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# Mechanical peeling of potatoes without water use

*The majority of potatoes are peeled before eating or processing whereby mechanical methods of peeling are increasingly used. Depending on the potato peel properties the operation can lead to substantial loss of mass. Where peeling takes place with water supplementation additional costs are involved for the water and its cleaning. The project described had the aim of producing a simple mechanical peeler for peeling potatoes without water supplementation and with low peel losses.*

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## Keywords

Potatoes, peeler, mass losses

Around 5.8 million t potatoes are consumed each year in Germany [1]. The majority of the potatoes are peeled before eating or processing. The peeling often takes place in large plants with mechanical peelers. Depending on type of skin, average mass losses measured over a year with mechanical peeling are 50%. [2, 3]. Such loss has to be lowered in order to reduce production costs. Furthermore, a reduction in environmental pollution through decreasing wastewater production during the peeling procedure is urgently required. With this in mind, modern mechanical peelers utilise none or very little water for the actual peeling operation. These types of machines use continually or intermittently operating Carborundum or knife peeling units or a combination of both. If Carborundum peelers are used first followed by knife peelers the peeled tuber has a smooth, attractive surface just like hand-peeled potatoes. With the number of peeling steps the effort for machinery control rises, especially where intermittently working peeling units are applied. The investigations described here were aimed at developing a mechanical peeler with the main points:

- 10% reduction in peel waste
- avoidance of water use
- continuous mode of working, and
- simple construction

### Development of a mechanical knife peeler

A wide range of theoretical and practical investigations into potato peeling on a three-dimensional moveable knife plate [4] showed that a single layer of potatoes in the peeling area had a positive effect on the ability of tubers to change position and on consistency of peeling. A disadvantage was the complicated three-dimensional drive of the knife plate.

Resulting from these investigations a mechanical peeler was developed (*fig. 1, 2*) which had 12 flat knives radially configured on an 800 mm rotating cutter disc. Above the cutter disc a construction with eight peeling chambers for positively transporting the potatoes through the process slowly revolves. Around 10 to 15 tubers (1 kg) are loaded into the peeling chambers by the filling mechanism and transported round the knife plate. After each revolution the peeled tubers are guided off the peeling machine at the delivery point without any additional mechanical input. Special deflection angles on the rotating knife disc ensure a continual revolving of the tubers so that during peeling eyes and crowns are also exposed to the knives. Knife disc speed and that of the positive transport system can be varied by frequency converter to vary intensity of tuber

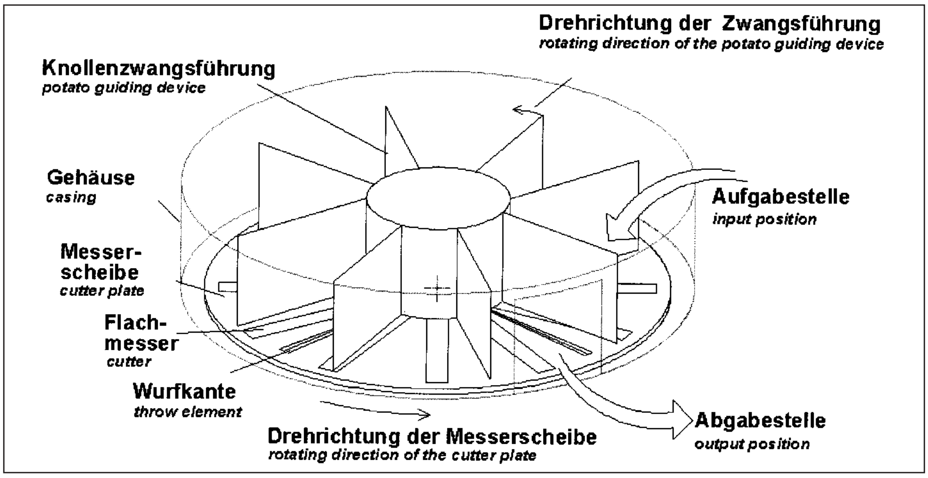


*Fig. 1: Mechanical peeler with rotating positive potato transport device.*

Fig. 2: Prototype of the mechanical peeler.

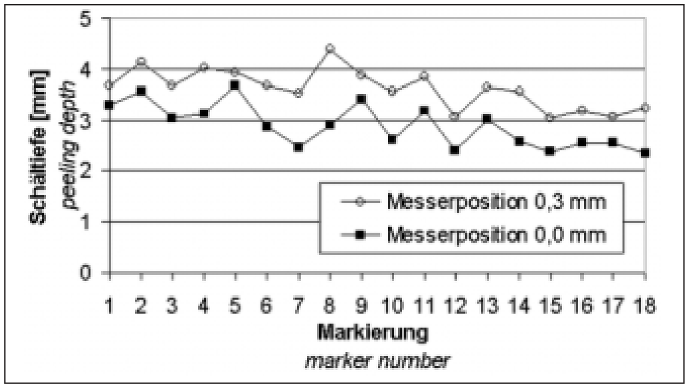


Fig. 4: Average peeling depth at defined measuring points on each of 20 potato tubers as function of cutter height 0.3 mm: variety Likaria, long tuber form; 0.0 mm: Linda, long tuber form.

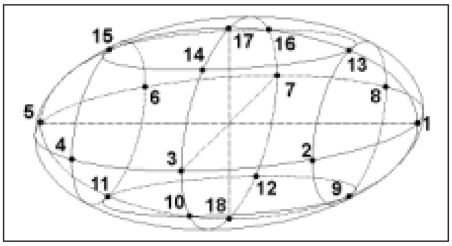


Fig. 3: Markers for determination of peeling depth and uniformity.

movement and thus peeling. The peeling waste collects under the knife disc and is mechanically ejected without use of water.

### Determination of peeling results

In the first place, peeling was evaluated according to the mass losses. Because the only way of achieving less mass losses where tubers are to be completely peeled is through uniform peeling of the total surface area, peeling consistency is therefore a further important evaluation criterion. For determining peeling uniformity 10 mm deep coloured markings were inserted at 18 positions on tubers (*fig. 3*). From the remains of the markers after peeling average peeling depth and variations were determined. Inconsistent peel depths (high variability) indicated a too small deflection (potato movement) intensity. Peeling that was uniform but too deep occurred through too long peeling or through a too high knife positioning above the surface of the knife disc.

### Results

Despite its simple construction a continuous working action was able to be achieved with the peeler. No water was required. Limited effort was required for operating the peeler and the potato positive transport system.

Without alteration of the deflection angles, round, oval or long oval tubers were able to be peeled uniformly well. Variation of peel depth represented only 1 mm when the knives were positioned level with the peeler disc surface (*fig. 4*). This low knife position led to longer than necessary peeling time so that in practice a higher position of 0.3 mm is recommended for more rapid peeling. Even with this knife position, consistent peeling with only a 0.3 mm variation in peel depth was achieved. With freshly harvested and with stored tubers the mass loss was only 30 to 35% where tubers showed no deep damage.

Raw material throughput achieved with the 12-knife peeler investigated was from 400 to 600 kg/h. Because of the good peeling results the company Müller Anlagenbau Eisenach has begun development of a 36-knife peeler. The planned peeler should have a throughput of from 1200 to 1800 kg/h.

### Summary

Using a continuous-process mechanical peeler with positive potato transport system allowed good peeling performance to be achieved. Where tubers are one-layer deep in the chambers of the potato transport system special deflection elements turn the tubers so that even the eye and crown positions are properly peeled.

## Literature

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