EMULSIFYING CAPACITY AND EMULSION STABILITY OF ANIMAL LIVER

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Abstract. *Meat food emulsions are liquid multiphase systems consisting of water, fat and emulsifier, liquid being single, relatively stable thermodynamically. Influence the amount of emulsifier emulsifying capacity is proportional and is a growing trend. Emulsion stability after heat treatment increases as the increasing amount of emulsifier (pork liver) is virtually identical to nature addicts emulsifying capacity of the amount of emulsifier. Research has been carried out in model systems representing oil 100ml 100 ml water 7 g liver. On meat emulsion technology (pate, liverwurst) is considered an ideal recipe containing emulsified product: non-fat meat, pig fat or lard, water, the following chemical composition corresponds to 10-12% total protein (including 2 to 2.5 % collagen), 20-25% fat and 60-70% water.*

Key Words: Emulsifying capacity, emulsion stability, liver, protein, fat, water

I. Introduction

To obtain liver products such as pate it is necessary to ensure the smooth (homogene) texture of the finished product which contains soluble and fat-soluble substances.

The purpose of the research was to estimate the emulsifying capacity and emulsion stability of solid liver protein products such as L/A [10].

In general, there can be two types of emulsions, depending of the ratio between two phases

• Water in oil emulsion, the water is dispersed in oil, which is the external phase;

• Oil in water emulsion, the oil is dispersed in water, which is the external phase.

The meat food emulsions are multiphase systems consisting of water, fat and emulsifier, liquid being single, relatively stable thermodynamically. In general, emulsions (single or multiple) have limited stability, where the role of liver protein and emulsifier has the following meat emulsions and products remain steadye as we heat treated condition indicating a high emulsifying capacity so as heat treatment ensuring high stability of the emulsion [1].

Interaction of fat-protein-water type is due to the large number of hydrophilic and hydrophobic groups in proteins. The capacity emulsifying of proteins causes formation of emulsions and their stability.

Hydrophilic and hydrophobic groups of proteins determines the targeting of polar groups to water and non-polar groups to fat. Elastic and strength properties of proteins after heat treatment texture depends on the stability of micelles and, as a consequence, determines the quality of end products(ready-made products). Solubility, the degree of denaturation of proteins, as well as pH and ionic strength (the ionic force) of the solution influence the emulsifying capacity and emulsion stability [2].

The lipid content of pork liver is from 3,6 ... 7,8% and bovine liver from 2,2 ... 3,9% [3].

II. Materials and methods

For the research was used raw material pork and bovine liver from Republic of Moldova refrigerated and thawed after storage. The raw material used to make pate was shredded (minced) to Ø3mm. Emulsion was prepared in microcuter for 8 ... 10 minutes.

The capacity of emulsifying and emulsion stability was investigated on model systems representing oil 100ml +100 ml water +7 g liver [4]. The capacity of emulsifying and emulsion stability are determined by the ratio of emulsified oil to 1 g liver. Emulsion stability is obtained after thermal treatment of liver ($t = 80°C$, $\tau = 30min$). The capacity of retention of fat by absorption [5].

III. Results and discussion

The problem proposed to be solved is determination of lipids (fats) in liver products (pate) as emulsion type L/A. Emulsion stability is ensured by layer (stratum) lipo - protein on cell surface of fat [6].

Emulsifying capacity of the liver and establishment of emulsion based on liver can be achieved on the basis of qualitative and quantitative content of protein and lipids. Capacity of emulsifying and formation of stable emulsions depends on the primary structure of

protein macromolecules, in particular of amino acid residues content with hydrophobic groups [7].

The protein macromolecules composed of polypeptide ionized chain with electric charges and neutral fragments (hydrophobic) shows double capacity, of hydration and of hydrophobic interactions. In complex compositions these macromolecules are oriented and arranged in a determined way. By intensive stirring of food composition protein complexes, water and fat from forming hydrophobic hydration and interaction combined macromolecular structures. On the macromolecules surface protein and on the polypeptide ionized chains is added water. Simultaneously, hydrophobic fragments of the protein macromolecules regects water molecules and adds fragments of the hydrophobic lipid [8].

Compositions consisting of proteins, water and lipids are ordered as follows: polar fragments of proteins bound water, at the same time hydrophobic fragments of protein macromolecules bind lipids by hydrophobic interactions [9]. Therefore lipid molecules are retained by protein macromolecules (Figure 1).

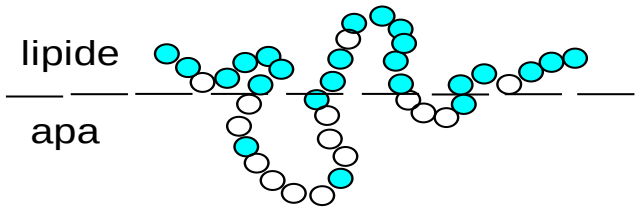

Figure 1. *The scheme of probable orientation of the protein macromolecule phase limit that separates water-protein - lipid.* ○ *- Polar groups of the protein molecule* ● *- the molecule of protein hydrophobic groups.*

By similar retention mechanism of lipids are formed emulsions such as lipid / water. For such systems of power, showing the structure of finished (end) products is important the emulsion stability during of storage (Figure 2).

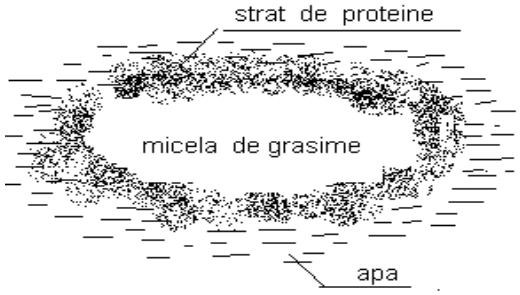

Figure 2. *Schematic representation of emulsion formed by sorption of fat protein micelle on the surface of water-protein - lipid.*

Hydrophobic groups are formed on the outer (exterior) surface of the layer of fat droplets is strongly adsorbed, which acts as a barrier to agglomeration of fat droplets. Hydrophilic groups are oriented to water molecules.

It should be noted that the system's ability to retain the fat meat grows by increasing the amount of collagen. Retention capacity of the protein fat issue is greater than that of muscle and liver protein, which is explained primarily by the fact that collagen protein shell swells considerably during heat treatment and is able to retain fat in its cells. To improve the emulsifying capacity and therefore the amount of fat linked protein emulsion preparations is used protein preparations in particular soy protein isolate.

The capacity of emulsifying the liver is determined by its protein emulsifying ability. Proteins are surface active substances are characterized by a polar amino acid ratio (hydrophilic) and non-polar (hydrophobic), following which actually become able to reduce surface tension at the boundary of phase separation A / L. Surface activity of emulsifiers polimoleculari, primarily determined by differences and spatial structure of content quantity, location and availability of polar and non-polar groups of the protein molecule. System fat / water phase boundary separating the proteins in Brownian motion account open so that non-polar amino acids are oriented lipid phase and polar amino acids in the aqueous phase, where it is their interaction. At a subsequent absorption of protein molecules they interact not only with the phase of fat and water, but also with other proteins that contribute to formation of a strong gel layer.

The orientation of hydrophilic protein groups to the aqueous phase and to those hydrophobic lipid phase separation limit as adsorbed layer, decreases the surface tension in the disperse systems and makes them resistant to aggregation and at the same time ensures smooth(homogeneous) texture.

From total oil that is introduced into the system oil + water + liver in emulsion stage contains 46,8 ... 57,3% of the total oil 200ml, remaining oil forms separated lipid phase of water and liver.

The indicator values of emulsifying capacity and emulsion stability of oil composition, water, bovine liver are higher on average by 2 ... 4%, this is mainly due to a non-polar amino acids ratio in polar amino acids in bovine liver is greater (0, 72) as pork liver (0,70).

Table 1. *The capacity of emulsifying and emulsion liver stability*

Indicator	unit of measurement	pork liver	beef liver
The emulsifying capacity	g mulsion / 1g liver	6,7… 7,7	7,0… 8,2
The emulsion stability	g mulsion / 1g liver	4,5… 5,2	5,0… 5,6
Fat retention capacity	% of the initial mass	17,7… 21,9	19,8… 23,4

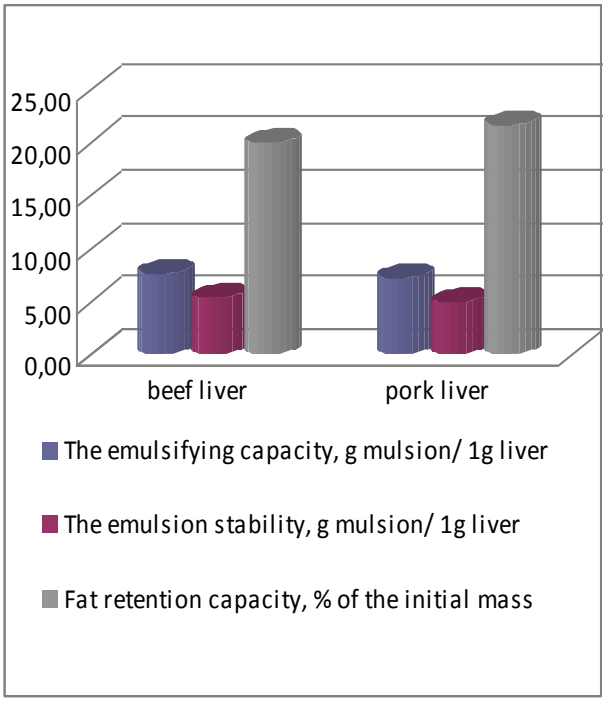

Figure 3. *Emulsifying capacity and fat retention capacity of bovine and pork liver.*

Following the heat treatment of oil-based emulsion / water / protein (porcine liver) compared to 100: 100: 7, emulsion stability is 1,5 to 1,6 times less practical as emulsifying ability of proteins of porcine liver which shows that, in the heat treatment, liver proteins have the ability to stabilize the emulsion lower than when using the native liver.

IV. Conclusions

1. Emulsifying capacity is greater than the emulsion stability on the grounds that the denaturing the liver proteins lose this ability.

2. Emulsifying capacity and emulsion stability depends on the ratio hydrophilic amino acids in the liver protein macromolecules structure.

3. Liver emulsifies from 7,2 to 7,6 parts oil to one part liver and as a stabilizer after heat treatment stabilizes from 4,8 to 5,3 parts oil to one part liver.

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