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INVESTIGATIONS ON THE PREPARATION OF GRANULAR PRODUCTS *)

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Granular protein products which can resemble fish roe and which may be used as carriers of flavouring substance for meat and fruit aroma respectively, are made by dropping of deaerated protein suspension on hot vegetable oil. The main ingredients are dried bovine blood plasma, dried wheat gluten and egg protein. The influence of these ingredients on following functional properties were investigated: viscosity of the protein suspension, their ability to form droplets, the firmness and sphere-shape of the formed protein bodies. The results show that the production of desirable texture characteristics is possible and that bovine blood plasma influences greatly the firmness of the protein bodies after a short heating time; vital gluten increases this firmness after a long heat treatment. Blood plasma shows a positive effect on the sphere-shape of the protein bodies and favours the simulating of fish roe.

INTRODUCTION

It is known to produce gel-like particulate protein formed bodies which possess the character of synthetic fish roes. These particulate bodies consist of gelatine, casein and a polysaccharide, for example an alginate or pectinate, and the necessary flavouring materials [1]. According to this know soviet invention for the production of particulate products, proteins of animal or vegetable origin, for example casein, are dissolved in an aqueous alkaline solution and mixed with gel-forming materials, for example gelatine. After adding glycerol, carbohydrates, lipides and lecithines, the mixture is formed into particles by introduction, in an appropriate manner, into a water-immiscible liquid, for example liquid

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paraffin. The liquid paraffin must not have a temperature above 50°C. since, above these temperatures, melting of the initially formed envelopes of the particles and thus a deformation thereof takes place. The particles obtained in this manner are, for the consolidation of the envelopes, treated with aqueous extracts of tanning agents.

The particulate products produced according to this know processes, especially synthetic caviare, are only stable up to a temperature of about 50°C. These products are not suitable for heat sterilisation and as flavour carriers.

It is an object of the present investigation to produce particulate, protein-containing formed bodies by the use of heat coagulatable protein-containing mixtures and the simple treatment of aqueous suspensions thereof.

In the preparation of binders in order to simulate meat products from spun proteins many other properties and interesting application possibilities were observed, amongst others the possibility to produce granular protein products which resemble fish roe and which can be used as carriers for flavouring substances with meat and fruit aroma, respectively.

METHODS AND RESULTS

To create these new possibilities for the application of binder materials mixtures of dried vital gluten, whole egg powder and bovine blood plasma were suspended in water according to a three levels factor design, deaerated (-94.67 kPa, 60 min) and investigated. The three levels factor design [2] is shown in Table 1. The levels were selected after preliminary examinations.

Table 1. Three levels factor design

	Levels			Dimension
	-1	0	+1	
x_1 Wheat vital gluten powder	15	20	25	(%)
x_2 Whole dried egg	4	6	8	(%)
x_3 Dried bovine blood plasma	4	8	12	(%)

Figures 1, 2, and 3 show the influence of raw materials on viscosity, ability to form droplets and firmness of heated suspension. The viscosity was measured with Rheotest II (cylinder S 1, level 7 a). The ability to form droplets was determined by observation the dropping from a glass-stick (5 mm diameter). The scores were recorded on a 3-point scale viz. 0 = no dropping, 3 = very good dropping. The firmness tests were carried out using Firmness Testing Machine model BPG 50 with Wolodkewitsch shear

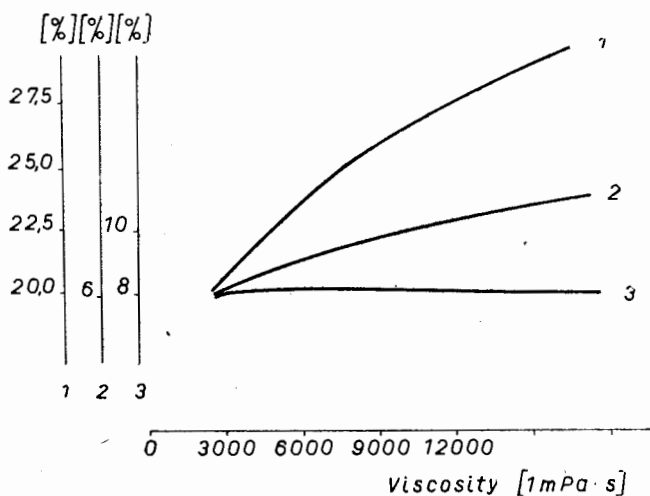


Fig. 1. Influence of dried wheat vital gluten [1], dried whole eggs [2] and dried bovine blood plasma [3] on the viscosity of suspensions $r = 0.58$; 1 — dried wheat vital gluten, 2 — dried whole eggs, 3 — dried bovine blood plasma

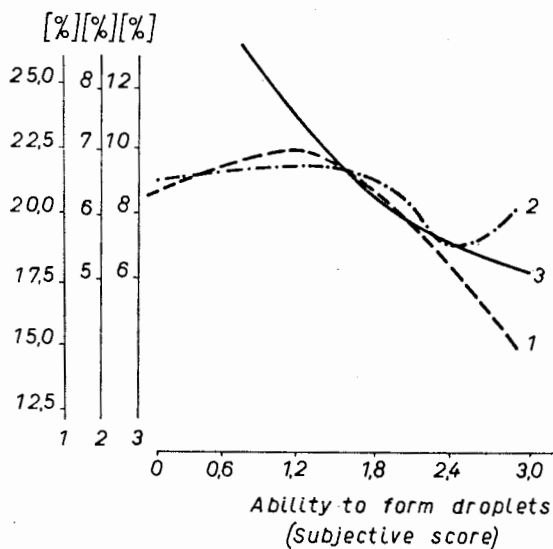


Fig. 2. Influence of dried wheat vital gluten [1], dried whole eggs [2] and dried bovine blood plasma [3] on the ability to form droplets $r = 0.83$; 1 — dried wheat vital gluten, 2 — dried whole eggs, 3 — dried bovine blood plasma

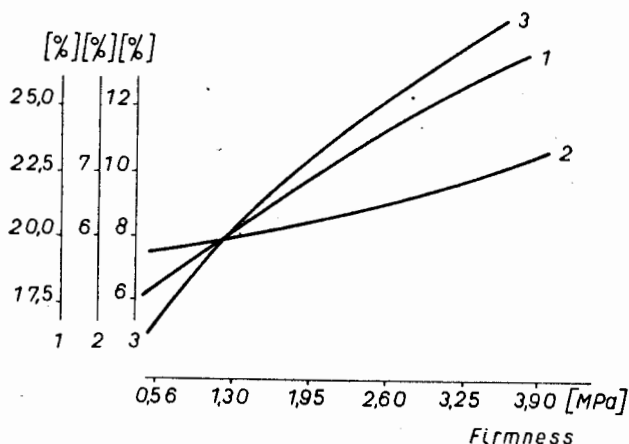


Fig. 3. Influence of dried wheat vital gluten [1], dried whole eggs [2] and dried bovine blood plasma [3] on the firmness of heated suspensions $r = 0.97$; 1 — dried wheat vital gluten, 2 — dried whole eggs, 3 — dried bovine blood plasma

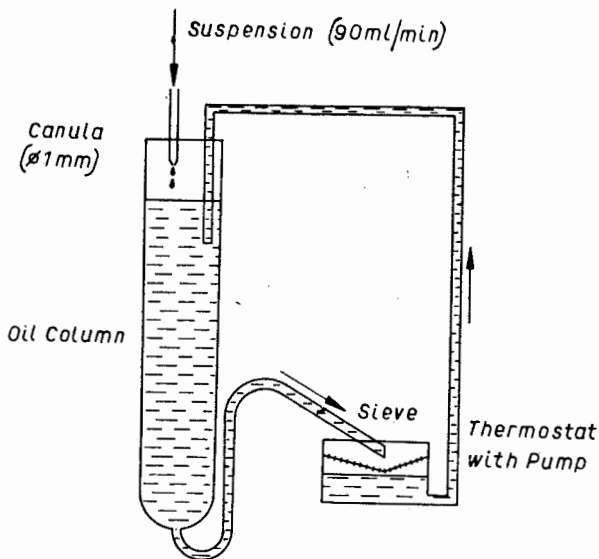


Fig. 4. Laboratory device to produce granular protein products, consisting of column with oil and thermostat with pump

device (slit-method) (4). Two grams of sample were pressed through a 0.5 mm slit and the shear force registered.

The results shown in Fig. 2 to 4 suggest:

1. The viscosity of these suspension can be changed widely by gluten (Fig. 1).

2. In order to form droplets the protein of gluten is to be reduced. Suspensions with contents of 15% wheat gluten 6% dried whole eggs and 6% dried bovine blood plasma are easily made drop (Fig. 2).

3. Bovine blood plasma shows the greatest influence on the firmness of the heated suspensions (Fig. 3).

From these results it may be also concluded that protein suspensions containing bovine blood plasma at lower levels can be textured by heating. The positive properties of bovine blood plasma were a good assistance in searching for possibilities to produce granular formed flavour carrier and new fish products. Based on the obtained results, suspensions of components according to Table 2 were deaerated (-94.67 kPa, 60 min) and made coagulate by dropping into heated vegetable oil [3]. The levels were selected after preliminary examinations.

Table 2. Two levels factor design

	Levels		Dimension
	-1	+1	
x ₁ Wheat vital gluten powder	3.00	5.00	(%)
x ₂ Dried egg whites	0.75	1.00	(%)
x ₃ Dried bovine blood plasma	7.00	11.00	(%)
Herring homogenate	25%		
Xanthomonas polysaccharid	0.01%		
Temperatur of vegetable oil	110°C		

The laboratory equipment for the coagulation of the suspension is shown in Fig. 4.

The suspension is dropped through a canula onto a 170 cm column of sunflower seed oil, the temperature of which is 110°C.

When the protein suspension comes into contact with the oil, droplets are formed with a diameter of 2 to 3 mm. The descending droplets are removed continuously from the column via a suck-off tube.

Four parameter were of special interest:

Viscosity of the suspension, its ability to form droplets, firmness, and sphere-shape of the formed protein bodies. The results of these investigations are shown in Fig. 5 to 7. The sphere-shape of the formed protein bodies was determined by visual valuation and recorded on a 6-point scale viz. 1 = no globular, 6 = globular.

The results show that bovine blood plasma influences greatly the firmness after a short time heating. Therefore blood plasma will be used as a main ingredient in the production of globular protein bodies by heat coagulation. Vital gluten increases the firmness after a long time heating.

This effect is undesirable for simulating fish roe, for example after pasteurisation of the canned product. Moreover, blood plasma shows a positive effect on the sphere-shape of the protein bodies. The ability of short time heat treatment and the positive effect on the sphere shape increase the importance of blood plasma for the production of globular protein foods. Basing on the relation between the components of protein mixtures and on the knowledge of the functional properties of the raw materials, it is possible to get new protein products with desirable properties by the illustrated method.

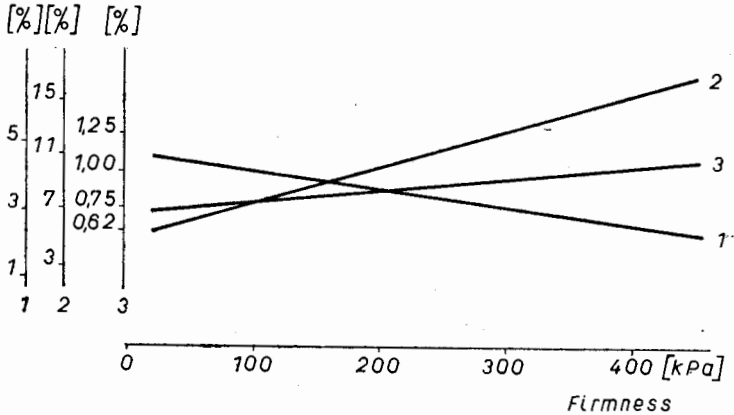


Fig. 5. Influence of ingredients on the firmness of coagulated protein formed bodies containing wheat vital gluten [1], dried bovine blood plasma [2], dried egg white [3] and herring homogenate (25%) after short time heating (30 s) in hot oil (110°C) $r = 0.67$; 1 — dried wheat vital gluten, 2 — dried bovine blood plasma, 3 — dried egg white

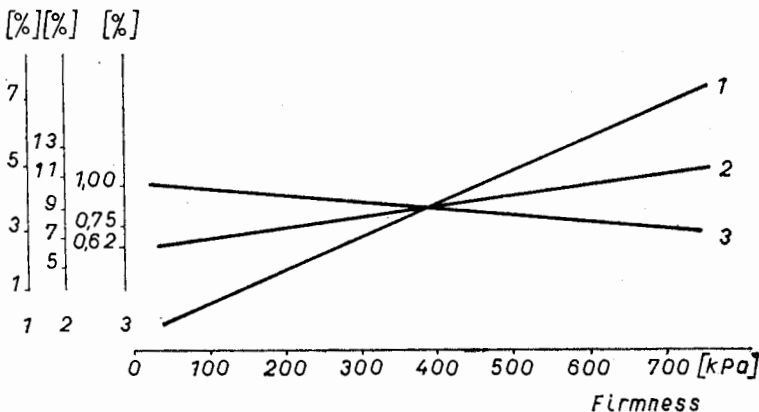


Fig. 6. Influence of ingredients on the firmness of coagulated protein formed bodies containing wheat vital gluten [1], dried bovine blood plasma [2], dried egg white [3] and herring homogenate (25%) after long time heating (90°C, 30 min) $r = 0.76$; 1 — dried wheat vital gluten, 2 — dried bovine blood plasma, 3 — dried egg white

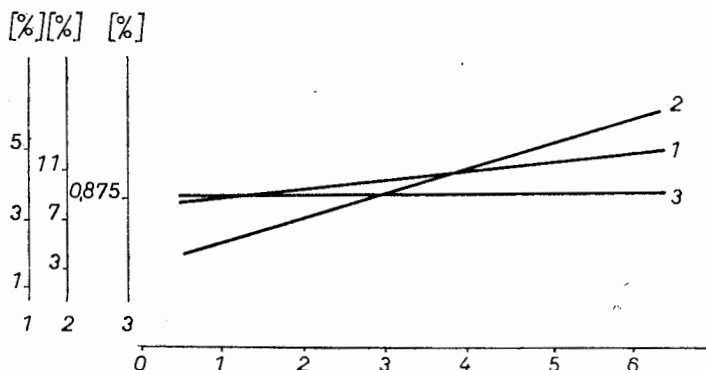


Fig. 7. Influence of ingredients on the sphere-shape of coagulated protein formed bodies containing wheat vital gluten [1], dried bovine blood plasma [2], dried egg white [3] and herring homogenate (25%) $r = 0.94$

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BADANIA NAD OTRZYMYWANIEM PRODUKTÓW GRANULOWANYCH

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Streszczenie

Produkty białkowe zgranulowane przypominające ikrę rybą, które mogą być użyte jako nośniki substancji aromatycznych do mięsa i aromatu owoców zostały wykonane przez wpuszczanie odpowietrzonej zawiesiny białka do gorącego oleju roślinnego. Głównym składnikiem jest suszona plazma krwi wołowej, suszony gluten i białko jaja. Badano wpływ tych składników na właściwości funkcjonalne, a mianowicie: lepkość zawiesiny białkowej, zdolność jej do tworzenia kropli, twardość i tendencja do utrzymywania kształtu utworzonych tworów białkowych. Wyniki wskazują, że wytwarzanie tekstury o pożądanej charakterystyce jest możliwe i że wołowa plazma krwi wpływa w bardzo dużym stopniu na twardość ciał białkowych po krótkim czasie ogrzewania, a witalny gluten zwiększa twardość po dłuższym okresie ogrzewania. Plazma krwi daje pozytywny efekt odnośnie utrzymywania kształtu ciał białkowych i sprzyja upodobnieniu się do ikry rybkiej.