SESSION 6. TECHNOLOGY OF HEAT PROCESSED PRODUCTS

6:1

THE EFFECT OF VARIOUS HYDROCOLLOIDS ON THE PROPERTIES OF MINCED MEAT PRODUCTS

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SUMMARY

The effect of adding various hydrocolloids, including carrageenans, locust bean gum(LBG), guar gum, or xanthan gum to minced meat products , with or without added trisodiumpolyphosphate (TPP) was examined. The effect was assessed based on measurements of water holding capacity (WHC),jelly formation, texture, and sensory evaluation of selected samples.
It was concluded that although xanthan resulted in excellent WHC, such products had poor texture. Similarly, guar gum was found to be less suitable because it gave a weak gel.
In combination with TPP the best properties were found with LBG or carrageenan formulations.
However, if the products were heated to high temperature, this impaired the LBG product.
Overall, 0.25% kappa carrageenan together with TPP seems to improve the properties the most with regard to low jelly formation , WHC and texture.
Differences were only found by sensory evaluation in samples added xanthan gum in comparison with the control sample.

INTRODUCTION

The ingredients in minced meat products as well as the procedure for processing are of great importance for the consumer's acceptance of the finished product. Thus both a good texture and low jelly formation are desirable properties, and of great importance.
It is well-known that using a fairly large and high quality of fat in meat emulsions result in desirable properties with regard to juiciness and "spring", but this of course also results in a high calory content.
Since polyphosphate, e.g. tripolyphosphate(TPP) is known to posess emulsifying properties, this is often used in meat emulsions, but TPP is not permitted for use in all countries. It would also be desirable to substitute some of the fat for dietary reasons. For this reason there has been an increased interest for using other, low or non-calory ingredients.
One type of ingredients which meets the above description is hydrocolloids, including carrageenans, LBG, guar gum, and xanthan gum. Many of these materials have been permitted for use as food ingredients. Especially carrageenans and LBG which have been commonly used for a number of years.

MATERIALS AND METHODS

Carrageenans. This is a group of high molecular, sulphated, linear polysaccharoses. The carrageenans are available in three forms: kappa, lambda, and iota carrageenans. In this trial a mixture of kappa and lambda (in this paper called P-car), or a pure kappa carrageenan (in the following called C-car or N-car) were tried out. All three are commercial preparations.

Locust bean gum (LBG). This hydrocolloid is a galactomannan polysaccharose with a 1 to 4 ratio between galactose and mannose. LBG is known to have good water binding and viscosity increasing properties and is used as stabilizer in many composite foods.
On its own, it is unable to form a gel, but it acts synergetically with e.g. the gel forming properties of carrageenans.
Guar gum is also a galactomannan. It differs mainly in structure from LBG by a 1 to 2 ratio of galactose and mannose. Guar gum can increase the viscosity of a food mixture, but it is unable to form gels.

The chemical composition of xanthan gum is more complicated than that of the other hydrocolloids. Basicly it comprises a skeleton of glucose to which is bonded trisaccharoses with glucoronic acid and mannose Xanthan gum has food viscosity increasing properties and is known to show synergism with other hydrocolloids, such as LBG and guar gum.
The minced meat models have the following composition: 38.5% lean pork, 30.9% back fat tissue, 28.6% ice/water, and 2% salt. In addition, the model is added one of the above described hydrocolloids, either in pure form or as mixes. The concentration of the hydrocolloids varies from 0.3% to 0.6%. Further, 0.3% TPP is added,as indicated under the result section.
The minced meat models were stuffed in artificial casing, heated to 72.5°C after being inserted in a polyester casing to avoid moisture changes during heating.
Some additional trials were made with model sausages with a basic recipe as follows: 42.9% pork meat, 30.9% fat tissue, 23.8% ice/water, 2% salt, and 0.4% TPP. These sausages were also added one of the hydrocolloids, heated, either as described above, with subsequent chilled storage, or to 111°C to simulate sterilization, or assessed after freezing for two weeks at -20°C.
Water Holding Capacity (WHC) was assessed by centrifugation of a meat meat mix cylinder (1.5 by 2 cm.) for 30 minutes at 3300 RPM, at 2°C. During centrifugation the meat cylinders were placed on a membrane in specially made containers. Loose water can be estimated after centrifugation by simple weighing.

Jelly formation was also estimated by simple weighing of cooked samples after stripping-off of visible jelly An Instron apparatus was used to measure the apparent elasticity module. This is used to illustrate the textural performance.

RESULTS AND DISCUSSION

The measurements of jelly formation and WHC are shown in the tables below, illustrating the results of runs 1 to 6. For practical reasons the experiments had to be made over a number of weeks, each run with their own control.

Minced meat model	Jelly,in %	WHC, in %	Elasticity in N/cm^2
Run 1 Figure 1			
Control	18.8	27.0	7.8
0.3%LBG	7.9	15.7	9.1
0.3 guar gum	7.7	13.8	5.0
0.6% LBG	8.3	12.2	7.6
0.6% guar gum	8.6	12.4	3.7
Run 2 Figure 2			
Control	15.7	21.6	15.0
0.3% xanthan gum	7.8	17.1	4.8
0.6% xanthan gum	7.3	13.5	1.3
0.5% P-carrageenan	12.7	23.4	6.6
0.3% TPP	9.1	17.9	28.6
Run 3 Figure 3			
Control	10.0	25.0	5.0
0.3%TPP,0.6: guar	2.7	7.7	8.4
0.3%TPP,0.6%xanthan	4.1	7.6	5.5
0.3%TPP,0.5%P-carr	6.3	11.1	7.0
0.3%TPP,0.5 P-carr,0.6 % LBG	4.5	8.3	35.6
Run 4 Figure 4			
Control	18.9	26.7	5.0
0.3%TPP,0.6% guar	6.0	9.2	13.3
0.3%TPP,0.6% xanthan	0.4	6.4	9.9
0.3%TPP,0.5%P-carr.	9.7	14.9	24.4
0.3%TPP,0.5%P-carr. 0.6% LBG	7.2	10.1	20.6

Minced meat model	Jelly,im %	WHC,in %	Elasticity, N/cm^2
Run 5 Figure 5			
Control	17.4	24.6	3.8
0.3%TPP,0.5%P-carr. 0.6%guar	7.4	10.0	8.2
0.3%TPP,0.5% P-carr. 0.6% xanthan	8.9	12.9	7.3
0.3% xanthan,0.6%guar	8.5	14.4	0.5
0.6%LBG,0.6% guar	5.9	9.1	0.8
Run 6 Figure 6			
Control	18.5	28.1	4.4
0.15%xanthan,0.3%guar	5.9	11.3	1.9
0.3%LBG,0.3% guar	4.4	7.3	2.8

As will be seen, hydrocolloids generally improve the WHC and decrease the jelly formation. Further, LBG does not change the firmness of the mix, whereas xanthan results in a much softer texture. This was also found for some combinations, such as xanthan plus guar gum and LBG plus guar gum. Carrageenan alone or together with other hydrocolloids such as LBG or guar gum did not improve the elasitcity much, either. Best textural results were found with mixtures of carrageenan and TPP.
The results of the "factory-made" sausages are shown in figure 7, below:

Figure 7
"Factory-made" sausages, all samples added 0.4% TPP.

Product	Jelly,%			WHC,%		
	A	B	C	A	B	C+)
Control,no TPP	15.3	28.2	18.1	21.4	30.7	33.0
Control	9.0	14.5	10.6	16.1	17.7	27.4
0.25% guar	5.3	19.0	6.4	11.2	22.4	16.0
0.25% LBG	3.7	8.1	4.7	8.2	10.4	16.4
0.25% P-carr.	2.7	8.4	3.1	7.1	13.0	15.5
0.25%C-carr.	2.8	8.6	3.5	8.3	14.0	13.7
0.25%N-carr.	2.8	9.2	3.3	7.6	13.3	12.5
0.25% xanthan	4.3	8.2	5.4	10.7	13.5	17.6
0.25%C-carr, 0.25% guar	4.1	6.9	4.9	10.5	11.4	14.9
0.25%C-carr, 0.25%LBG	4.1	6.6	5.6	9.4	11.5	14.9
0.25% LBG, 0.25%guar	5.0	10.0	6.6	8.8	12.7	12.8
0.25%LBG, 0.25%xanthan	4.8	3.8	5.3	8.7	8.1	18.2
0.25%guar, 0.25%xanthan	4.0	9.7	4.5	8.2	13.1	10.6

+) A=after manufacture,B=heated to 111°C,
C= stored frozen at 20°C

The above results show that when testimg the "factory made" sausages, the results of the model products were confirmed: the lowest jelly formation and best WHC are found im mixes added either 0.25% LBG, or 0.25% kappa or kappa/lambda carrageenan, im all cases added 0.4%TPP.
As expected, heating to 111°C resulted in WHC changes. In general, the elasticity is poorer compared to more moderately heated samples(not shown in table)
Freezing generally result in a decreased WHC, but jelly formation and texture remaimed nearly unchanged

Overall it can be concluded that, everything considered, either 0.25% LBG or 0.25% of any of the carrageenan formulations, in all cases with TPP, improve th properties of the models and the sausages the most.

A sensory evaluation with triangel tests, where carrageenan, xanthan gum, or LBG and xanthan gum were tested against control samples,revealed that only the pure xanthan gum sample was significantly different from the corresponding control.