| Trial 2 maximum | $\bar{x}$ |
|---|---|
| 23.60 | 23.35 |
| 17.10 | 16.70 |
| 57.70 | 57.60 |
| 2.60 | 2.55 |
| 0.326 | 0.320 |
| 2.61 | 2.56 |
| 11.06 | 10.96 |
| 106.31 | 105.20 |
| 123.41 | 121.90 |

| Trial 2 a* | b* |
|---|---|
| 17.35 | 12.59 |
| 15.47 | 12.33 |
| 18.55 | 13.32 |
| 17.12 | 12.75 |
| 1.55 | 0.51 |

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# INFLUENCE OF DIFFERENT CUTTER KNIVES ON BATTER QUALITY AND PROPERTIES OF COOKED SAUSAGES

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**Keywords:** cutter knives, cutting process, energy consumption, batters quality, cooked sausages

## Introduction

The consumption of cooked sausages is on a high level in many countries and classical cutter machines are the most important equipment for the production of cooked sausage batter.

For the technical construction of cutter machines the following aspects have high importance:

- technical construction of the cutting mechanism (shape and volume of the cutting room, form of bowl)
- different chopper knives, sharpness and mode of grinding
- number and arrangement of the knives in the cutting machine
- knife speed and speed of the bowl in the cutting machine.

Limited new information about cuttting (chopper) knives can be found and it is published only by a handful of authors (Hammer *et al.*, 2003), (Schnäckel *et al.*, 2004), (Micklisch *et al.*, 2004). Meantime the competition between meat producing factories expands to the equipment suppliers, especially producers of chopper knives. Therefore possibilities to reduce the cutting time and energy consumption for cutting, especially for cooked sausage batter, are in demand. On empirical way producers of chopper knives try to change some construction aspects of the knives. Alternatives are hole- and hack-hole-knives or block knives (3 knives combined as one) (Haack *et al.* 2006).

The aim of this work is to test different forms of cutter knives for the production of cooked sausage batter and to find out the most effective one. The authors would like to investigate the influence of knife surface area and grinding mode on batters quality, energy consumption and properties of sausages regarding the best knife form.

## Materials and Methods

In the first test series the authors want to investigate if the 5 different cutter knives (Figure 1) lead to different batters and sausage qualities. Secondly the influence of cutter knife area and grinding mode were analysed. For the experiments minced meat (3 mm) was used. The pouring media was ice. The composition consisted of 45 % pork, 35 % fat tissue and 20 % ice.

The pre-minced meat materials together with all other additives (broken ice, nitrite curing salt, ascorbic acid, spices) were cut in a one step procedure. The cutting conditions were as follows: knife revolutions: 2500 1/min, bowl revolutions: a) first 30 sec. 7 1/min b) till the end 14 1/min. The process was stopped at 12 °C batters temperature. The lean minced meat of each batch was filled into sausage covers (∅ 60 mm) and treated in a smoking-cooking procedure.

The following parameters were measured and recorded on-line: electrical power parameters of the machine, temperature, viscosity of the lean minced meat and electrical conductivity of batters. In steps of 30 sec emulsion stability, penetration hardness and colour of the lean minced meat were detected. The final products were examined for their texture, colour and sensoric value.

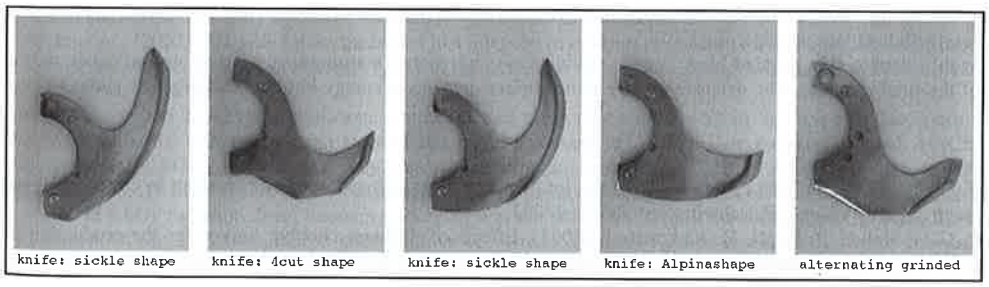


**Figure 1:** Types of knives used.

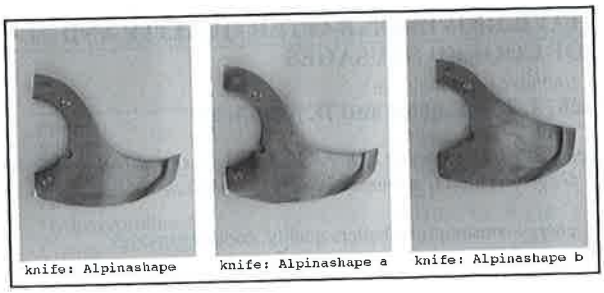


**Figure 2:** Knives with the same basic shape (M4), varying surface and grinding mode.

**Results and Discussion**

The first experimental series showed that knives M2, M4 and M5 lead to less temperature increase and thus to a longer total cutting time in comparison to knives M1 and M3 (Figure 3).The engine power of the main drive using knives M2, M4, M5 was significantly lower than using M1 and M3, while the total energy consumption stayed relatively constant according to the longer cutting time. A longer cutting time corresponds to a higher total number of knife revolutions and hence a more homogeneous batter and a better sensorically evaluated final product can be achieved. The development of emulsion stability and penetration hardness of the lean minced meat during the cutting time shows no significant differences between the tested knives.

The comparison of standard knives (sample M4) and knives with a double side grinded blade (M4a; equal surface according to M4) show that the changed grinding leads to an accelerated temperature increase and thus to a shorter cutting time (Figure 4). A minor total energy consumption should be quite relevant. No significant differences in the quality of the final product, especially in the texture, can be found between the samples.

Knives of sample M4b (larger surface according to M4) also lead to an accelerated increase in temperature and to shorter cutting time. The average electrical engine power is relatively constant. Therefore an increased surface reduces energy consumption. The extended knife surface however causes a softer texture of the final products.

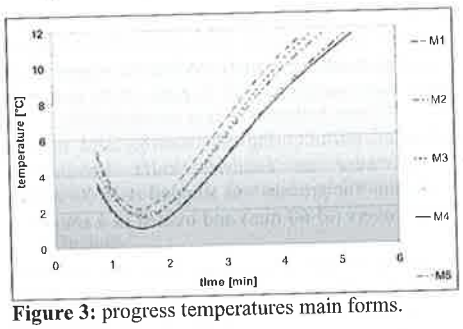


**Figure 3:** progress temperatures main forms.

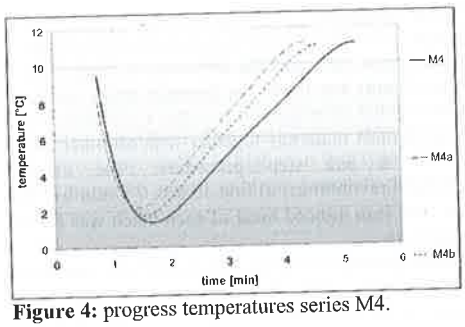


**Figure 4:** progress temperatures series M4.

**Conclusions**

In the production of cooked sausages the application of steep knives with short cutting edge is superior to the use of even knives with long cutting edge.

Knives with a double side grinded blade reduce cutting time and energy consumption without any influence on the quality of the final products. The extension of the knife surface area saves energy but the final products show a softer texture.

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