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## Investigation of Some Factors Affecting Emulsifying of Tallow of Meat Products.

The problem of fat emulsions in the batters of many products of comminuted meat has attracted attention of a numbers of workers in the recent years. Especially, the factors affecting the emulsifying capacity and the quality of the emulsions produced like the effect of temperature, concentration and the kinds of proteins, kinds of meat, pH, salt concentration, the manner of the mechanical meat processing, kinds of fat, and so on, were investigated. It is evident, from the standpoint of the science nad practice of the meat processing, the role of sarcoplasmatic and miofibrilar proteins on the formation and stability of emulsions are of the great significance.

Practical experience and literature data (4, 11) indicate that the beef tallow emulsions with the meat proteins are more stable compared to the pork fat emulsions. There are some other reasons showing that the tallow emulsifying is more interesting than pork fat from the meat processing standpoint.

Most authors (3, 4, 8, 10, 12) consider that the emulsifying capacity of meat extract depends on the salt soluble quality of proteins; it is suggested that the water insoluble

muscle proteins almost do not affect the emulsion formation or that this effect is minimal (12). It is claimed that the water soluble proteins are better emulgators than the other meat proteins (2).

Until now there is not satisfactory theoretical explanation due to which the differences in emulsifying activity between water soluble and salt soluble proteins exist. The studies were made to investigate the effect of some physical and chemical characteristics of water - soluble and salt-soluble proteins on their ability to form a sausage emulsion. It is established that there exists the definite relationships between the shape and the reactive groups on the protein fractions and their emulsifying activity (1). The emulsifying ability of water - soluble proteins appeared to be affected by the shape of the molecule; changes in net charge of the water - soluble proteins molecules are slight and not believed to exert as much influence on the emulsifying capacity as shape of the molecule. The emulsifying capacity od salt - soluble proteins is influenced by both net charge and shape of the molecules (as indicated by electrophoretic mobility and viscosity data).

Some data indicate that the meat proteins, prior the postmortal rigor appearance, form emulsions of better quality, as there is a higher content of water soluble proteins in such meat. This problem is of the special interest for the practice of meat industry, which long period experience learns that the slaughter - warm meat offers manifold possibilities.

The task of this work was to investigate if the meat extracts in water, NaCl and buffer, prepared immediately after slaughter, and 48 hours of ripening, have the same emulsifying capacity and give the emulsions of the same quality.

Experimental work

a) Preparation of extract.

M. Longissimus dorsi of beef, immediately after slaughtering, is free from coarse connective and fat tissues, it is twice ground in the grinder, applied in the dish in the form of the thin layer and quickly cooled to the temperature of +2°C ± 1°C. An aliquot of 25 g is weighted in the 250 ml beaker, 50 ml of the previously cooled extraction solutions (water, 2 % water solution of NaCl or buffer solution) are added, homogenized in the mixer (4000 rpm) for seconds, followed with the other 50 ml of the extraction solution and homogenization is prolonged for additional 90 seconds. To prevent the increase of the temperature of the extract, during the treatment in the mixer, the beaker is kept on the ice, and after homogenization, the contents of the beaker are extracted for 30 minutes at + 2°C ± 1°C. It is followed with centrifuging (4000 x G for 5 minutes) and filtering through the qualitative filter paper. The percentage of proteins by Kjehldahl (micromethod) is determined in 5 ml of filtrate. The parallel sample of m. longissimus dorsi, taken immediately after slaughtering, is cooled for 48 hours at + 2°C, and than it is subjected to the same treatment as above.

b) Preparation of extraction solution.

Three solutions were used:

1. water
2. 2 % water solution of NaCl and
3. buffered solution of the followed composition: 0,04 M $Na_2HPO_4$ x 12 $H_2O$ + 0,06 M $NaH_2PO_4$ x $H_2O$ (pH - 7,4).

c) Preparation of beef tallow emulsions.

Beef tallow and the certain amount of the extract

(heated at + 40°C) are homogenized in the mixer (4000 x G) for the period of 30 seconds, transferred in the 100 ml cylinder and after keeping at the room temperature for 2 and 12 hours, respectively, the percentage of the separated fluid is measured. The next relationships of the tallow and fluid are applied:

| I | II | III |
|---|---|---|
| 50 : 50 | 30 : 70 | 70 : 30 |

At the identical manner the emulsions with the extracts obtained from 48 hours cooled meat were prepared.

d) Apparatus.

The mixer of the German production: Labor - Rühr - werk, Type LR 40, Medingen - Dresden, and the centrifuge AHT, Type P6, M4, England production, with 6000 rpm were used.

## Results and discussions

In Table 1. the protein content in water-, salt- and buffer-extracts of slaughter-warm meat and meat after 48 hours of ageing is illustrated. The hightest protein content is found in the extract of 2 % NaCl, less protein content was found in the buffer extract, and the least protein content in the water extract. At the same time, the extracts of slaughter-warm beef contain considerably more proteins in all cases.

Protein content (%) of meat extract

Table 1.

| | extract in | | | proteins content (%) of beef sample |
|---|---|---|---|---|
| | water | 2% NaCl | buffer | |
| slaughter warm beef | 5,03 | 7,72 | 6,04 | 24,22 |
| beef after 48 hours ageing | 4,04 | 6,31 | 5,59 | |

From Table 2. it is illustrated that the salt-extract of slaughter-warm beef shows the highest emulsifying capacity and gives the most stable tallow emulsions; slightly less emulsifying capacity and less stable tallow emulsions are obtained in the extract of slaughter-warm beef in the buffered solution while the water extract of the same meat has the least emulsifying ability and gives unstable emulsions.

The effect of fresh extracts of slaughter warm beef on tallow emulsion stability

Table 2.

| Tallow/ extract | % released water in emulsion with extract in | | | | | | emulsion with water | |
|---|---|---|---|---|---|---|---|---|
| | water | | 2 % NaCl | | buffer | | | |
| | 2 | 12 | 2 | 12 | 2 | 12 | 2 | 12 |
| | | | (in hours) | | | | | |
| 50 : 50 | 15 | 15 | 5 | 5 | 6 | 6 | 40 | 40 |
| 30 : 70 | 45 | 45 | 21 | 22 | 44 | 44 | 50 | 50 |
| 70 : 30 | 1 | 1 | - | - | 1 | 1 | - | - |

Twenty - four hours keeping of salty slaughter-warm beef extracts improves both the emulsifying capacity and stability of its tallow emulsions, where as it does not exert any effect on emulsifying properties of the other extracts.

The effect of 24 hours keeping of slaughter warm beef extracts on tallow emulsion stability

Table 3.

| Tallow/ extract | % released water in emulsion with extract in | | | | | | emulsion with water | |
|---|---|---|---|---|---|---|---|---|
| | water | | 2 % NaCl | | buffer | | | |
| | 2 | 12 | 2 | 12 | 2 | 12 | 2 | 12 |
| | | | (in hours) | | | | | |
| 50 : 50 | 18 | 18 | 2 | 2 | 7 | 9 | 40 | 40 |
| 30 : 70 | 48 | 48 | 13 | 13 | 38 | 38 | 50 | 50 |
| 70 : 30 | - | - | - | - | 1 | 1 | - | - |

Table 4. indicates that the extract of 48 hours aged beef in 2 % NaCl and buffer extract of the same meat manifest the higher emulsifying capacity and give more stable

talow emulsions of the corresponding extracts of slaughter-warm beef. However, the emulsifying capacity and emulsion stability of the water extract of aged beef are weaker as compared to the water extract of slaughter-warm beef.

The effect of fresh extracts of aged beef on tallow emulsion stability

Table 4.

| Tallow/ extract | % released water in emulsion with extract in | | | | | | emulsion with water | |
|---|---|---|---|---|---|---|---|---|
| | water | | 2 % NaCl | | buffer | | | |
| | 2 | 12 | 2 | 12 | 2 | 12 | 2 | 12 |
| | | | (in hours) | | | | | |
| 50 : 50 | 32 | 32 | 2 | 2 | 3 | 3 | 40 | 40 |
| 30 : 70 | 47 | 48 | 30 | 30 | 31 | 31 | 50 | 50 |
| 70 : 30 | - | - | - | - | - | - | - | - |

Twenty - four hours keeping of aged beef extract in 2 % Na Cl improves the emulsifying capacity and the stability of its tallow emulsions, while 24-hours keeping of the buffer extract of the same meat weakens its emulsifying capacity. One day keeping of the water extract of the aged beef does not exert any effect on the quality of its tallow emulsions.

The effect of 24 hours keeping of aged beef extract on tallow emulsion stability

Table 5.

| Tallow/ extract | % released water in emulsion with extract in | | | | | | emulsion with water | |
|---|---|---|---|---|---|---|---|---|
| | water | | 2 % NaCl | | buffer | | | |
| | 2 | 12 | 2 | 12 | 2 | 12 | 2 | 12 |
| 50 : 50 | 33 | 33 | - | - | 6 | 6 | 40 | 40 |
| 30 : 70 | 41 | 41 | 25 | 25 | 40 | 40 | 50 | 50 |
| 70 : 30 | - | - | - | - | - | - | - | - |

It can be concluded that there exists the relationship between the quantity of the extracted proteins and emulsifying activity of the extract, that is, meat. A higher amount of extracted proteins in meat, immediately after slaughtering, and ever increasing amount of proteins in the extract with 2 % NaCl (and partly, in the buffered solution) are the cause of, undoubtedly, better emulsifying capacity and better stability of the emulsions produced. It seems quite justified to believe that, presumably, the differences in the protein quantity rather than the differences in the molecular structure between water-soluble and salt-soluble proteins are considered to be the cause of better emulsifying abilities. The same applies to a better emulsifying capacity of the slaughter-warm beef extracts.

Such conception is in agreement with the practical experiences where it is known that leaned meat and meat in general giving more extracted proteins, regularly shows better abilities of emulsifying. Thus, a poorer emulsifying capacity of water beef extracts is not predominantly, the result of the difference in the kinds of proteins but, of course, the result of the difference of the total amount of proteins.

From our results a considerable emulsifying capacity of the extracted proteins of warm meat is evident. The investigations carried out in one industrial slaughter house by a group of experts for a longer period revealed that the emulsifying capacity of the meat dough prepared of slaughter warm beef is rather high. It is desirable to conduct the fat emulsifying simultaneously by adding water and the amounts equivalent to the water quantity added. It has been proved that with the phosphate preparations and the preparations on the basis of milk, added to meat after 24 and 48 hours of ageing the original emulsifying ability can be produced. Namely, the effects of hydration and emulsifying activity of slaughter-warm meat are more completed and because of that they produce better efficiency of raw material. If the possibility of the finished products of better quality are considered, the need of reinvestigation of the rational application of the so called cold treatment in meat dough production exists.

It is the fact that 24-hours keeping of the extracts - both those prepared immediately after slaughtering and those prepared of the meat after 48-hours of ageing - improves their emulsifying capacities. It indicates that ageing of meat dough which is carried out in the practice of meat industry, is justified among the others from the emulsifying standpoint (not only from the standpoint of more completed hydration of proteins and other changes).

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