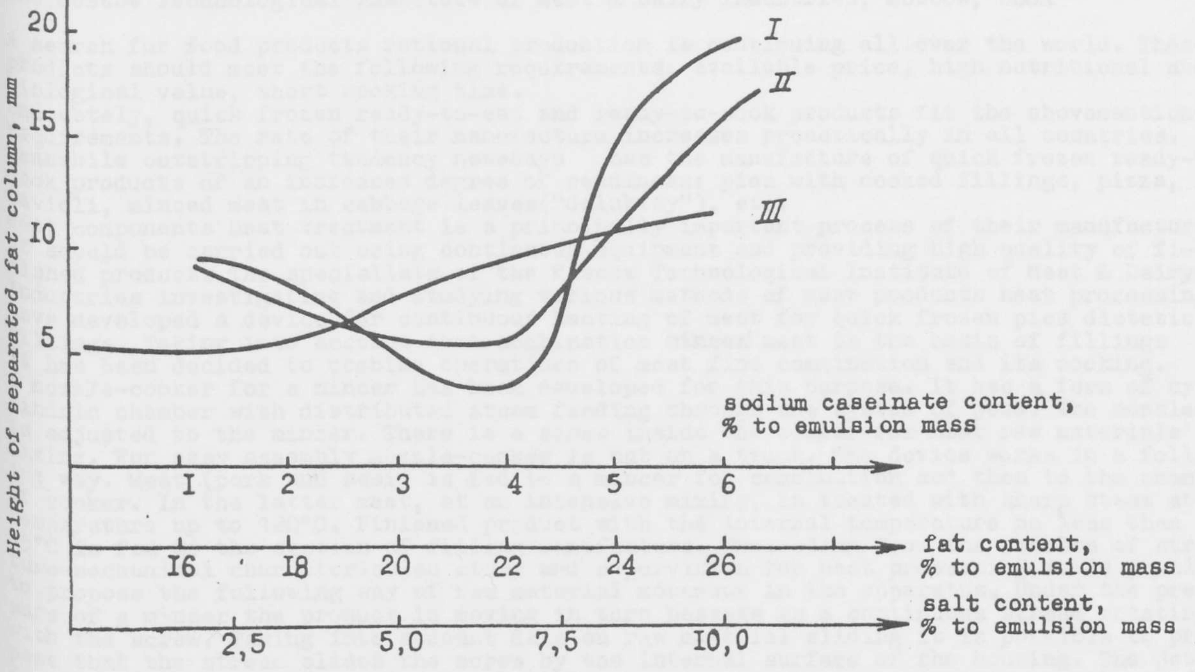

Fig.I Emulsion stability as a function of sodium caseinate (I), rendered chicken fat (II) and table salt (III) content

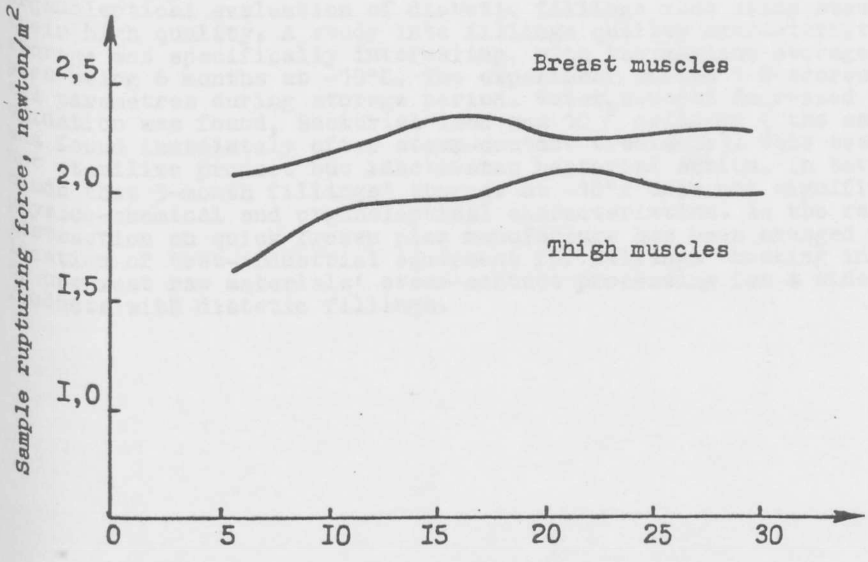

Fig.2. Effect of massaging time on the nam integrity