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Influence de l'addition de la viande desossée d'une facon Mechanique sur les Propriétés /MDM/ physico-chimiques des farces expérimentaux.

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On a etudié les propriete's fonctionelles de la viande desosse'e d'une facon mechanique - dite MDM utilisée dans la farce.
Cette viande a remplace'e 10 et ensuite 20% de protéines de la farce. On a observé e'galement l'influence simultanée de l'addition de la viande desosse'e et des protéines d'une autre provenance que la viande, ajonte'es en quontité de 10% de protéines totales. Dans les farces prepare'es de cette facon on a examiné: la composition chimique, le pH, la capacité d'absorption de leau, la viscosité, les propriete's emulsifiantes, la couleur, la volume de coule'e formée pendant le traitement thermique.
L'addition de MDM dans les farces auqmente le pH, la capacité d'absorption de l'eau la viscisité, et aussi la longueur d'onde dominante et l'intensite de la couleur; il n'agit pas sur les proprietés emulsifiantes et baisse la volume de la coule'e en foncant e'galement la couleur.
L'addition simultanée de la viande desosse'e avec le caseinate de sodium et l'isolat de soja dans les farces donne des re'sultats inférieurs par rapport a' ceux qui ont e'te obtenus dans le cas d'addition de la viande desosse'e seule.

Влияние добавки механически обваленного мяса /МОМ/ на физикохимические свойства модельных фаршов.

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Исследовались на модельных мясных фаршаш функициональные свойства механически обваленного мяса. МОМ добавлено к мясным фаршам в количестве IO и 20% заменителя белка. Кроме того было учтено влияние одновременной добавки МОМ и белков немясных препаратов, которые вводилось в количестве IO% заменителя белков.
В изготовленных фаршаш определялись: основной химический состав, pH, водосвязывающая способность, вязкость, эмульгирующая способность, цвет, количество термической убыли.
Добавка МОМ увеличивала pH, водосвязывающую способность, вязкость, а также показатели цвета. /насыщение и доминирующая дина волн/. Не обнаружено влияния на эмульгирующую способность, но термические померы уменьшались, уменьшались тоже показатели яркости цвета.
Одновременная добавка фарша МОМ, казеината натрия и соевого изолята приводит к понижению исследованных показателей по сравнению с фаршем, составленным только с добавкой МОМ.

The influence of the addition of Mechanically Deboned Meat/MDM/ on the physicochemical properties of meat model blends.

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Introduction

The degree of shredding and technological properties of mechanically deboned meat limit the posibilities of using it in meat processing. At present, the meat-fat mass /MDM/ is used for processing comminuted products. It is being added to sausages, canned meat, luncheonmeat, ready-to-serve food/Fried 1976/. So far, the studies on determining the optimization of using MDM as a recipe ingredient of meat products indicate that added at the level of 5 to 20 per cent substitution of meat protein is accepted by the consumer in sensoric evaluation. The level of exchange of the basic meat raw material for mechanically deboned meat seems to be an open question. However, the enrichment of recipes for meat products simultaneously with MDM and substitutes of non-meat proteins should be based on results of pilot investigations on meat model blends. It will allow adequate, economically favourable use of raw materials in industrial scale with simultaneous maintaining of technological standards and of satisfactory organoleptic quality of final products. In this paper, on the basic of measurements of pH value, water holding capacity of added water, viscosity, emulsifying capacity, the amount of cooking loss, colour and its stability, an analysis was undertaken of technological usefulness of prepared meat model blends, studying the influence of the level of added MDM or MDM and non-meat substitutes on the above mentioned properties of the blends.

Material

On the basis of analyses of the basic composition of pork class I, mechanically deboned meat, lard, sodium caseinate and soya isolate, meat model blends were prepared under applying stable value of the ratio Water/protein=5.3 ;Fat/Protein=2.4. In the recipe of meat blends 10 per cent, 20 per cent and 30 per cent of pork protein were substituted with MDM protein or MDM and non-meat substitutes. The following were used for preparing of meat model blends: -pork, class I /m. semimembranosus/, taken at random from current production of Meat Plants, -mechanically deboned meat /pork/ from backbone, obtained from Soffelaar-Looyen equipment, type MRS 40, -back fat taken from the back of carcass classIII, -sodium caseinate, produced by Meat Plant in Kutno, -soya isolate type 500E produced by Ralston Purine Company, -NaCL added in quantity of 2 per cent, and water with ice. Muscle semimembranosus and back fat were shredded on laboratory grinder before cuttering. Meats blends were prepared in laboratory cutter of "Hobart" production, Model 84142. The single components of blends were cuttered in the following order: meat raw materials, NaCL in portions, water with ice, sodium caseinate or soya isolate. Back fat was added in the second minute of cuttering. The total time of cuttering was 9 minutes. Final temperature of blends amounted to +12^{o}C. Determinations were made on the following meat model blends: /1/ control blend without additions, /2/ blend with exchange of 10 per cent of meat protein for MDM protein, /3/ blend with exchange of 20 per cent of meat protein for MDM protein, /4/ blend with exchange of 20 per cent of meat protein /10 per cent MDM and 10 per cent sodium caseinate/, /5/ blend with exchange of 30 per cent of meat protein /20 per cent MDM and 10 per cent sodium caseinate/, /6/ blend with exchange of 20 per cent of meat protein /10 per cent MDM and 10 per cent soya isolate/, /7/ blend with exchange of 30 per cent of meat protein/20 per cent MDM and 10 per cent soya isolate/. Moreover determinations were done on MDM /8/ before it was used for preparing meat model blends. MDM /8/ and blends /1-7/ after sterlization in cans were preserved 7 days under refrigoration for further studios.

Methods

The content of total protein was determined by Kjeldahl method, fat content was determined by Soxhlet method, water content by drying method in 105°C. Physicochemical studies: water holding capacity of added water was determined by centrifugal method /Mierbicki et al.19[illegible]/ viscosity was determined on viscosimeter W-2 with negative pressure 0,2 atn./Tyszkiewicz 1969/, emulsifying capacity was determined by Swifft method /Grabowska et al.1971/, colour was determined by reflexive method using "Specol" aparato with wavelength 560 and [illegible] nm. Values of colour were calculated from regression equations for ground meat/dominant wave-length, intensity of colour, purity of colour/. On the basis of obtained results coefficients of colour stability were calculated /Kortz et al.196[illegible]/., pH value was measured by potentiometric method using potentiometer N-512, cooking loss in model blends /after heating cans containing blend in water bath in 70°C/ was determined assuming that 1cm³ of cooking loss has the mass of 1 g. The quantity of loss was expressed in per cent in relation to the blend before thermal treatment.

Results and discussion

Analysis of chemical composition of pork class I and MDM-basic components of meat blends, shows essential differences in content of protein, water and fat. It was found that MDM has protein content lower by 4 per cent units, water by 17.6 per cent units, whereas the fat content is tenfold higher /Table 1/. Such essential differences observed in basic composition allow to assume that MDM as a recipe ingredient will influence in a specific way the physicochemical properties of meat blends. pH values of meat model blends showed clearly lower values in comparison with pH of MDM /Fig.1/. With the increasing level of added meat-fat mass an increase of pH value for single blends can be observed. It was found that for blends containing soya isolate in their recipe, both at the exchange level of 10 per cent and 20

Table 1. Physico-chemical properties of meat model blends and MDM

Traits	Investigated meat model blends							MDM
	1	2	3	4	5	6	7	
Moisture %	60,5	59,94	59,61	60,77	59,77	60,28	59,95	58,65
Protein %	11,51	11,48	11,46	10,94	10,91	11,37	11,35	16,04
Fat %	26,02	25,71	26,13	26,28	26,89	25,97	26,25	25,28
pH	5,86	5,92	5,94	5,9	6,02	5,78	5,83	6,26
WHC of added water %	41,0	46,8	55,7	42,3	53,4	31,3	40,3	36,2
Viscosity /st/	628	655	766	516	647	355	511	673
Emulsifying capacity of oil phase	51,7	49,8	51,3	50,6	50,0	50,6	50,0	53,7
Cooking loss %	17,8	11,2	9,9	20,4	13,6	24,7	22,5	21,6
Dominant wavelength /nm/, before	581,4	582,6	583,7	583,3	584,2	582,7	583,7	592,8
after cooking	580,1	580,8	580,4	580,7	580,5	580,4	580,0	583,5
Purity of colour, before	27,88	28.25	32,61	33,31	34,49	30,16	30,98	29,80
after cooking	20,22	20,93	18,99	19,83	18,67	18,60	19,96	19,31
Lightness of colour /%/, before	45,98	41,56	38,58	40,14	38,05	39,32	37,07	17,39
after cooking	46,42	41,59	40,05	40,16	39,41	39,48	37,20	26,82
Stability of colour after cooking	1,578	1,439	1.246	1,304	1,128	1,482	1,269	1,426

per cent of pork class I protein for MDM, pH values are lower than the control sample. Also as regards holding capacity of added water we note that increase of MDM level/in meat blends/ improves the holding capacity of added water. This phenomenon is observed although MDM itself shows a fairly low water holding capacity. Favourable effect of MDM on this property of the meat blend is particularly visible at its 20 per cent addition /Fig.1/.

The addition of sodium caseinate lowered the value of water holding capacity in comparison with blends with only MDM added. These values, however, were not lower than the water holding capacity of the control sample. A definite drop of water holding capacity is to be noted in blend with soya isolate added. In this case the addition of 10 per cent and 20 per cent of MDM does not improve water holding capacity of the given blend, at least to the level of control sample. Meat model blend containing 10 per cent of soya isolate protein and 10 per cent of MDM protein is marked for a definitely low holding capacity of added water/Fig.1/. The known dependence of holding capacity of added water from active acidity/Tyszkiewicz 1972/ was confirmed in our work by obtaining for meat blends the correlation coefficients r=0.91 and for MDM r=0.67.

A vital determinant of technological usefulness of meat blends is their viscosity, which essentially influences the holding of single ingredients in the final product. In the studies of meat model blends an increase of viscosity was observed with the per cent share of MDM in the recipe. A marked increase of viscosity was noted in blends with 20 per cent addition of MDM. Addition of non-meat substitutes caused lowering of viscosity in blends. It was found that both sodium caseinate and soya isolate lower the viscosity of blends/Fig.1/. Only the addition of 20 per cent MDM to the composition in case of blend with sodium caseinate allowed to exceed the value of control sample. In case of blend with soya isolate neither 10 per cent nor 20 per cent exchange of pork for MDM allowed to obthin at least the value of control sample. There was shown statistically the influence of pH value on viscosity, correlation index r=0.75, and the influence of holding capacity of water added on this qualitative determinent of meat models blends r=0.91.

Meat model blends under study were characterized by a similar emulsifying capacity/table1/. Statistically there was shown no correlation between pH value and emulsifying capacity of the blends. It appears, however, that MDM, which has higher pH values in comparison with blends, also shows tendency to a higher emulsifying capacity/Table1/.

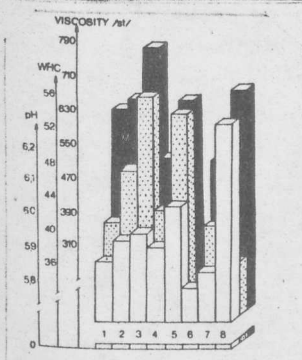

FIG.1 pH, WHC of added water, viscosity estimated for 7 meat model blends and MDM /white graphs-pH, white graphs with black spots-WHC of added water, black graps- viscosity/

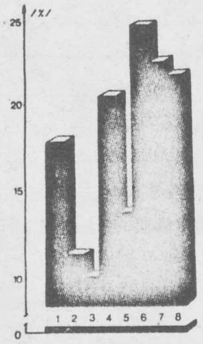

FIG.2 Cooking loss estimated for 7 tested meat model blends and MDM.

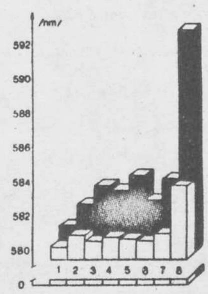

FIG.3 Dominant wavelength estimated for 7 tested meat model blends and MDM /white graps - after cooking, black graps-before cooking/

The quantity of obtained cooking loss from blends under study indicates a favourable role of MDM which at 10 per cent and 20 per cent addition especially evidently lowers the amount of cooking loss from the blends. Addition of non-meat protein preparations to the blends caused an increased cooking loss in comparison with blends with only MDM added /Fig.2/. In as far as in case of increasing MDM to 20 per cent with 10 per cent of sodium caseinate caused a decrease of the amount of cookind loss, with substitution with soya isolate the addition of MDM both at 10 per cent and 20 per cent did not bring about a definite decrease of the amount of cooking loss. The quantity of loss was higher than in control sample. That blend also showed the lowest pH value and the lowest holding capacity of water added. In our work we indicated a statistical correlation between the cooking loss and holding capacity of water added r=0.88.

Analysis of results of colour of both blends and MDM indicates that the observed features of MDM such as high value of dominant wavelength and low purity of colour influenced the

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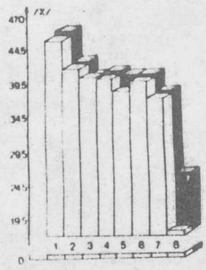

FIG.4 Lightness of colour estimated for 7 tested meat model blends and MDM /white graps - before cooking, black graps-after cooking /.

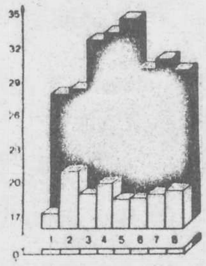

FIG.5 Purity of colour estimated for 7 tested meat model blends and MDM /white grops - after cooking, black graps-before cooking /.

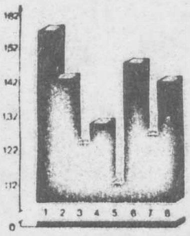

FIG.6 Stability of colour after cooking estimated for 7 tested meat model blends and MDM.

above metioned colour determinants of blends under study. Addition of 10 per cent, and particularly of 20 per cent, exchange of pork protein for MDM influenced raising of value of dominant wavelength, lowering of photometric purity and also increasing of colour intensifying of blends under study /Fig.3,4,5/. The obtained results were more favourable than in control samples.

The attemp undertaken in our work of determining correlation between composition qualities of colour before and after thermal treatment of meat model blends showed statistically a high correlation between purity of colour before and after thermal treatment r=0.98. There was also carried out a statistical calculation of correlation indices between colour parameters of blends and their content of basic chemical compounds and pH. It was found that the colour parameter dependent from water content was the colour intensity which showed the higher value the smaller the water content was /r=0.99/. There was also stated a favorable correlation between intensity of colour and pH values of meat blends r=0.57.

The colour stability of blends was expressed by the so-called colour stability index "Tb" /Kortz 1968/. It was proved that the addition of MDM to model blends affected unfavourably the colour stability after thermal treatment. The highest colour stability was shown by a control blend with addition of MDM or non-meat substitutes /Fig.6/. The value of "Tb" index for blends was actually correlated with pH values /r=0.54/ and water content /r=0.54/.

Conclusion

The addition of MDM to meat blends caused an increase of pH value, WHC, viscosity, dominant wavelength and purity of colour. No evident effect on emulsifying capacity were observed, although diminished values of thermal cooking losses and lightness of colour were observed. The addition of blends of MDM and soya isolate or sodium caseinate caused lower values for investigated features than those observed when only MDM was used.

References

1. Fried J., Regulatory Considerations concerning mechanically deboned red meat. J. Food Technology 9,35,1976.
2. Wierbicki E.P., Burrel C.R., Determination of meat swelling as a method for investigation the water biding capacity of muscle protein with low water holding forces. Fleishwirtschaft 42,10948,1962.
3. Grabowska I., Goraj I., Sikorski Z.E., Obiektywna metoda oznaczania zdolności emulgującej białek mięśniowych. Przemysł Spożywczy 24,412,1971.
4. Kortz J. Różyczka J., Gajewska-Kołaczyk. S., Metodyczne aspekty obiektywnego pomiaru barwy surowego mięsa wieprzowego. Roczniki Nauk Rolniczych 90-B-3,333,1968.
5. Tyszkiewicz S., Tyszkiewicz I., Wybrane podstawowe zagadnienia nauki o mięsie. Białka mięsa. Gospodarka Mięsna 3,20,1972.
6. Tyszkiewicz S., Badanie fizycznych właściwości mięsa. WNT - Warszawa 1969