EFFECT OF MODIFIED STARCH ON THE PROPERTIES OF MEAT BATTER WITH ADDED WATER

Marek Cierach, Agnieszka Paulo, Halina Ostoja, Jadwiga Batura, Aleksandra Kwiatkowska

Chair of Meat Technology and Chemistry, University of Warmia and Mazury in Olsztyn, ul. Oczapowskiego 2, 10-957 Olsztyn, Poland

Key words: modified starch, meat batter, structure, texture, colour, hydratation properties

Background

The additives that function as texture determiners only to little degree identified and used in the meat industry, are types of modified starch. Starch is added mainly to comminuted meat products in order to bond water, diminish thermal drip, form texture and to diminish caloric value of the product (Bater et al. 1992, Claus and Hunt 1991, Pietrasik 1999). The most significant ways of modifying starch are netting and stabilizing. Thanks for these modifications netted starch, in the identical technological processes maintains the same form and properties, it does not undergo mechanical stress, whereas native starch becomes decomposed. The stabilization of starch causes it being durable while storing and also reduced syneresis and retrogradation (Bater 1992, Claus and Hunt 1991, Tederko 1998).

Objective

The aim of this work was to determine the effect of adding selected types of modified starch to hydrated meat batter on its hydratation properties, structure, textural characteristics, and colour stability.

Methods

The raw material was pork meat of grade III. It was comminuted on a grind through a net with holes` diameter of 4 mm, next 2,3% curing blend (0,6 $NaNO_2$/1000 g NaCl) was added and the curing lasted for 4 h. Next, 30 % of iced water and 3 % of starch preparate were added and everything was stirred so as to obtain substance with appropraite consistency and stickinness. The meat batter was closed in air proof, metal cans and it was pasteurized at the temperature of 80°C ±1 for 2 h until the core temp. was, approximately 75°C. Six types of modified starch were applied: E 1412 - distarche phospate "skronet", E 1412 - distarche phospate "adaix", E 1414 - acetylat distarche phospate "lubostat", E 1414 - acetylat distarche phospate "fremix HS", E 1422 - acetylat distarche adipate "adamyl HS" and E 1422 - acetylat distarche adipate "adanet HS". PH values of the canned meat were determined with pH-meter type 340 / ION - SET of a WTW firm. The amount of thermal drip was determined by weight after a can had been openned. Microstructure of meat was analysed under the scanning microscope JEOL JSM 5200. The parameters of texture were determined with the use of Texture Analyser TA-XT2i/25 and a computer programme TEXTURE EXSPERT EXCEED for the samples with diameter and height of 10 mm (Bourne 1982). The parameters of colour L*, a*, b* of the surface of a slice of canned meat were measured with the use of an appliance Spektro-color Dr Lange with software SPEKTRAL-C. The slices of canned meat were subjected to light with intensity of 500 lux for 1, 3 i 6 h in order to determine durability of colour (Cierach and Paulo 2000). Synthetic coefficient of a change in colour (ΔE) was calculated according to the formula $\Delta E=\sqrt{(\Delta a^*)^2+(\Delta b^*)^2+(\Delta L^*)^2}$. In order to statistically compare means, test q-SNK was applied (SAS Institute 1991).

Results and discussion

The pH value of the meat batter with added starch did not differ significantly from the control sample. The addition of starch diminished thermal drip from 22,58% (control sample) to 7,56%-11,92% for the canned meat with added starch (tab. 1). The canned meat with added starch adamyl HS and adanet HS characterised with heterogenous and porous structure of proteinaceous matrix. The presence of irregularly distributed air spaces among porous elements of the proteinaceous matrix, gives it a disarranged character. (photo 1). The observed, heterogenous structure of canned meat may influence the considerable tenderness of the product, and thus determine its weak elasticity and springiness. In the instrumental evaluation, it was confirmed that the hardness of these products was the least (tab. 1). The granular and dense structure of the proteinaceous matrix was observed in the photographs with the canned meat with added starch skronet and fremix HS. The proteinaceous matrix, in this case, characterised with a more homogenous structure in comparison to the canned meat with added starch adamyl or adanet. Simultaneously, a more tight structure of the proteinaceous matrix may have been correlated with the reduction in the accessibility of water as the effect of more efficient bonding of water by starch, which next may have caused an increase in the protein-protein interaction through the formation of greater amount of lateral bonds. The proteinaceous matrix, formed in this way, created more firm gel and consequently a more hard product. The hardness of the canned meat samples with added starch evaluated by TPA test was the greatest, except from the control sample, which hardness was 1323 g (tab. 1). The remaining parameters of texture characterised with greater values for the sample without starch. The most apparent was the effect of added starch on gumminess and chewiness - the parameters were approximately twice as low than for the sample without starch. The values a* and b* for the samples with added starch were lower than for the control sample. It was caused not exactly by the colour of the starch component but by considerable differences in the amount of thermal drip (tab. 1). The samples of meat batter with added starch characterised with more durable colour. After 1, 3 and 6 h of exposure to light most of them characterised with a significantly lower value ΔE. It suggests that starchy gruel may cause a decrease in the rate of changes in pigments and be a protective agent.

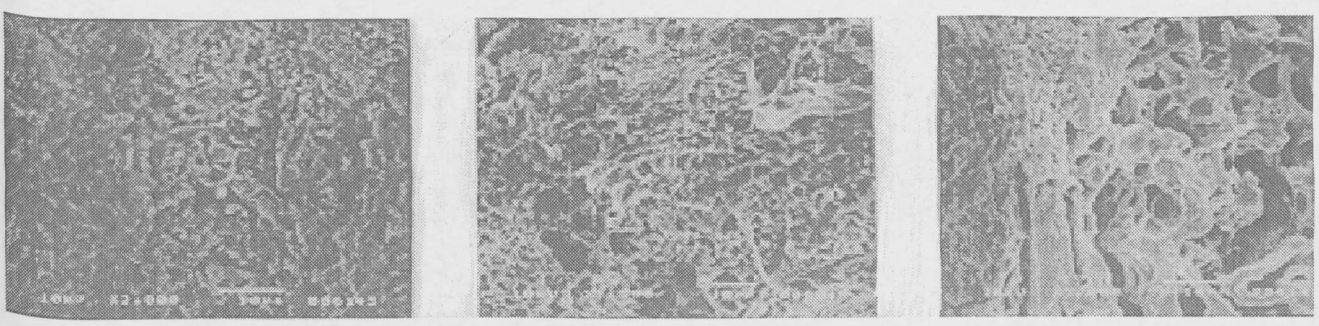
Conclusions

The addition of modified starch to hydrated meat batter 2-3 times diminished the amount of thermal drip, changed the structure, texture and colour of the batter after thermal processing. The meat batter with modified starch added characterised with a heterogenous and porous structure of the proteinaceous matrix with a different degree of heterogeneity and different tightness, which significantly influenced the parameters of texture. The greatest differences were in the hardness, chewiness and gumminess. The

parameters were significantly lower for the meat batter with added starch. The addition of starch was beneficial for the stability of the product's colour during the exposure to light, even though the colour saturation (a* and b*) was initially greater for the samples without starch.

References

1. Bater B., Descamps O., Maurer A.J. 1992. *Quality characteristics of hydrocolloid-added oven-roasted turkey breasts.* J. Food Sci., 57, 1068-1070.
2. Bourne M. C. 1982. *Food texture and viscosity: concept and measurement.* Academic Press, INC, New York.
3. Cierach M., Paulo A. 2000. *Influence of functional additives on colour stability of model canned meat products.* Natural Sciences 6, 181-189.
4. Claus J.R., Hunt M.C., 1991. *High-water bologna formulated with texture-modifying ingredients.* J Food Sci., 56, 643-647.
5. Pietrasik Z. 1999. *Effect of content of protein, fat and modified starch on binding, textural characteristics, and colour of comminuted scalded sausages.* Meat Sci., 51, 17-25.
6. SAS Institute, Inc. 1991. SAS/STAT® Users Guide, Version 6.03. SAS Institute, Inc., Cary, NC.
7. Tederko A. 1998. *Zastosowanie skrobi w przetwórstwie mięsnym.* Gosp. Mięs., 50, 42 - 43.



Skronet Fremix HS Adamyl HS

Photo 1: The structure of meat batter after thermal processing with different types of modified starch added

Table 1

The properties of meat batter with modified starch added after thermal processing

Feature	Control sample	Type of added starch					
		E 1412 "skronet"	E 1412 "adaix"	E 1414 "lubostat"	E 1414 "fremix HS"	E 1422 "adamyl HS"	E 1422 "adanet HS"
PH	6,26^{a}	6,26^{a}	6,26^{a}	6,27^{a}	6,28^{a}	6,24^{a}	6,23^{a}
Thermal drip	22,58^{a}	9,22^{c}	8,68^{c}	11,58^{b}	11,92^{b}	7,56^{d}	8,00c^{d}
Hardness	1323^{a}	897^{b}	874^{b}	767^{c}	928^{b}	756^{c}	710^{c}
Springiness	0,860^{a}	0,813^{a}	0,824^{a}	0,810^{a}	0,771^{ab}	0,756^{b}	0,756^{b}
Cohesiveness	0,522^{a}	0,424^{b}	0,426^{b}	0,405^{b}	0,372^{b}	0,404^{b}	0,387^{b}
Gumminess	676^{a}	390^{b}	384^{b}	332^{bc}	348^{bc}	303^{c}	296^{c}
Chewiness	601^{a}	316^{b}	296^{b}	269^{bc}	270^{bc}	229^{c}	232^{c}
L*	56,22^{a}	56,16^{a}	56,32^{a}	55,51^{a}	54,98^{a}	56,42^{a}	55,58^{a}
a*	10,79^{a}	9,44^{b}	9,46^{b}	9,52^{b}	9,24^{b}	9,24^{b}	9,21^{b}
b*	17,10^{a}	15,66^{b}	16,16^{ab}	15,88^{b}	15,81^{b}	15,75^{b}	15,80^{b}
ΔE/1h	2,76^{a}	2,34^{ab}	2,01^{b}	2,08^{b}	2,30^{ab}	2,39^{ab}	2,22^{b}
ΔE/3h	5,44^{a}	4,32^{b}	4,45^{b}	4,49^{b}	4,31^{b}	4,86^{ab}	4,81^{ab}
ΔE/6h	6,42^{a}	6,01^{a}	5,62^{b}	5,71^{b}	5,22^{b}	5,92^{ab}	5,81^{b}

^{abcd}-means in the same rows followed by different letters are significantly different at $P<0.05$