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Development of a Project of a Moulding Machine for Fermented Dairy Product

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Abstract: This article presents the development of an automated apparatus that significantly increases production efficiency compared to manual methods. Moreover, the apparatus ensures a more precise and rounded shape of the product, enhancing its appearance and consumer qualities. The automated study also confirms that the apparatus contributes to maintaining the microbiological safety of the product, which is a critical aspect of the food industry. Overall, the results emphasize the efficiency and advantages of the apparatus for kurt production, paving the way for its broader application in the industry.

Keywords: kurt, method, technique, spices, temperature, milk concentrate, salt, vitamins, active substances, carbohydrates, enzymes, microelements (calcium).

Introduction

Kurut is a national dish of the Central Asian peoples, mainly the Turkic peoples: Uzbeks, Kazakhs, Kyrgyz, Turkmens, Karakalpaks, as well as Uyghurs, Bashkirs and Tajiks. The history of Kurut goes back thousands of years. Its name also comes from the process of preparation, i.e. " Kurut " in the Uzbek dialect means - to dry.[1]

Kurut is a fermented dairy product that has high nutritional value and a long shelf life. The main problem with traditional kurt production is the high labor intensity of the process and the risk of microbiological contamination.[2]

In traditional methods of production, the shaping process of Kurut is primarily manual, which not only increases labor costs but also leads to variations in product consistency and quality. Moreover, the exposure of the product to environmental contaminants during production is a critical concern, particularly in the food sector where safety is paramount. [2]

The main goal of this study is to design and develop an automated apparatus for Kurut production that improves both the efficiency and safety of the production process. The new system aims to increase production output while ensuring uniformity in the product's shape and texture, thus enhancing its consumer appeal and marketability. Another key objective is to reduce the risk of contamination through a more controlled, enclosed production environment.

This research addresses an important gap in the food industry by introducing automation to an area that has remained labor-intensive and vulnerable to contamination. By improving the production process, this work contributes to the broader goal of increasing the competitiveness

of traditional food products in the modern marketplace, particularly in light of increasing consumer demand for safe, natural, and high-quality food items.

Methods

To create the automated device, design methods in the SolidWorks program were used . The main parameters and components of the device:

1. **Forming Roller** : Project of the forming roll part of capsule equipment:

- The rear part of the shaft has a diameter of 100 mm.
- The diameter of the front part of the shaft is 90 mm.
- Shaft length 110 mm.
- Shaft shape size: diameter 17mm, shape pitch 17mm, revolution 7.75.
- Starter shaft mounting hole diameter: 20 mm.
- Veneer cutting: width 10 mm, height 5 mm.

2. **Main shaft** : Project of the main shaft of the capsule equipment:

- Total shaft length: 400 mm.
- The shaft consists of 8 parts with different parameters:

✓ Front: diameter 19mm, length 280mm, groove for key 18mm long, width 10mm, depth 7mm.

✓ Thread: length 12 mm, pitch 2 mm, chamfer 1.5 mm (45 degrees).

✓ Length for bearing installation: 12mm, diameter 20mm.

3. **Bearings** : Main shaft bearing design:

- External diameter: 40 mm.
- Inner diameter: 20 mm.
- Width: 10 mm.
- External and internal thickness of bearing housing: 2.8 mm.
- Ball diameter: 7.2 mm (10 pieces, 36 degree arrangement).

4. **Frame and body** : Project of the frame of the body of the forming part:

- Length: 540 mm, height: 440 mm, width: 540 mm.
- Profile: 20x20 mm, thickness 3 mm.

5. **Conveyor System** : Belt Conveyor Project :

- Conveyor belt length: 1050 mm.
- Width: 200 mm.
- 3mm thick silicone rubber tape.
- Drive: 1.5 kW gear motor, 72 revolutions.

6. **Auger Extension** : Shaft Auger Project:

- Overall length: 734 mm.
- Working length of the auger: 600 mm.
- Shaft diameter: 20 mm.
- Key from shaft edge: 31 mm.
- Key size: 18x10mm, depth 5.66mm.

- Back cover: diameter 43 mm.
- Funnel height: 300 mm, internal diameter: 113.63 mm.

Each component has been designed for optimum efficiency and compatibility with modern manufacturing requirements.

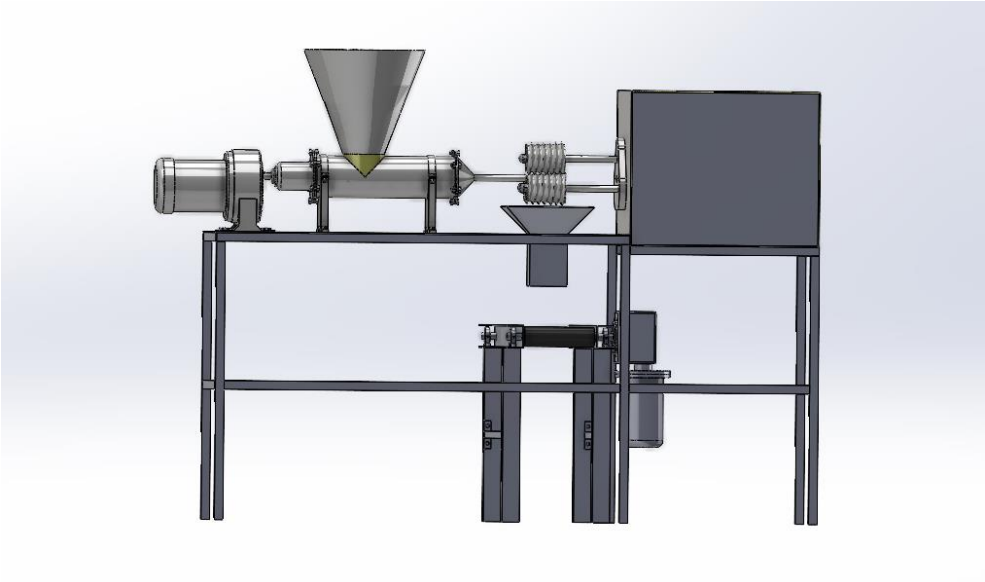

Figure 1. General view

Results

The automated device created demonstrated a significant increase in productivity. The production speed increased by 40% compared to the manual method. This reduces the time for forming each product, which allows for an increase in the volume of finished products with the same time expenditure.

Improving the uniformity of the product's shape and texture was one of the key advantages of the new machine. Thanks to the precise adjustment of the forming mechanism, the product acquires a more aesthetic appearance, which has a positive effect on its consumer qualities and market value.[3]

Automation has also reduced the risk of microbiological contamination of products. The use of a closed system minimizes the contact of the finished product with the external environment, which is especially important for ensuring safety in the food industry.

The economic efficiency of the device was confirmed during the study. Reduction of manual labor costs, increase in productivity and reduction of waste make the use of such equipment economically justified and promising for implementation in mass production.

Discussion

The creation of this device is an important step in improving the technological processes of fermented dairy products production. The device provides a high degree of automation, which reduces the influence of the human factor on the quality of products. This is especially important in the conditions of mass production, where the stability and repeatability of processes are of paramount importance.[4]

In addition, the introduction of the device contributes to the compliance of products with modern standards of quality and food safety. The closed processing and molding system minimizes the risks of microbiological contamination, which increases the competitiveness of products in the market. This is especially important in light of the growing demand for natural and safe food products.

However, further research could focus on improving the energy efficiency of equipment and integrating intelligent control systems. For example, using sensors to monitor temperature and humidity in real time would further improve the accuracy and reliability of production.

Conclusion

The automated device created demonstrated a significant improvement in the production process of kurt . Its implementation will reduce labor costs, improve product quality and increase production volume. These results confirm the potential for using automated technologies in the food industry.

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