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THE EFFECT OF SOME ENVIRONMENTAL FACTORS ON THE PHYSICOCHEMICAL PROPERTIES OF PROTEIN PREPARATIONS*)

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Key words: protein preparations, physicochemical properties of protein, effect of environmental factors.

The investigations concerned protein preparations differentiated in terms of the methods of their production (meal, concentrate, isolate), origin (soya protein, milk protein) and elements of technological treatment applied (method of drying). The physicochemical characteristic has been determined on the basis of an investigation of solubility, water and fat absorption capacity, viscosity and emulsifying capacity taking into consideration the changing pH, salt concentration and protein concentration. The majority of preparations showed substantial variability under the influence of the investigated environmental factors.

INTRODUCTION

The qualitative effect of the use of protein preparations as an additive to meat products is conditioned, to a large extent, by the physical and physicochemical properties of these preparations.

Most important from the viewpoint of using the preparations as an additive to meat products are properties resulting from a mutual interaction of protein and water as well as protein, water and fat, that is solubility, hydrophilic and lipophilic properties. These properties are usually measured using such indices as solubility, water absorption capacity, viscosity, fat emulsifying and fat absorption ability.

The physicochemical properties of protein preparations are not a fixed characteristic. Many authors point to their strict dependence on various

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factors connected with the preparation (protein content, granulation, structure, etc.) as well as with the environment of the product to which the preparation is added. The environmental factors conditioning almost all the physicochemical properties of the preparations include pH and the ion strength [4, 9, 10, 14, 22, 26, 29], the concentration of salt in the solution [4, 7, 10, 11] and the concentration of protein [4, 5, 6, 9, 11, 12, 13, 18].

It is difficult to take direct advantage of data included in literature in order to draw conclusions as to the effect of the various environmental factors on the physicochemical characteristic of protein preparations because of the differences in methodological procedures and the fact that the examinations are carried on various, usually comparatively restricted experimental materials. There is also a shortage of comparable data concerning the effect of the main environmental factors such as the pH of the solution, salt concentration and protein concentration on protein preparations of various origin and of various types. This effect, however, cannot be neglected when drawing a complete physicochemical characteristic of the preparations, essential from the viewpoint of their technological usability.

The purpose of this work was to determine the effect of the above listed factors (within the range of their variability found in food products) on the physicochemical characteristic of eight protein preparations differentiated in terms of their production methods (meal, concentrate, isolate), origin (soya protein, milk protein) and elements of technological treatment (method of drying).

EXPERIMENTAL

A. MATERIAL

The following materials were used for the examinations:

a) commercial soya protein preparations (of Central Soya Co.): isolates (Promine D — sodium proteinate and Promine R — obtained at the isoelectric point of protein), concentrate (Promosoy 100), preparation based on soya meal (Soyabits 25T),

b) preparations based on milk protein, of Polish production: sodium caseinate (S), spray dried, sodium caseinate (D), drum-dried and sodium proteinate and milk protein concentrate (obtained at the isoelectric point of protein) being the result of experimental production conducted at the Experimental Centre of the Academy of Agriculture in Olsztyn [23].

The main chemical composition and pH of examined protein preparations are listed in Table 1.

Table 1. Basic chemical composition and pH of examined protein preparations

Type of preparation	Water %	Total protein (N×6.25) %	Soluble protein (Nsol.× ×6.25) %	Fat %	Ash %	pH
Soya protein preparations						
Promine D	5.4	89.3	64.0	0.14[2]	4.3	6.80
Promine R	5.0	90.9	1.5	0.06[2]	2.8	5.20
Promosoy 100	5.9	65.5	7.9	0.85[2]	5.9	7.00
Soyabits 25T	10.5	49.7	14.9	2.56[2]	5.9	6.80
Milk protein preparations						
Sodium caseinate (S)	4.1	86.5	80.9	0.95[1]	5.3	6.35
Sodium caseinate (D)	3.6	88.3	78.3	0.93[1]	3.9	6.65
Sodium proteinate	4.6	84.6	71.9	0.74[1]	4.5	6.65
Milk protein concentrate	4.8	78.2	1.8	0.37[2]	3.0	5.00

The content of dry substance was determined by drying up to a fixed weight at 105°C, total nitrogen by Kjeldahl's method, soluble nitrogen by the method of Inklaar and Fortuin [2, 16], fat by the method, of Schmidt-Bądzyński[1] or of Soxhlet[2]), ash by the sample mineralization method at 550°C, pH in 10% solutions of the preparations in distilled water

B. METHODS

a) The content of soluble nitrogen has been determined by the method of Inklaar and Fortuin [16] as modified by Baryłko-Pikielna et al. [2]. The solubility of preparations was determined as a ratio of the content of soluble nitrogen to total nitrogen (NSI).

b) The water absorption capacity was determined according to smith et al. [25], partly modifying the conditions of the determination. 30 ml of distilled water were added to 1 g of the preparation placed in a test-tube for centrifuge of a 50 ml volume. It was mixed for 10 min, then centrifugated for 30 min at 3000 rpm. The unabsorbed water was decanted, the test-tube was turned upside down up until it was completely drained off and after 10 min the "wet" preparation was weighed. The water absorption capacity was expressed as a ratio of the "wet" preparation weight (preparation + absorbed water) o the "dry" weight of the preparation (initial weight of the preparation taking into consideration the water contained in it determined by the method of drying at 105°C). The mean value obtained from 4-6 determinations done parallelly was taken as the final result. The water absorption capacity was tested in a water environment and in a 0.3, 0.6 and 1.0 M NaCl solution.

c) The viscosity of the preparations was determined with the use of a rotational viscometer Rheotest-2 [19]. Viscosity was measured at 20°C, in 4-6 independent repetitions. Solutions of the preparations, concentration 2-16%, were prepared by the standard method [1]. In order to be able to compare the viscosity of particular preparations the shear rate gelling (coagulation) Dr = 243 s^{-1} was adopted for solutions with a concentration of 2-12% and Dr = 48.6 s^{-1} and Dr = 16.2 s^{-1} for solutions of a concentration of 14 and 16%. The effect of pH [5, 6, 7] on viscosity was examined in 10% solutions in distilled water and in 0.3 M NaCl. The required pH was attained by adding several drops 1 N HCl or 1N NaOH to the solution. The influence of NaCl concentration on viscosity was also examined in solutions of preparations with a 10% concentration, using 0.3, 0.6 and 1.0 M NaCl solutions.

d) The fat emulsifying capacity (EC) was determined by the method of Swift et al. [26] modified by Webb et al. [27] and Grabowska et al. [8]. The authors designed their own measurement set enabling measurements in series [18]. Samples for the determination of emusifying capacity were prepared in the form of water solutions or suspensions of a 10% concentration. Next, the basic solution was diluted in order to achieve the required concentration of protein in 10 ml of the solution being determined. EC was expressed as the amount of oil emulsified by 100 mg protein (V_{100}) and as a proportion of the oil phase (OP%) [18]. The mean value taken from 6 parallel determinations was taken as the final result. The effect of protein concentration on the fat emulsifying capacity was tested within the 9-220 mg/10 ml range for the majority of the preparations and 9-180 mg/10 ml for sodium caseinate (D), sodium proteinate and milk protein concentrate. The concentration of salt was constant — 1 M NaCl, and pH was natural for the given product (Table 1). The effect of pH was tested at milk concentration abt. 90 mg/ml. EC was also determined at different NaCl concentration (0.3, 0.6 and 1.0 M).

e) The fat absorption capacity was determined by a method developed at the Central Soya Laboratory [30]. 125 ml/soya oil were added to 25 g of the preparation and after 10 min (mixing it twice), the whole preparation was centrifugated for 4 min at 1200 rpm. The amount of fat absorbed was calculated from the difference between the oil which was added and oil which was not absorbed. The amount of the latter oil was determined after decantation of the sample after centrifugation. The calculation of mean results was based on 4-6 individual ones.

RESULTS AND DISCUSSION

THE EFFECT OF SALT CONCENTRATION

The water environment is not a typical environment of the meat products. Their aqueous phase is practically always constituted by the NaCl solution. For this reason, while drawing a characteristic of the physicochemical properties of protein preparations one has to be aware of the development of these properties in the presence of salt.

THE EFFECT OF SALT ON SOLUBILITY

The examined protein preparations, because of the technology by which they were obtained, present a wide range of soluble protein content (NSI 1.6-93.6%). These values are equivalent to solubility in water solutions (Table 2, column 1). The majority of soya protein preparations (Promine D, Promosoy 100, Soyabits 25T) show a distinct drop of solubility in 0.3 M NaCl solutions, whereas the solubility of milk protein preparations remains at an unchanged level (Table 2, column 2). Reduced solubility of soya preparations in NaCl solutions of similar concentrations was observed also by Hermansson [10] in her studies on soya protein isolate Promine D and Megen [21] in the studies on native soya protein.

Table 2. NSI of examined protein preparations in water and in 0,3 M solution NaCl

Type of preparation	NSI (%)	
	H_2O	0.3 M NaCl
Promine D	71.6	32.7
Promine R	1.6	15.4
Promosoy 100	12.0	9.3
Soyabits 25 T	30.0	19.6
Sodium caseinate (S)	93.6	93.3
Sodium caseinate (D)	88.6	89.3
Sodium proteinate	85.0	85.2
Milk protein concentrate	2.3	8.4

Protein isolates obtained at the isoelectric point behave differently irrespective of the material from which they are derived (Promine R, milk protein concentrate). They display a growth of solubility in 0.3 M NaCl in relation to solubility determined in water. The mechanism of this phenomenon has not yet been fully explained; however, it can be assumed that at pH = abt. 5.0 this is pH natural for both of the above mentioned "isoelectric" isolates), due to the presence of ions Cl^- the protein particles charge of these preparations becomes negative and the repulsive forces cause that solubility grows. This observation may have a certain practical importance when adding protein preparations to food with a low pH.

THE EFFECT OF SALT ON WATER ABSORPTION

According to some authors [7, 20] the level of water absorption by the preparations in connected with the solubility of protein in water and in salt solutions. In case there really is such a connection, one should expect a certain interdependence between the results presented above and concerning the effect of NaCl on solubility and the influence of NaCl on water absorption by the various protein preparations under study.

Basing on the results obtained for several of the preparations examined (Fig. 1) one can assume that the water absorption capacity in a water environment is higher than in NaCl solutions of a concentration of 0.3 M and 0.6 M, with the exception of Promosoy 100 and milk protein concentrate. At higher NaCl concentration (0.6 M and 1.0 M) practically all preparations had a water absorption capacity higher than at 0.3 M concentration. The observed trends comply with the observations of Fleming et al. [7] concerning, among other things, the Promine D soya isolate.

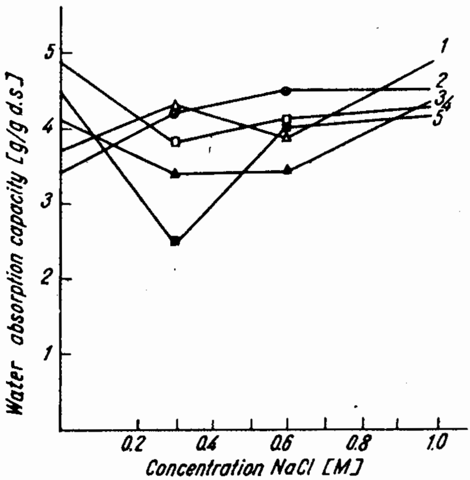

Fig. 1. Effect of NaCl concentration on water absorption capacity; 1 — Promosoy 100, 2 — milk protein concentrate, 3 — soyabits 25T, 4 — Promine D, 5 — Promine R

Table 3. Water absorption capacity of examined protein preparations in water and in 0.3 M solution NaCl

Type of preparation	Water absorption capacity g/g d.s.	
	H_2O	0.3 M NaCl
Promine D	4.9	3.8
Promine R	4.5	2.5
Promosoy 100	3.7	4.3
Soyabits 25 T	4.1	3.4
Sodium caseinate (S)	4.5[1)]	4.8[1)]
Sodium caseinate (D)	4.1[1)]	3.8[1)]
Sodium proteinate	4.8[1)]	4.8[1)]
Milk protein concentrate	3.4	4.2

[1)] Determinations made acc. to the method reposted by Chojnowski [3]

The highest water absorption capacity in the 0.3 M NaCl solution (Table 3) — taking this solution as typical in terms of salt concentration in fine-minced meat products — was shown by sodium caseinate (S) and sodium proteinate and the lowest by the Promine R isolate obtained in the isoelectric point of protein.

Table 4. Viscosity of 10%-solutions of examined protein preparations at different NaCl concentration

Type of preparation	Concentration NaCl (M)			
	0	0.3	0.6	1.0
	Viscosity (cP)			
Promine D	30.7	13.8	14.3	19.7
Promine R	4.6	4.6	4.6	7.1
Promosoy 100	9.6	8.0	8.0	8.0
Sodium caseinate (S)	27.0	45.3	59.1	402[1)]
Sodium caseinate (D)	45.1	41.0	50.3	567[1)]
Sodium proteinate	27.6	37.8	72.8	320[1)]
Milk protein concentrate	5.0	8.0	8.0	9.2

[1)] Dr = 48.6 s^{-1}; other determinations at Dr = 243 s^{-1}

THE EFFECT OF THE SALT ON VISCOSITY

Salt concentration is also one of the essential factors changing the viscosity of colloidal protein preparations solutions; the direction of these changes depends on the character and origin of protein.

The solution of salt at 0.3 M concentration caused a lowering of the viscosity of soya protein preparations (Table 4). In solutions where NaCl has a higher concentration (0.6 M and 1.0 M) and a pH natural for this preparation, the viscosity of solutions grew or stayed at the same level.

A decline of viscosity of various soya preparations in salt solutions with a concentration of 0.2-0.3 M was observed by other authors as well [7, 11]. This suggests that NaCl has a specific influence on the structure of soya protein by acting on its quaternary structure owing to which it is easily subject to the reactions of association and dissociation [17, 28].

Unlike in the case of soya preparations, a NaCl addition causes an increase of viscosity of milk protein preparations. The same phenomenon was observed by Hermansson [11] in her studies of sodium caseinate. This may be caused by the influence of salt on the effect of protein hydration or changes in the micellary structure of casein resulting from the cooperation of protein with NaCl.

THE EFFECT OF SALT ON THE EMUSIFYING CAPACITY

The effect of NaCl concentration on the emulsifying capacity (EC) in the examined protein preparations at pH 5.0, 6.0 and 7.0 is presented on Fig. 2. NaCl concentration had nosignificant influence on the EC of milk

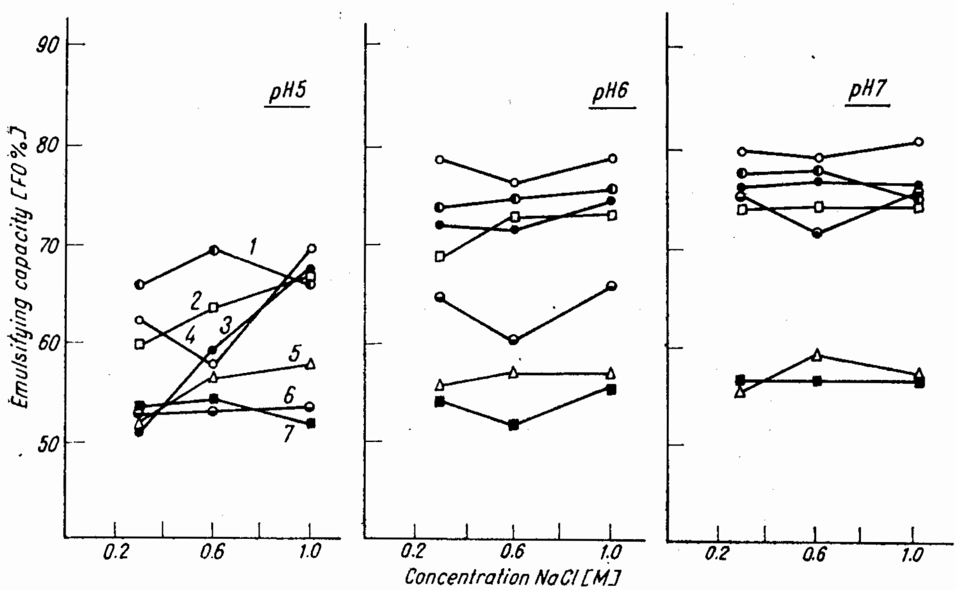

Fig. 2. Effect of NaCl concentration on emulsifying capacity of examined preparations at pH 5, pH 6 and pH 7; 1 — sodium proteinate, 2 — Promine D, 3 — sodium caseinate (D), 4 — sodium caseinate (S), 5 — Promosoy 100, 6 — milk protein concentrate, 7 — Promine R

preparation (sodium caseinates and proteinates) at pH 6 and pH 7, however, the observed EC level (72-80%) similar for all three preparations was higher than at pH 5. The highest EC in these conditions was displayed by sodium caseinate obtained by the spray method which conforms previous results and complies with the observations of Pearson et al. [22], concerning sodium caseinate. The milk concentrate, a preparation obtained in the isoelectric point of protein behaves in a quite different way. Its EC does not depend on NaCl concentration at pH 5 and 7 but it shows a certain tendency to drop at 0.6 M NaCl when pH equals 6. At pH 7, the ES of milk protein concentrate gets nearer to the EC level obtained for milk protein preparations occuring in the form of soluble potassium salts. This trend is most certainly linked with a growth of protein solubility in milk protein concentrate at pH higher than the pH of the isoelectric point of milk protein.

Also the EC of soya protein isolate Promine D does not depend on NaCl concentration; it was the lowest at pH 5 and grew with the increase of pH of the solution. Somewhat different results were noted as regards the dependence of EC on NaCl concentration for soya protein preparations of low solubility i.e. Promine R isolate and Promosoy 100 concentrate. The EC of these preparations was always lower as compared with Promine D isolate yet it was close to it and only slightly dependent on NaCl concentration.

Generally it can be said that within the examined range of NaCl concentrations which more or less correspond to the range of salt concentration found in food, the effect of NaCl on the fat emulsifying capacity is comparatively low.

EFFECT OF pH

The pH of food products environment, especially that of meat products differs within comparatively narrow limits but even then it is the second next to NaCl major environmental factor changing the physicochemical properties of protein preparations.

Within the examined pH range (5-7) the viscosity of 10% water solutions of the preparations grew with the increase of pH; however, the rate and intensity of this growth was differentiated. The lowest changes of viscosity were shown by soya concentrate Promosoy 100 while a specially dynamic growth of viscosity was recorded for protein isolates obtained in the isoelectric point of protein because of their passing, at pH 6 and 7 into soluble forms. This was most clearly visible in the case of milk protein concentrate (Fig. 3).

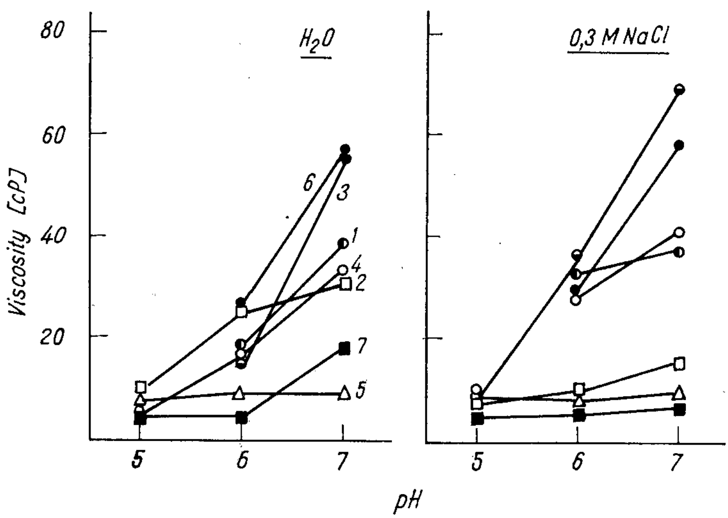

Fig. 3. Effect of pH on viscosity of 10%-solutions of examined protein preparations in water and in 0.3 M solution NaCl; 1 — sodium proteinate, 2 — Promine D, 3 — sodium caseinate (D), 4 — sodium caseinate (S), 5 — Promosoy 100, 6 — milk protein concentrate, 7 — Promine R

Since in the natural environment of meat products there usually occurs a cooperation of the two factors discussed (NaCl, pH), it is of interest to compare the dynamics of viscosity changes with the change of pH in a water environment and in the environment of 0.3 M NaCl (Fig. 3). The inter-action of these two environmental factors has a visible influence on the change of the dependence of viscosity on pH in soya protein isolates (Promine D, Promine R) but it has a smaller influence on the respective dependence in milk protein isolates (sodium caseinate, sodium proteinate), yet it is more evident in the case of milk protein concentrate obtained in the isoelectric point of protein. Once again, the specific character and the origin of protein in the preparation come into prominence.

Cooperation of the two environmental factors discussed and their joint impact on the fat emulsifying capacity level in the preparations examined has been presented in Fig. 2 discussed above. It was possible to observe that a decisive factor changing the EC of the preparations was the growing pH of the solution (within 5-7), whereas the influence of NaCl concentration was insignificant, a fact already stressed before. It is also possible to observe that the dependence of EC on pH has a course similar to that of solubility as a function of pH, recorded by other authors [5, 9].

EFFECT OF CONCENTRATION

On of the environmental factors which may influence the physicochemical properties of the preparations is the concentration of protein in the solution, linked with the amount of protein preparation added.

Viscosity as a function of concentration of protein preparations of the isolate type is presented in Fig. 4. This relationship is similar to the logarithmic one characteristic for macromolecular colloidal solutions. The logarithmic character of the relationship between the viscosity of protein preparations and concentration of the preparation in the solution is also confirmed by other authors [4, 7, 11]. Noteworthy is the fact that among the four preparations examined sodium caseinate obtained by the drum-drying method shows the highest viscosity within the concentration range 6—12%, probably due to the fact that the preparation acquires a specific structure during drying, characterized by a more developed surface and a higher hydration activity.

The influence of protein concentration on the fat emulsifying capacity by the preparations examined has been illustrated in Fig. 5. The results indicate that, in general, EC of the preparations is highly dependent on protein concentration within the concentration range 9 to 90-130 mg/10 ml solution and it displays almost no dependence at higher concentrations. One should note that in the food environment in which protein preparations can be found (also in meat products) EC will not depend or will depend to a small extent only on the concentration of protein in the environment.

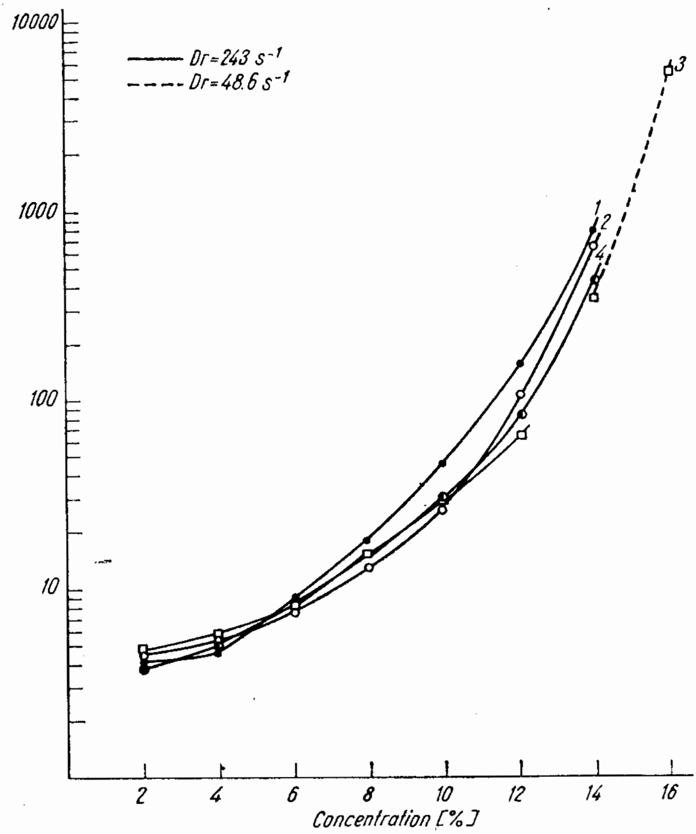

Fig. 4. Viscosity as a function of concentration of protein preparation; 1 — sodium caseinate (D), 2 — sodium caseinate (S), 3 — Promine D, 4 — sodium proteinate

The differences in production methods and origin of the preparations examined result in a differentiation of their physicochemical properties. Another factor affecting the physicochemical properties of protein preparations is the variability of the environment to which the preparation is added. The studies made have pointed to a high variability of solubility, water absorption capacity, viscosity and fat emusifying capacity of the preparations under the influence of such factors like NaCl concentration, pH of the solution and protein concentration.

The impact of NaCl concentration was particularly remarcable in the case of solubility and viscosity of the preparations; it was lesser in the case of the fat emulsifying capacity. In 0.3 M NaCl solution corresponding approximately to the salt content of finely minced meat products, it is possible to observe a decrease of solubility and viscosity of 10% solutions of these preparations, characteristic for soya protein preparations, as well as of their water absorption capacity.

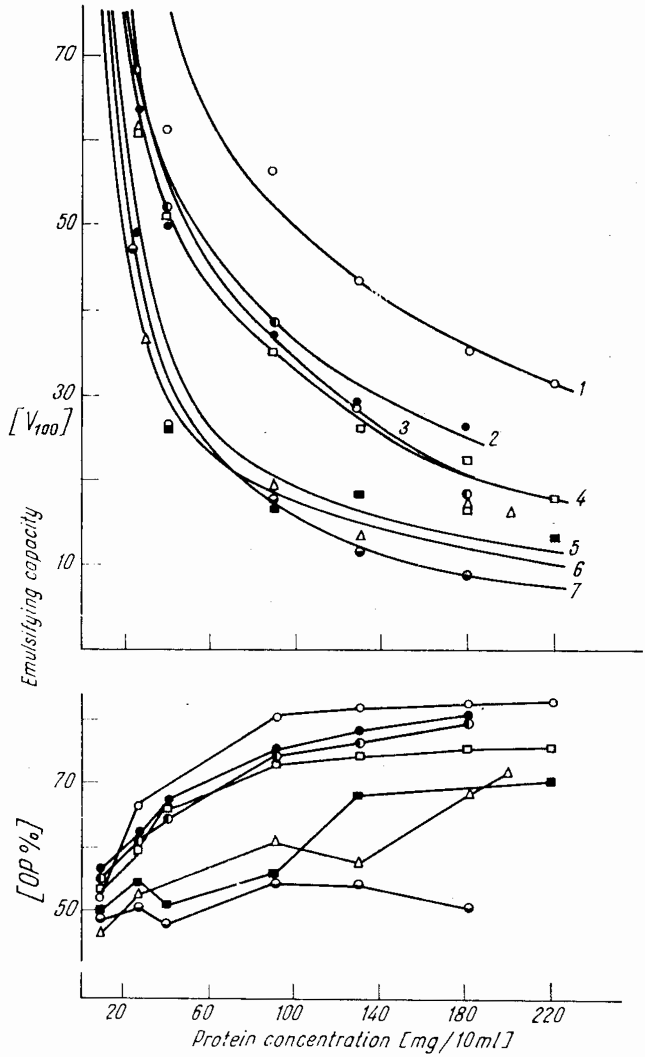

Fig. 5. Effect of protein concentration on emulsifying capacity of preparations, expressed by V_{100} and OP%; 1 — sodium caseinate (S), 2 — sodium proteinate, 3 — sodium caseinate (D), 4 — Promine D, 5 — Promine R, 6 — Promosoy 100, 7 — milk protein concentrate

The pH of the solution within the examined range of 5-7 observed in meat products proved to be a critical factor increasing the fat emulsifying capacity of the preparations together with their viscosity. Nevertheless, the viscosity growth intensity together with pH growth was differentiated and depended on the character of the preparation examined.

Protein concentration in the solution which depended on the amount of preparation added had an essential influence on the fat emulsifying capacity but only up to 90-130 mg protein/10 ml solution. In the case of a increased concentration of the preparation (2-16%), within the whole range of concentrations examined, a logarithmic growth of viscosity in 10% solutions of preparations of the isolate type was observed.

In the natural environment of meat products we usually observe a joint operation of all the three factors examined (NaCl concentration, pH, protein concentration). The authors of the present study have laid particular emphasis on the effect of interaction between pH of the solution and NaCl concentration. Noteworthy is also the possibility of another type of interaction, i.e. the influence of the preparations solubility (at a specific pH) on their other physicochemical properties: viscosity and fat emulsifying capacity. A number of observations have pointed to the mutual dependence of these factors which was later confirmed by relatively high correlation coefficients. Dependence between EC and NSI (at pH natural) was expressed e.g. by the linear correlation coefficient $R = 0.99$ (for NSI determined in water) and $r = 0.89$ (for NSI determined in 0.3 M NaCl) both significant for level $\alpha = 0.01$. It is true that correlation has been based either on very low or on camparatively high NSI values characteristic for the preparations examined as no preparations of an average NSI range were available. The effect of protein solubility on EC was also emphasized by other authors [5, 9, 25], but they did not observe any significant correlation between these factors.

Because of the poorly investigated dependence on environmental factors, a separate place is occupied by fat absorption. There are few data concerning the fat absorption capacity by protein preparations and no one has fully explained its mechanism [15, 24]. The results concerning fat absorption in the preparations examined have been presented in Table 5.

Table 5. Fat absorption capacity of examined protein preparations

Type of preparation	Fat absorption %
Promine D	109
Promine R	87
Promosoy 100	79
Soyabits 25 T	80
Sodium caseinate (S)	148
Sodium caseinate (D)	168
Sodium proteinate	155
Milk protein concentrate	60

The highest fat absorption capacity has been shown by sodium caseinate and sodium proteinate and the lowest by milk protein concentrate. From among soya protein preparations those of the meal and concentrate type were characterized by a distinctly lower fat absorption capacity. Among soya protein concentrates, Promine R was distinguished by a much lower fat absorption than Promine D. The low absorption of fat of the Promine R isolate and also the low absorption of milk protein concentrate are probably both connected with the method in which these preparations are obtained (protein obtained in the isoelectric point).

CONCLUSIONS

1. The physicochemical properties of soya and milk protein preparations are significantly dependent on the type of preparation. Also the major part of these preparations shows great variability under the influence of the environmental factors examined: NaCl concentration, pH of the solution and protein concentration.

2. The effect of NaCl concentration within the concentration range 0.3, 0.6 and 1.0 M was distinctly visible in the case of the solubility and viscosity of preparations. A decrease of solubility and viscosity as well as of the water absorption capacity characteristic for soya protein preparations was observed in 0.3 M NaCl solution.

3. The pH of the solution growth within 5 to 7 was a decisive factor increasing the fat emulsifying capacity of the preparations together with their viscosity. A particularly intensive growth was recorded in the viscosity of protein isolates obtained in the isoelectric point of protein.

4. Protein concentration in the solution which depends on the preparation added had a significant influence on their fat emulsifying capacity within the range of 90-130 mg protein/10 ml solution. When the concentration grew from 2 to 16%, a logarithmic increase of viscosity of the water solutions of preparations of the isolate type was observed.

5. The differentiation of physicochemical properties enhanced by the observed relationship with the environmental factors examined indicates that one ought to expect potential differences in the influence exerted by preparations on the products to which they will be added. To achieve optimum effects, the preparations should be carefully adjusted to the type of product, on the basis of the relationships observed.

LITERATURE

1. Baryłko-Pikielna N., Iwańska W., Jacórzyński B.: Gosp. Mięs., 1972, 24(11), 24.
2. Baryłko-Pikielna N., Iwańska W., Jacórzyński B.: Gosp. Mięs., 1973, 25(8), 26.
3. Chojnowski W., Śmietana Z., Poznański S., Jakubowski J., Rymaszewski J.: Przem. spoż., 1974, 28(5), 218.
4. Circle S. J., Meyer E. W., Whitney R. W.: Cereal Chem., 1964, 41, 157.
5. Crenwelge D. D., Dill C. W., Tybor P. T., Landmann W. A.: J. Food Sci., 1974, 39, 175.

6. Dolby R. M.: Austral. J. Dairy Technol., 1961, 16, 256.
7. Fleming S. E., Sosulski F. W., Kilara A., Humbert E. S.: J. Food Sci., 1974, 39, 188.
8. Grabowska J., Goraj I., Sikorski Z. S.: Przem. spoż., 1971, 25, 412.
9. Grabowska J., Naczk M., Sikorski Z. S.: Gosp. Mięs. 1972, 24(2), 20.
10. Hermansson A. M.: Determination of functional properties of protein foods. In:-Proteins in human nutrition, chapter 27. Eds. Porter J. W. G., Rolls S. B., Academic Press, London 1973.
11. Hermansson A. M.: J. Texture Studies, 1975, 5, 425.
12. Hayes J. F., Muller L. L.: Austral. J. Dairy Technol., 1961, 10, 265.
13. Hegarty G. R., Bratzler L. J., Pearson A. M.: J. Food Sci., 1963, 28, 663.
14. Hutton C. W., Campbell A. M.: J. Food Sci., 1977, 42, 454.
15. Hutton C. W., Campbell A. M.: J. Food Sci., 1977, 42, 457.
16. Inklaar P. A., Fortuin J.: Food Technol., 1969, 23, 103.
17. Koshiyama J.: Ceral Chem., 1968, 45, 405.
18. Kwaśniewska I., Jacórzyński B., Baryłko-Pikielna N.: Acta Alim. Polonica, 1976, 2(4), 307.
19. Kwaśniewska I., Zawadzka L.: Project No. PL-ARS 13(PL 480). Ann. Res. Report 1974/75, Rep. 2/75.
20. Lemancik J. F., Ziemba J. V.: Food Eng., 1962, 34, 90.
21. Megen W. H.: J. Agric. Food Chem., 1974, 22, 126.
22. Pearson A. M., Spooner M. E., Hegarty G. R., Bratzler L. J.: Food Technol., 1965, 19, 1841.
23. Poznański S., Surażyński A., Jakubowski J., Sobina A., Jacyk A.: Przegl. Mlecz., 1971, 20(12), 1.
24. Puski G., Szuhaj B. F., Kadane V. V.: Fleischwirtschaft 1974, 54, 1967.
25. Smith G. C., Hyunil J., Carpenter Z. L., Mattil K. F., Cater C. M.: J. Food Sci., 1973, 38, 849.
26. Swift C. E., Lockett C., Fryar A. J.: Food Technol., 1961, 15, 468.
27. Webb N. B., Ivey F. J., Craig H. B., Jones V. A., Monroe R. J.: J. Food Sci., 1970, 35, 501.
28. Wolf W. J.: J. Agric. Food Chem., 1970, 18, 969.
29. Wolf W. J., Cowan J. C.: Soybeans as a food source, CRC Press, Cleveland, Ohio, 1971.
30. Zestaw metod oznaczeń fizykochemicznych preparatów białka sojowego. Central Soya Co. Inc. 1973.

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WPŁYW NIEKTÓRYCH CZYNNIKÓW ŚRODOWISKOWYCH NA CHARATERYSTYKĘ FIZYKOCHEMICZNĄ PREPARATÓW BIAŁKOWYCH

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S T R E S Z C Z E N I E

Badaniom poddano różne preparaty sojowe (Promine D, Promine R, Promosoy 100, Soyabits 25T) oraz preparaty mleczne (kazeinian sodu, białczan sodu, koncentrat białka mleka). Określano ich charakterystykę fizykochemiczną na podstawie zna-

czenia rozpuszczalności, zdolności absorpcji wody, lepkości, zdolności emulgowania tłuszczu i zdolności absorpcji tłuszczu, uwzględniając zmienne warunki środowiskowe: stężenie NaCl, pH roztworu i stężenie białka.

Stwierdzono, że właściwości fizykochemiczne badanych preparatów są określone typem preparatu i sposobem jego otrzymywania oraz wykazują dużą zmienność w zależności od badanych czynników środowiskowych. Wpływ stężenia NaCl (0,3, 0,6 i 1,0 M) zaznaczył się szczególnie wyraźnie w przypadku rozpuszczalności i lepkości preparatów, natomiast w mniejszym stopniu w przypadku ich zdolności emulgowania tłuszczu. W 0,3 M roztworze NaCl obserwuje się specyficzne dla preparatów białka sojowego obniżenie rozpuszczalności i lepkości, jak również ich zdolności absorpcji wody.

Wzrastające pH roztworu, w zakresie 5-7 było decydującym czynnikiem zwiększającym zdolność emulgowania tłuszczu preparatów, jak również ich lepkości, niemniej dynamika wzrostu lepkości była zróżnicowana i zależna od charakteru badanego preparatu. Najmniejsze zmiany lepkości wraz ze wzrostem pH wykazywał koncentrat sojowy Promosoy 100, szczególnie dynamicznie wzrastała lepkość izolatów białkowych uzyskanych w punkcie izoelektrycznym białka (izolat Promine R i koncentrat białka mleka).

Stężenie białka w roztworze miało istotny wpływ na zdolność emulgowania tłuszczu, ale tylko w zakresie do 90-130 mg białka/10 ml roztworu. Przy wzroście stężenia preparatu od 2 do 16% obserwowano logarytmiczny wzrost lepkości wodnych roztworów preparatów typu izolatu.

Zróżnicowanie właściwości fizykochemicznych preparatów, pogłębione stwierdzonymi zależnościami od badanych czynników środowiskowych wskazuje, że należy się spodziewać potencjalnych różnic w oddziaływaniu preparatów na produkt, do którego zostaną one dodane. W celu osiągnięcia optymalnych wyników należy precyzyjnie dobierać preparat do rodzaju produktu, opierając się na stwierdzonych zależnościach.