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Increase of effectivity in chopping processes by using a blade head with obliquely fixed blades for production of emulsified sausages (#117)

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Introduction

In food industry choppers are often used for fine comminution and emulsification processes. For the production of so-called meat emulsion these machines are equipped with cutting tools in various forms, stabilities and designs which depends on processed raw materials and produced final products /1/.

The economic situation in meat processing industry leads to use of choppers with high capacity and as possible high efficiency. In dependence from their capacity, diameter of blades in bowl choppers can be until 800 mm and number of rotations in between 3000 – 7000 1/min /2/.

By cutting in a traditional engine, means an angle of blades in the chopping head of 0°, raw materials can be chopped finely, but mixing and emulsification sometimes is not optimal. Too intensive chopped tissue particles are not able to bind water and/or fat fully /3/. That can lead to a lower sausage quality and lower yield.

To increase the processing efficiency a cutting tool head was developed, which guaranties a high comminution effect and simultaneously an extensive emulsification of processed materials.

Methods

For experiments was used a bowl chopper type LASKA KT 45 V. This machine has a bowl volume of 45 l. The compared chopper heads are presented in figure 1. There was studied the influence of number of blades in a chopping head (2 versus 6), angle of blades in the chopping head (0° versus 15°) on different technological and quality parameters, especially necessary electrical power, chopping time and emulsion stability.

The recipe for meat emulsions was 75 % pork shoulder and 25 % pork nack fat. Based on these raw materials 20 % crashed ice, 1.8 % nitrite curing salt, 0.3 % diphosphate (E 450) and 0.6 % spices were added.

For chopping was used the two stage procedure, means in the beginning pork shoulder was chopped with nitrite curing salt, diphosphate and 1/3 of ice, after 45 seconds were added pork fat, rest of ice and spices. The chopping end-point was 10 or 12°C (i.e. below the possible 15°C by using phosphate).

Electrical power was measured by using an instrument NANOVIP Plus (ELCONTROL ENERGY NET S.R.L.). For meat emulsions was measured the so-called emulsion stability (calculated by centrifugation losses of heated sample). For final finished products were measured texture and sensory acceptance (not shown).

Results

In figure 2 is presented the development of electrical power for the three different chopping blade configurations.

It can be seen that for use of 6 blades the chopping time is the shortest, but with highest electrical power. Energy consumption increase from 613.5 Wh to 636.5 Wh. By comparing the variants with 2 blades the 15° obliquely fixed blades shows a shorter chopping time and the lowest level of electrical power. Energy consumption decrease from 613.6 Wh to 519.2 Wh, means by 15.4 %. Additionally, the standard deviation for electrical power during the second phase of chopping is the lowest (2.67 kW). For variant No B the standard deviation is a little bit higher (2.87 kW), but for variant No A with 6 blades it is much higher (3.39 kW). It can be concluded that a head with obliquely fixed blades works more silent and continuously.

In figure No. 3 are presented the results for progress of emulsion stability after heating. It shows that the increase of emulsion stability for variant No A and B are comparable, independently from number of blades. For variant No C the increase of emulsion stability starts later but finally the emulsion is already stable at 10°C, while the other variants required 12°C for comparable stability.

Conclusion

Electrical power and by this energy consumption for chopping processes in bowl choppers can reduced by using of obliquely fixed blade position. In comparison with perpendicular to the rotation axis fixed blades the work of engine is much more silent and continuously.

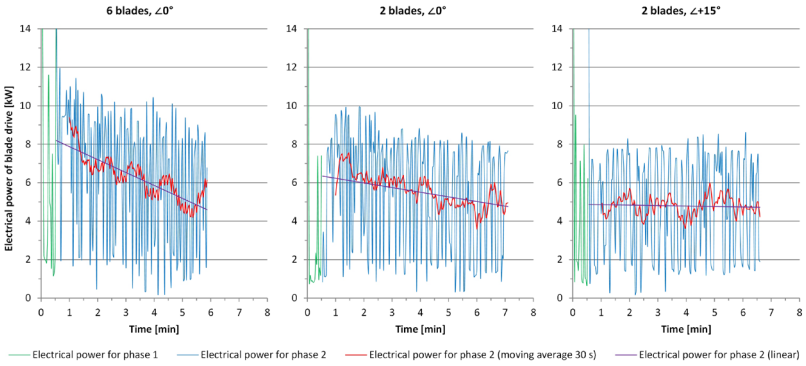
It could be verified, that obliquely fixed blades convey the meat batter turbine like through the cutting zone. This increased the emulsification performance. The chopping process can be finished at lower final chopping temperature of meat emulsion by using of this new blade head. This helps to reduce cost for raw materials and energy.

References

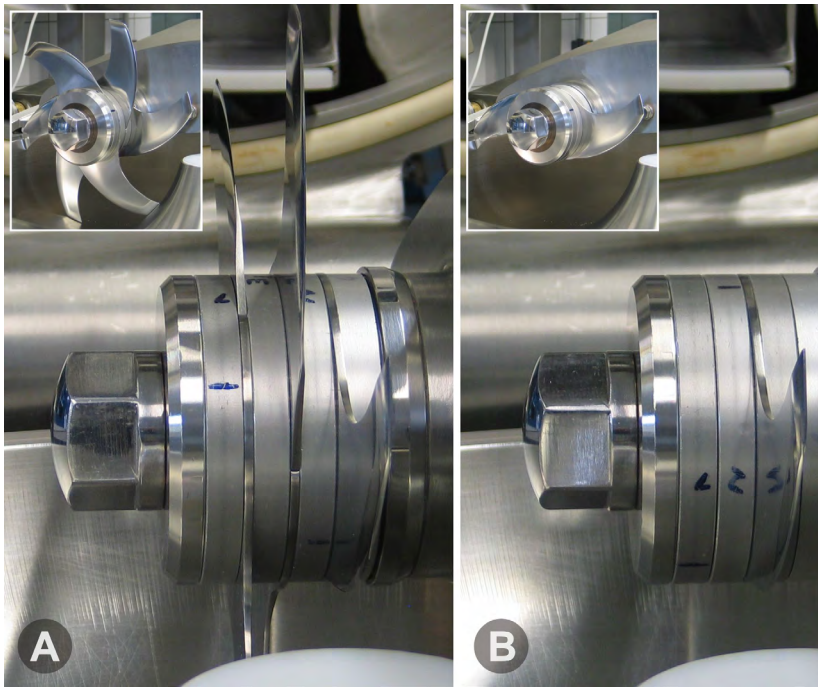
/1/ Hammer, G., Haack, E. and S. Stoyanov (2006): Fleischwirtschaft. 4, 88 – 92

Notes

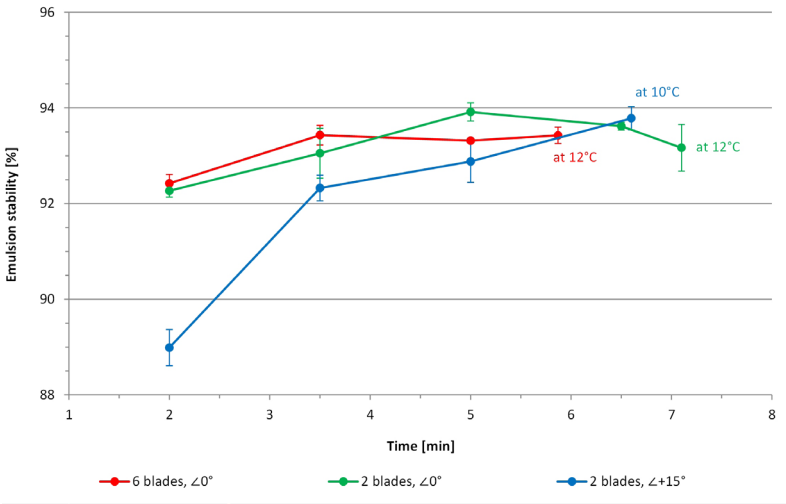
/2/ Sielaff, H. (1996): Fleischtechnologie. Behr's Verlag, 226
/3/ Micklisch, I. and W. Schnäckel (2018): Fleischwirtschaft. 4, 98 – 104



Progress of electrical power of blade drive Figure 2: Progress of electrical power of blade drive with different cutting set configurations (6 blades ∠0° (left), 2 blades ∠0° (middle) and 2 blades ∠+15° (right))



Chopper head
Figure 1: Chopper head (A: 6 blades, ∠0°; B: 2 blades, ∠0°; C: 2 blades, ∠+15° (large: side view; small: front view))



Emulsion stability
Figure 3: Development of emulsion stability (after heating) for the used chopping end-points with different cutting set configurations

Notes