XXI. EUROPÄISCHER KONGRESS DER FLEISCHFORSCHUNGSINSTITUTE

ALLUNIONS-FORSCHUNGSINSTITUT DER FLEISCHINDUSTRIE DER UdSSR

BLUTKLÄRUNG FÜR WURSTPRODUKTION MIT DER EMULGIERUNGS-METHODE

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Z U S A M M E N F A S S U N G

Wegen der dunklen Farbe wird das Blut wenig für Nährzwekke angewandt.

Die früher ausgenutzten Blutentfärbungsmethoden basieren sich auf der Anwendung von chemischen Stoffen, deren Anwesenheit in Lebensmitteln unerwünscht ist.

Wir haben die Methode der Blutklärung durch feines Emulgieren im EiweiB-Fett-Medium ausgearbeitet. Es wurden die optimale Konzentration von Emulsionskomponenten und die Emulgierungsbedingungen bestimmt. Die Emulsion enthält geschmolzenes Fett, Vollblut, trockenes Milch- oder PflanzeneiweiB und Wasser.

Das Gemisch wird mit einem hydrodynamischen Vibrator emulgiert, der bei einfacher Konstruktion, unkomplizierter Bedienung und niedrigem Herstellungspreis einen hohen Dispersionsgrad und gute Emulsionsstabilität sichert.

Die Zugabe von 10-15% der Emulsion zu Brühwurstbrät ermöglicht es, Fleischwaren herzustellen, die der Farbe, dem Geschmack und der Konsistenz nach den gestellten Anforderungen völlig entsprechen.

Die Anwendung der Blut-Fett-Emulsion trägt zur Erhöhung des Wasserbindevermögens von Brät und zu gewisser Zunahme der Ausbeute der fertigen Erzeugnisse bei.

Die durchgeführten histologischen, strukturell-mechanischen und mikrobiologischen Untersuchungen des die EiweiB-Fett-Wasser-Emulsion enthatlenen Produktes ergaben keine Verschlechterung der Struktur und der Qualität der Würste.

XXIst EUROPEAN MEETING OF MEAT RESEARCH WORKERS

ALL-UNION RESEARCH INSTITUTE OF THE MEAT INDUSTRY

BLOOD CLARIFICATION BY MEANS OF EMULSIFICATION FOR SAUSAGE PRODUCTION

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SUMMARY

Blood is insufficiently utilized for edible purposes, mainly, due to its dark colour.

Previously used methods for blood discolouration were based upon the application of chemicals which are undesirable in foods.

The authors have developed a procedure for blood clarification by means of its fine emulsification in a protein-fat medium. The optimum concentration of emulsion components and emulsification conditions have been established. The emulsion contains lard, whole blood, dry milk or vegetable protein and water.

The mixture is emulsified in a hydrodynamic vibrator which is simple in design and operation, cheap and provides highly dispersible and stable emulsion.

10-15% of such emulsion added to the forcemeat of cooked sausages allow to obtain a product which meets all the requirements as to colour, flavour and consistency.

The use of a blood-fat emulsion helps improve the water-holding capacity of the sausage meat and, to a certain extent, increase the yields of the finished product.

Histological, structure-mechanical and microbiological studies of the product containing a protein-fat-water emulsion did not reveal any deterioration in sausage structure or quality.

XXI ЕВРОПЕЙСКИЙ КОНГРЕСС
РАБОТНИКОВ НИИ МЯСНОЙ ПРОМЫШЛЕННОСТИ

Всесоюзный научно-исследовательский институт
мясной промышленности СССР

ОСВЕТЛЕНИЕ КРОВИ ДЛЯ КОЛБАСНОГО ПРОИЗВОДСТВА МЕТОДОМ ЭМУЛЬГИРОВАНИЯ

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А Н Н О Т А Ц И Я

Кровь недостаточно используется на пищевые цели в основном из-за темного цвета.

Применяемые ранее способы обесцвечивания крови, основаны на использовании химических веществ, присутствие которых в пищевых продуктах нежелательно.

Нами разработан способ осветления крови путем тонкого эмульгирования ее в белково-жировой среде. Установлены оптимальная концентрация компонентов эмульсии, режим эмульгирования. В состав эмульсии вводят топленый жир, цельную кровь, сухой молочный или растительный белок и воду.

Смесь эмульгируют на гидродинамическом вибраторе, который при простоте конструкции, несложности обслуживания, а также низкой стоимости изготовления обеспечивает высокую дисперсность и стабильность эмульсии.

Введение 10-15% эмульсии в фарш вареных колбасных изделий позволяет получить продукт по окраске, вкусу и консистенции, полностью отвечающий предъявляемым требованиям.

Применение крове-жировой эмульсии способствует повышению влагоудерживающей способности фарша и некоторому увеличению выхода готового продукта.

Проведенные гистологические, структурно-механические и микробиологические исследования продукта, содержащего белково-жиро-водную эмульсию, не оказали ухудшения в структуре и качестве колбас.

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At present, one of the most important tasks of meat production is to increase protein resources (1). With this in view, scientists of many countries give their suggestions as to the search of additional amounts of edible protein (microbial protein, chemically synthetized protein and other insufficiently utilized sources) (2-6). The biological properties of novel proteins are little studied, therefore, their use for nutrition should be preceded by extensive research.

Up to now, in most countries valuable blood proteins of slaughter animals are used insufficiently for edible purposes due to its dark colour.

Various metnods for blood clarification have been suggested both in this country and abroad, based mostly on the application of chemical additives, e.g. strong oxidizing agents (perhydrol) and solvents (acetone, etc.) (7-9).

The authors of this paper have developed a method for blood hemoglobin clarification by means of fine emulsification together with fat in a hydrodynemic acoustic installation. During emulsification, protein and fat particles are dispersed and re-arranged, this resulting in enveloping the particles with a protein-fat film; due to this, the effect of clarification is achieved (10). The main object of this work was to reveal the regularities of these processes and to make on their basis recommendations on the preparation and application of blood-fat emulsions in meat products.

For the experiments, a hydrodynamic acoustic installation was used which provides a high emulsion dispersity and is simple in design and in operation. It is schematically illustrated in Fig. 1.

The experimental work was carried out as follows: emulsion components were mixed in a mixer 5, fed to a filter 4 and via a pump 2 to a multislotted vibrator 1 for emulsification; and, finally, to a cooler 6.

Technical specification

Heater/mixer capacity, m^3	2
Oscillation frequency, kcs	11.3
Pressure of the liquid fed to the vibrator, Pa	$(11-13)\cdot10$
Installation output, l/hr	500
Motor power, kw	13

During the experiments components were chosen which ensure mixture clarification, their proportions and processing conditions providing the maximum clarification effect were found. Clarification degree of blood hemoglobin, as well as emulsion dispersity and stability as related to the contents of blood, fat, sodium caseinate or soya protein and water and to acoustic treatment time were determined. Clarification degree was assayed organoleptically and by optical density measured in reflected light at 545 nm on a spectrophotometer SF-10.

Fig. 2 shows emulsion dispersity as related to treatment time. The most finely dispersed emulsion was obtained in case of 7-8 min. treatment.

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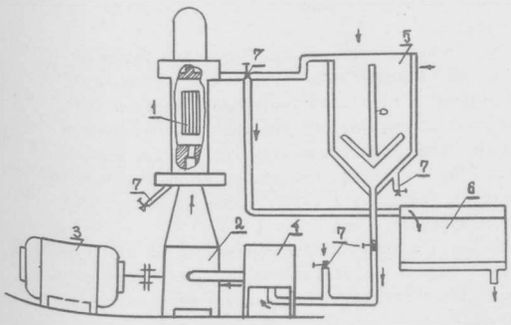

Fig. 1. A schematic view of an ultrasonic unit to prepare animal fat emulsions
1 - hydrodynamic vibrator; 2 - pump ShDP - 125; 3 - electric motor; 4 - filter; 5 - heater/mixer with an agitator; 6 - cooler; 7 - valve

4.

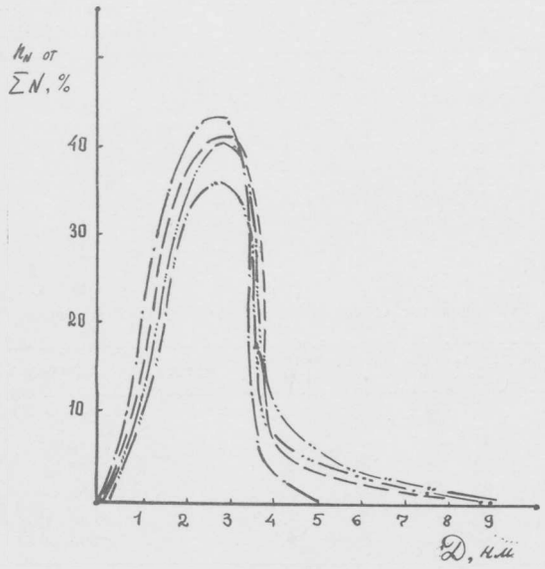

Fig. 2. Fat emulsion dispersity as related to acoustic treatment time
—·—·— treatment for 3 min.
—·—·— " 7 min.
— — — " 9 min.
—··—··— " 5 min.

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The effect of acoustic treatment upon finished emulsion quality is also expressed by the data of dispersion and sedimentation analyses (Table 1); it follows from them that the amount of water retained by the emulsion during centrifugation increased with treatment time (up to 7 min.), this indicating a rise in emulsifiability.

Table 1

Emulsion analysis

Acoustic treatment time, min.	Basic data of dispersion and sedimentation analyses			
	Average diametre of fat globules, nm	Content of fat globules of the first three size classes, %	Total surface area of emulsion particles, m^2	Emulsifiability, %
3				
5	3.16	75.2	9512	56
7	2.65	85.7	14506	69
9	1.95	96.0	15180	78
	2.48	84.8	14172	60

Under the given conditions, the amount of retained water characterizes emulsion stability and depends upon the lyophilic nature and mechanical properties of protective films and also upon emulsion dispersity degree. In highly-dispersed emulsions the amount of firmly retained water will be higher due to a large interface, this being confirmed with the data of Table 1, which shows an increase in emulsifiability with the total surface area of emulsion particles.

In case of over 7 min. emulsification the percentage of the particles of the first three size classes, as well as the total surface area of all the particles decreased. Seven minute treatment of the mixture provided the most stable, finely dispersed emulsion.

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The colour of the resulting emulsion depended, mainly, upon blood level, the latter determining the amount of added blood to comminuted sausage meat.

Studies indicated (Table 2) that emulsion optical density increased with blood concentration. With the blood content of 20-25% it ranged within the values of beef meat optical density.

Table 2

Emulsion optical density as effected with blood content

Sample No.	Blood, %	Water, %	Fat, %	Na caseinate, %	Optical density (D = 545 nm)
1	10	40	45	5	0.4400
2	15	35	45	5	0.4620
3	20	30	45	5	0.5125
4	25	25	45	5	0.6385
5	30	20	45	5	0.8000
6	35	15	45	5	0.8500

The effect of the concentration of dry proteins upon emulsion optical density is shown in Table 3.

The authors did not manage to determine the optical density of samples Nos. 1 and 2 because of emulsion physical properties. From the given data it follows that the optical density changes only slightly with increasing protein concentration (within 3%).

Sample 6 with the highest protein concentration had an increased viscosity, and it was difficult to emulsify it. On the basis of the foresaid, dry protein addition in quantities over 7% is considered inexpedient.

A relation of the optical density to fat and water levels was also found (Table 4). Changes in water-fat ratio were established to influence emulsion optical density only slightly, the latter falling with increasing fat content.

7.

Table 3

Effect of milk protein concentration upon emulsion optical density

Sample No.	Blood, %	Fat, %	Water, %	Protein, %	Optical density (D=545 nm)
1	20	45	34	1	-
2	20	45	32	3	-
3	20	45	30	5	0.5125
4	20	45	29	6	0.5250
5	20	45	28	7	0.5375
6	20	45	27	8	0.5500

Table 4

Fat and water effect upon emulsion optical density

Sample No.	Blood, %	Fat, %	Water, %	Protein, %	Optical density(D=545 nm)
1	20	25	50	5	-
2	20	30	45	5	-
3	20	35	40	5	0.5375
4	20	40	35	5	0.5250
5	20	45	30	5	0.5125
6	20	50	25	5	0.5000

The experimental results allow to conclude that the maximum blood clarification (with 20% of blood added) by means of emulsification in a protein-fat medium is observed for the following proportions of the components: fat - 45%, water - 30%, protein - 5%, and at emulsification time of 7 min.

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Due to a possible accelerated hydrolytic rancidity of pork fat in the emulsion and especially at higher temperatures and upon contacting water and blood proteinaceous matter, the development of oxidative processes in fat during its emulsification have been studied. E.g., acid and peroxide numbers, as well as the number of conjugated dienes have been determined as related to sonification time.

Studies indicated that in the process of emulsification fat quality did not decrease. The resulting emulsion is chemically similar to semi-fatty pork, is not exfolliated at thermal and mechanical treatments and can be used for cooked sausage manufacture.

Experimental batches of sausages with 5-20% of emulsion added instead of semi-fatty pork have been prepared.

To determine clarification extent of blood hemoglobin by means of emulsification, control sausages (Samples Nos. 4, 5 and 6) have been prepared, containing similar amounts of natural blood (3%) but introduced either as an emulsion (Sample No. 4), or in the natural form (Sample No. 5) or mixed with emulsion components (Sample No. 6).

Test sausage formulations are presented in Table 5. As their basis served the recipee of 2nd grade tea sausage. All the batches were similarly processed - both technologically and thermally.

Samples containing 5, 10 and 15% of emulsion added did not, practically, differ from controls by flavour and consistency, the sample with 15% of emulsion added having been scored more highly for colour.

On the basis of the foresaid, it is recommended to replace semi-fatty pork in the formulation with 10 to 15% of the emulsion. This level of the emulsion does not alter product organoleptical qualities, and colour in particular.

Comparison of Samples Nos. 4, 5 and 6 indicated the lightest colour for No. 4 and the darkest one for No. 5, this

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being confirmed with optical density values (Table 5).

Table 5

Test sausage formulations and optical density

Sample Nos.	2nd grade beef	Semi-fatty pork	Back-fat	Water	Blood	Emulsion components	Emulsion	Optical density (D=545nm)
1	70	15	10	32	-	-	5	0,4375
2	70	10	10	32	-	-	10	0.6000
3	70	-	10	32	-	-	20	0.7125
4	70	5	10	32	-	-	15	0.6250
5 (control)	67	20	10	32	3	-	-	0.6875
6 (control)	70	5	10	32	-	15	-	0.6625
7 (control)	70	20	10	32	-	-	-	0.4500

For the rest of the samples, changes in the optical density were proportional to the quantity of the emulsion added.

Blood-fat emulsion added to sausages helped preserve the quality of the finished product, distribute evenly the structural components of the sausage meat, increased its protein content and improved its water-holding capacity, the latter allowing to raise sausage yields (Table 6).

Table 6

Chemical analyses and yields of test sausages

Batch Nos.	Chemical analysis, %					Finished product yield,%
	fat	water	protein	ash	dry matter	
1	15.1	68	14.9	2.0	32	130.0
2	15.4	67	15.5	2.1	33	130.5
3	16.1	65	17.4	1.5	35	132.0
4	15.8	66	15.9	2.3	34	131.0
5	15.5	66	14.8	3.7	34	128.0
6	16.0	65	15.7	3.3	35	125.0
7	15	68	14.7	2.3	32	129.0

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Conclusions

Blood emulsification in a protein-fat medium provides its clarification, this allowing to utilize blood for edible purposes. The optimum composition of the emulsion and emulsification conditions have been developed.

The addition of certain amounts of blood-fat emulsion to the comminuted meat of cooked sausages improves sausage yields with the preservation of product quality.

Literature

1. **Hegsted M. World Protein Deficiencies and Human Health. WHO (FAO) UNICEF PAG, Bul., 6, 13, 1966.**
2. **International Action to Avert the Impending Protein Crisis. United Nation Publ., N.J., 1968.**
3. Покровский А.А. "Вопросы питания", 5, 1967, 42.
4. **Pirie N. Food Resources. Conventional and Novel. London, Penguin Bookd, 1969.**
5. Несмеянов А. Вестн. АН СССР, I, 1969, 27.
6. Пожарисская Л.С., Либерман С.Г., Горбатов В.М. Кровь убойных животных и ее переработка. М., Пищепромиздат, 1960.
7. Патент США, 1922, № I, 415. 277. Осветление крови перекисью водорода.
8. Мицык В.Е. и др. Способ производства обесцвеченной крови. Авторское свидетельство А-22 j I/06, № 289.804 от 4.12.1969 г.
9. Пальмин В.В., Петрова О.П. Получение пищевого глобина из крови животных. М., "Мясная индустрия", 6, 1972, 33.
10. Заяс Ю.Ф. Ультразвук и его применение в технологических процессах мясной промышленности. М., Пищепромиздат, 1970, 32.