INFLUENCE OF STARCH ADDING ON THE MEAT COMPOSITIONS VISCOSITY

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Abstract

Animal raw material processing is directly influenced by the physical and chemical characteristics of their. The various combinations and status of the raw materials used in the food industry determine specific behaviours that may influence the processing equipment performance and construction. The study on meat composition viscosity depending upon the added components, temperature and mixing time length, has shown that viscosity is increasing with lower mixing temperature , higher mixing time length and higher added starch percentage.

Key words: meat composition, viscosity, pork, mixing

INTRODUCTION

In order to study the behaviour of meat under the action of external forces, it is important to know its initial structure. From a physical point of view, meat structure is predominantly aggregate, and has two phases: solid and liquid. The solid phase consists in the proteins that are the basis for the muscle fibers and fascicles; the liquid phase consists in the cell juice while the fibers and fascicles make up a multiple-phase system.

The solid-liquid meat system is not stable as it is influenced by external conditions. Thus, the water in the meat freezes at low temperatures and the meat has the characteristics of a solid body. When minced, it turns into a colloidal system which, macroscopicall speaking, partially behaves like a liquid.

According to Gorbatov and others, the products and semi-products present in the meat product technology have the following structure: coagulated – weak viscosity, thixotropy, plasticity, characteristics of the finely minced meat; crystalline – absent thixotropy, thermodynamic instability, characteristic of fatness; condensed – high stability, typical of fried and baked meats, and boiled salami compositions; mixed structure.

The linking forces increase (develop in time) in the coagulated structure; they increase then decrease in the crystalline structure; they increase then remain constant at a certain level in the condensed structure. These forces influence the meat composition viscosity and their behaviour under the action of external forces.

The compositions of meat viscosities cited literature are varied, depending on the type and means of investigation. Thus, the composition of beef and pork were recorded between 18-22 Pas [1], and the compositions of turkey and starch investigated by Brookfield-R7 were found between 66-97 Pas [2].

MATERIALS AND METHODS

The study made use of a composition consisting in pork haunch, fatness, water, salt, polyphosphates and starch. Gammon, bacon and cooled water were finely minced and mixed with the other components. Mixtures were based on the starch as variation factor (1%, 2% and 3% starch), whereas the other components remained constant (50,7% muscle tissue, 27,3% fat tissue, 22% water, 2.5% salt and 0.5% polyphosphates).

The parameters that varied during processing were: mixing temperature (5°C, 10°C, 15°C) and mixing time (2,5 min., 5 min.).

For the laboratory measurements, a Brookfield DVII equipment was used, withand viscosity was expressed in Pas. The vascosity was measured with sprindl R7 and different revolutions (1 rpm- 12 rpm).

The experiments led to different behaviours in the dynamic viscosity of the meat compositions.

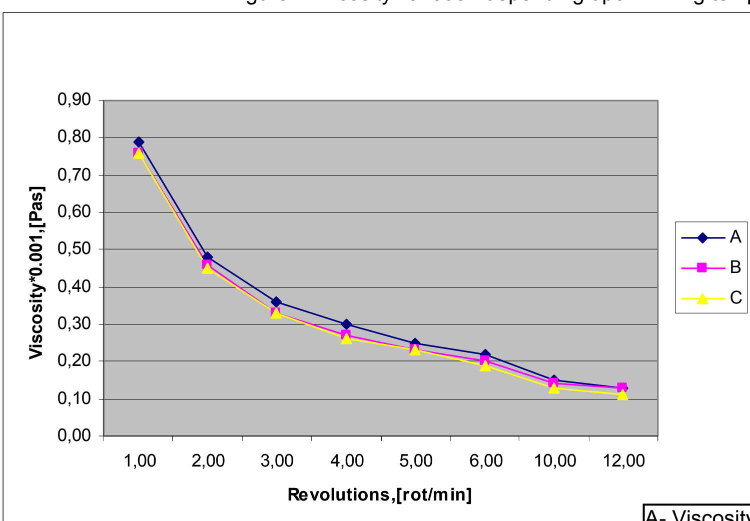
RESULTS AND DISCUSSIONS

To measure viscosity, in the first stage of the study, chemical composition was constant while the technological parameters, i.e. mixing temperature, mixing time length, varied. The compositions consisting in 50,7% muscle tissue and 27,3% fat tissue were finely minced and mixed with 22% water; after the addition of sodium chloride and polyphosphates, they were mixed for 2,5 minutes at temperatures of 5°C, 10°C, 15 °C. Figure 1 shows that the dynamic viscosity of the compositions varies inversely proportional with the mixing temperature and revolutions of the viscosimeter axle. Thus, for the same chemical composition (1% starch) and mixing time length, the following results were obtained: 220 Pas for a mixing temperature of 5°C and axle revolution of 6 rot/min, 203 Pas for t = 10°C and rpm = 6, and 191 Pas for t = 15°C and rpm = 6.

Table 1.
Viscosity variation depending upon mixing temperature

Revolution, [rot/min]	Viscosity*10-³, [Pas		
	t=5°C	t=10°C	t=15°C
1,00	0,79	0,76	0,76
2,00	0,48	0,46	0,45
3,00	0,36	0,33	0,33
4,00	0,30	0,27	0,26
5,00	0,25	0,23	0,23
6,00	0,22	0,20	0,19
10,00	0,15	0,14	0,13
12,00	0,13	0,13	0,11

Figure 1. Vicosity variation depending upon mixing temperature



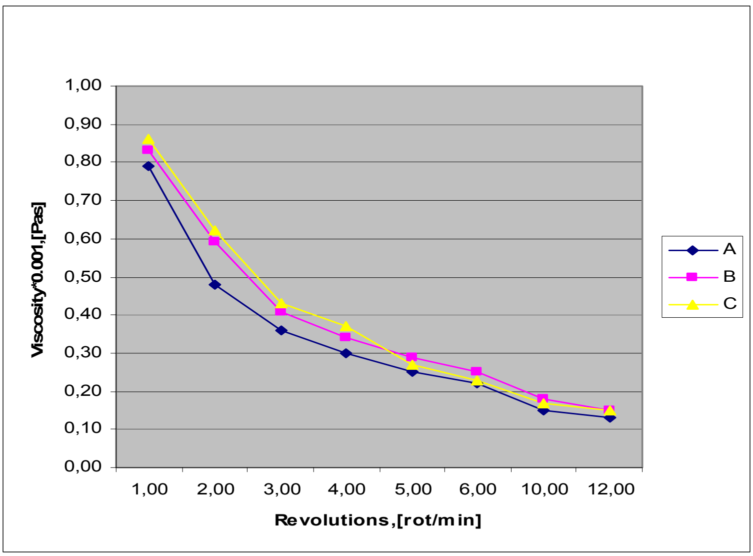
A- Viscosity variation at 5°C
B- Viscosity variation at 10°C
C- Viscosity variation at 15°C

The variation in the added starch percentage and constant muscle tissue, fat tissue and water, at the same temperature and mixing time length resulted in higher viscosity at higher starch content (fig. 2). The compositions had 1%, 2% and 3% much starch, the mixing temperature was 5°C and time length 2,5 minutes. Viscosity increased from 220 Pas for 1% added starch and axel revolution of 6 rpm, 249 Pas for 2% added starch and 6 rpm, and 271 Pas for 3% added starch and 6 rpm, respectively.

Table 2.
Viscosity variation depending upon the starch content of the composition

Revolution, [rot/min]	Viscosity*10-³, [Pas		
	1% starch	2% starch	3% starch
1,00	0,79	0,83	0,86
2,00	0,48	0,59	0,62
3,00	0,36	0,41	0,43
4,00	0,30	0,34	0,37
5,00	0,25	0,29	0,28
6,00	0,22	0,25	0,27
10,00	0,15	0,18	0,17
12,00	0,13	0,15	0,15

Figure 2. Viscosity variation depending upon the starch content of the composition



A- Composition of 1% added starch
B- Composition of 2% added starch
C- Composition of 3% added starch

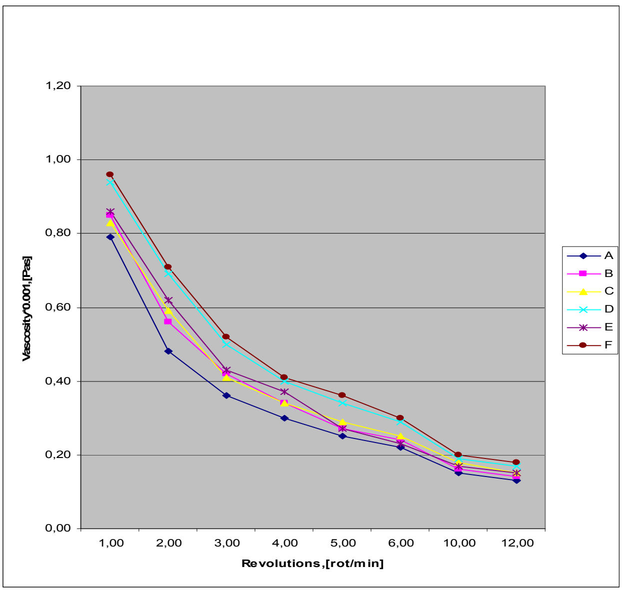
For the same chemical composition (1% added starch) and varied mixing time length, figure 3 shows that viscosity is increasing together with the mixing time length, i.e.220 Pas for 2,5 minutes of mixing at rpm = 6, and 240 Pas for 5 minutes of mixing and rpm = 6. For the composition of 2% added starch, viscosity is increasing from 249 Pas for 2,5 minutes of mixing , to 287 Pas for 5 minutes of mixing and for the composition of 3%

added starch, viscosity is increasing from 271 Pas for 2,5 minutes of mixing , to 291 Pas for 5 minutes of mixing and.

Table 3.
Viscosity variation depending upon mixing time length

Revolution, [rot/min]	Viscosity*10-³, [Pas]					
	1% starch, mixing 2,5 min.	1% starch, mixing 5 min	2% starch, mixing 2,5 min	2% starch, mixing 5 min	3% starch, mixing 2,5 min	3% starch, mixing 5 min
1,00	0,79	0,85	0,83	0,94	0,86	0,97
2,00	0,48	0,56	0,59	0,69	0,62	0,72
3,00	0,36	0,42	0,41	0,50	0,43	0,51
4,00	0,30	0,34	0,34	0,40	0,37	0,42
5,00	0,25	0,27	0,29	0,34	0,28	0,37
6,00	0,22	0,24	0,25	0,29	0,27	0,29
10,00	0,15	0,16	0,18	0,19	0,17	0,20
12,00	0,13	0,14	0,15	0,17	0,15	0,18

Figure 3. Viscosity variation depending upon mixing time length



A1 Composition of 1% added starch, mixed for 2,5 mins
A2 Composition of 1% added starch, mixed for 5 mins
B1 Composition of 2% added starch, mixed for 2,5 mins
B2 Composition of 2% added starch, mixed for 5 mins
C1 Composition of 3% added starch, mixed for 2,5 mins
C2 Composition of 3% added starch, mixed for 5 mins

CONCLUSIONS

Research shows that the variation in chemical composition results in changes of the structural and mechanic characteristics, while more starch added leads to higher viscosity of the meat mixtures.

The variation in the forces operating on the materials generates changes in their behaviour, the increased number of revolutions of the viscosimeter leading to lower viscosity.

Also, the technical parameters applied have their own influence, as higher mixing temperature results in lower viscosity due to decreased fat viscosity, whereas longer mixing time length leads to higher viscosity induced by the hydration and distension starch particles and decrease the free water.

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