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A Review on Development and Fabrication of Halwa making Machine

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Abstract: Halwa holds a significant place in the realm of traditional Indian sweet dishes, with numerous varieties specific to particular regions. One of India's most popular desserts, halwa typically comprises semolina as its base ingredient, with flour, grains, and nuts added for flavor and texture. The preparation of halwa often involves a time-consuming process, which can be a significant challenge. To address this challenge, an automated machine has been designed to reduce the need for human labor and improve production quality. The machine aims to minimize material wastage associated with manual processing. By automating the processing operations, the proposed system eliminates the negative aspects of traditional methods while promoting the desired quality. The development of this halwa-making machine at the domestic level enables the production of a high-quality product.

Keywords: Halwa, Automation, Quality Product, Food processing

INTRODUCTION

Halwa is a delectable, dense confection that belongs to the dessert category, characterized by its thick and sweet pudding-like consistency. It is crafted from an assortment of ingredients such as fruits, vegetables, grains, nuts, and lentils. The raw components commonly used in its preparation include fine sooji (semolina) from wheat, mung dal, chickpea, and carrot. In India, there exist various types of halwa, including Nauki halwa, Carrot halwa, Mung dal halwa, Bombay halwa, and more. In North India, halwa exhibits a yellow-brownish hue, possessing an opaque, soft, and smooth texture. On the other hand, Southern Indian halwa is translucent, resembling a jelly-like substance with a glossy appearance. The process of creating halwa is intricate, involving precise specifications for the raw materials, their proportions, the sequence of additions, and specific processing steps.

The production of halwa requires the utilization of a Halwa Making Machine, which involves a series of laborious steps. These steps include inputting the ingredients into the feeder assembly, extruding the mixture from the feeder assembly, monitoring the quantity of the extruded mixture, ensuring the desired shape for the final product, cutting it accordingly, and shaping it to achieve the desired outcome.

Engaging in these manual processes can be arduous and time-consuming. However, the implementation of automated machines offers significant advantages. Automated machines not only save time but also ensure consistent and superior quality of work. They minimize material waste, promoting efficient resource utilization. Moreover, automated machines reduce dependency on human labor, resulting in lower costs. Low-cost automation employs standardized components to mechanize machines, systems, and processes. These automated machines can be operated by semi-skilled or unskilled laborers, as they require minimal human intervention.

Several well-known automation techniques include programmable logic control (PLC), relay logic control, and microcontroller technology. Relay logic control involves the use of internally connected relays that are activated by wires. However, relay logic control panels tend to be large, and the lifespan of relays is limited, necessitating occasional replacement. On the other hand, a programmable logic controller (PLC) is a digital computer

designed for automating electromechanical processes. PLCs are extensively utilized across various industries worldwide. They offer flexibility in terms of input and output configurations, immunity to electrical noise, resistance to temperature extremes, and resilience against vibrations.Microcontrollers, on the other hand, refer to small computers housed on a single chip, comprising memory, a microprocessor, and additional components. They are compact in size and affordable compared to other devices.

LITERATURE REVIEW

Sweet making Machines

A. Halwa Making Machine

The machine operates based on the concept of stirring while baking. By continuously rotating two agitator arms, the material in the bowl is shaken, twisted, and baked evenly in all directions. In addition to being used for baking a variety of halwa types such as moong halwa, Karachi halwa, Tirunelveli halwa, Bombay halwa, ice halwa, besan, atta, all types of burfi's, Mysore Pak, Mohan thal, halwasan, kajubite, the machine can also be used as a mixing tool for combining materials, liquids, slurry, and other ingredients. Moreover, it is particularly useful for making Doda Barfi, Mava, Dalpinni, Jelly, and other products. (Sumatilal Sheth 2015)

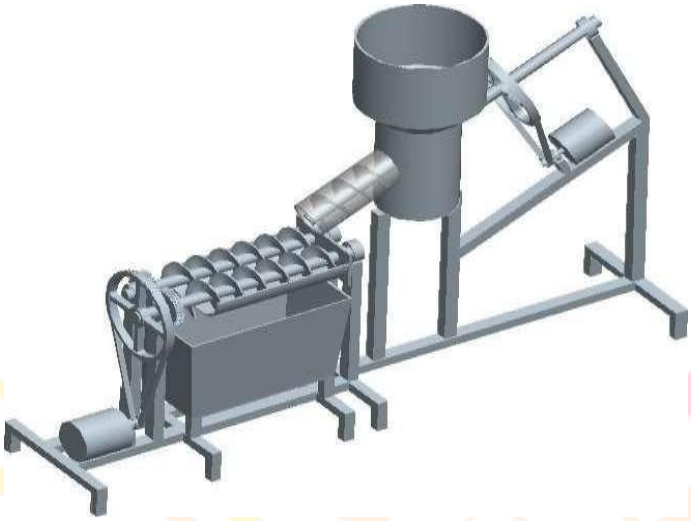
B. Ladoo making machine

In India, confectionery items like laddu, barfi, pedha, and others are renowned sweets. During festive occasions, people often place large orders for these sweets and expect prompt delivery. Meeting such demands within the required time frame often necessitates additional human resources for the vendors, all while ensuring the quality of the products. To address these challenges and enable large-scale production, the implementation of Special Purpose Machinery (SPM) proves beneficial. Automation can be a valuable tool for fulfilling orders in a shorter span of time.

During festivals, there is a surge in the demand for sweet products. However, due to limited production capabilities, only a few customers can be satisfied. Therefore, automating the sweet product-making process becomes essential. By automating production plants, productivity can be enhanced by efficiently utilizing input resources to create marketable end products. Moreover, automation significantly impacts the quality of the products. Delivering optimal quality to customers is a crucial objective for any industry, particularly in the food sector. High-quality products not only foster customer loyalty but also increase market share. Traditional quality assurance methods in the food industry often rely on human visual inspection, which can be laborious. Hence, it is crucial for the food industry to incorporate automatic quality assurance and control methods. Automation in this aspect has garnered significant attention, aiming to improve food manufacturing processes.

Furthermore, automation contributes to increased profitability, thereby enhancing shareholder value and enabling strategic investments in improving product quality and productivity. Both these factors directly contribute to overall profitability.

In summary, implementing automation, particularly through SPM, in the production of confectionery items can help meet high-demand orders during festivals while maintaining product quality. It enhances productivity, ensures consistent quality, and drives profitability for the industry. (Shyam Darewar et al., 2019)



C. Ice candy machine

Refrigeration refers to the process of achieving and maintaining a temperature lower than the ambient temperature to freeze ice or cool products or spaces to the desired temperature. One of the significant applications of refrigeration is in the ice candy machine, which freezes a mixture of water and syrup in standard molds placed in a rectangular tank filled with brine.

The ice candy machine operates using a simple refrigeration system that utilizes the vapor compression cycle. This cycle comprises four processes: compression, condensing, expansion, and evaporation. Our ice candy model includes various components such as a compressor, condenser, filter drier, expansion valve, evaporator coil, among others. The model's cooling capacity per unit mass flow rate of refrigerant is analyzed, and its coefficient of performance (COP) is calculated.

Furthermore, the model is compared based on its COP and cooling capacity using R-134, a refrigerant with a theoretical COP. This comparison is significant in determining the model's efficiency and the practicality of using R-134 as a refrigerant.

In summary, refrigeration is the process of achieving and maintaining temperatures lower than the surrounding temperature. The ice candy machine is one of the applications of refrigeration, utilizing a simple refrigeration system that operates using the vapor compression cycle. The ice candy model's performance is analyzed based on its COP and cooling capacity using R-134, providing insight into the model's efficiency and practicality of the refrigerant used. (Krunal Parikh et al., 2020)

D. Chocolate wafer making machine

The chocolate wafer-making machine is a specialized device designed specifically for producing chocolate wafers, which are thin and crispy layers of chocolate commonly used in cookies, ice cream, and other confectionery products. Typically found in commercial settings like chocolate factories or bakeries, these machines are optimized for efficient and consistent production of large quantities of wafers.

The machine features adjustable temperature controls that enable the user to set the heating element's temperature according to the specific type of chocolate being used. This ensures that the chocolate is melted and spread evenly across the wafer plate. Variable speed controls allow for customization of the wafer production process, adapting it to the requirements of the recipe or desired outcome.

An automatic wafer stacking feature simplifies the process of collecting and storing the produced wafers by stacking them as they are made. This streamlines transportation and facilitates convenient storage. Additionally, a wafer thickness control feature allows for precise adjustments to match the desired specifications, ensuring consistent results.
The machine incorporates interchangeable wafer plates, enabling the production of wafers in various shapes and sizes. This versatility allows for creative exploration and flexibility in meeting diverse production needs.

In summary, a chocolate wafer-making machine is a specialized device that efficiently produces chocolate wafers. It includes adjustable temperature controls, variable speed controls, automatic wafer stacking, wafer thickness control, and interchangeable wafer plates, providing precise customization options for creating a variety of delicious wafers. (Flavius kehr et al., 2012)

E. Traditional Food Mechanization

Traditional foods are culinary treasures that have been passed down through generations, enjoyed by communities for extended periods. These dishes often have historical significance and can be rooted in national, regional, or local

traditions. What sets traditional foods apart is their commitment to being free from additives, chemicals, and other modern food additives while providing exceptional nourishment.

Indian traditional food encompasses a rich tapestry of regional and cultural cuisines native to the Indian subcontinent. These foods are also considered functional foods, offering benefits beyond basic nutrition. The dietary patterns and traditional foods of India are deeply intertwined with the indigenous Ayurvedic system of medicine, which emphasizes natural methods for achieving physical and mental well-being.

Traditionally, these food items are prepared in batches, involving prolonged and labor-intensive processes. As a result, the quality of the products may vary, and they often have a short shelf life. Additionally, the traditional production methods may not always meet modern hygiene standards.

To address these limitations, mechanization emerges as a suitable solution. Implementing mechanized processes can result in the production of traditional food products with consistent quality, improved sensory and rheological attributes, and on a larger scale. This approach also helps reduce energy and labor costs per unit of production. Moreover, it enables traditional foods to establish a presence in the global market, promoting their cultural significance and culinary excellence.

In summary, traditional foods hold cultural and historical significance and offer exceptional nourishment. In the case of Indian traditional food, they are closely linked to Ayurvedic principles and regional cuisines. Mechanization provides an opportunity to produce these foods with consistent quality, improved attributes, and at a larger scale, while also enhancing their marketability globally. (SV Anadhani et al., 2020)

Automation techniques for machine making

A sweet-making machine offers various automation options to streamline its operations. Among the well-known automation techniques are programmable logic control (PLC), relay logic control, and microcontroller-based systems.

Relay logic control involves using internally connected relays that are operated by wires. This method typically requires large relay logic control panels. However, relays have a limited lifespan and may need replacement, which can impact production as the machine needs to be stopped for relay replacement. Moreover, troubleshooting and identifying errors in this complex system can be challenging and time-consuming. Skilled electricians are required to handle these intricate error detection processes. Additionally, due to the system's complexity and inflexibility, making changes or modifications must be done gradually. Considering these implications, there are more favorable alternatives to relay logic control for operating the sweet-making machine.

The programmable logic controller (PLC) is a digital computer utilized to automate electromechanical processes and finds extensive use across various industries worldwide. PLCs are specifically designed to handle multiple input and output configurations, while also offering benefits such as immunity to electrical noise, extended temperature tolerance, and resistance to vibration. Machine operation control programs are stored in non-volatile memory within PLCs.

On the other hand, a microcontroller refers to a compact computer system integrated onto a single chip, encompassing memory, a microprocessor, and additional components. Microcontrollers are cost-effective and compact compared to other devices. They can be equipped with various accessories like analog-to-digital converters, digital-to-analog converters, programmable timers, counters, and more. With carefully selected electronics, microcontrollers are capable of running a wide range of systems efficiently. While PLCs require a computer, programming software, and a PLC control console for operation, a microcontroller combined with the necessary accessories can automate a machine. PLC-based controllers tend to be more expensive than microcontroller units. Although PLCs offer greater flexibility, in the case of automating sweet-making machines, the flexibility requirements are relatively straightforward. Thus, the microcontroller technique proves highly suitable for achieving automation in sweet-making machines. Therefore, when it comes to manufacturing sweet-making machines, the microcontroller technique is the optimal choice. (Sanket Kedar et al., 2017).

Table 1

Domestic machine capabilities

Domestic machine capabilities	Method of benefits
Optimize Space Usage	Versatile Mounting Options for Compact Systems
Reduction in Manufacturing Time	Enhanced Speed, Efficiency, and Rapid Reconfigurability
Enhance Product Quality	Advanced Process Control for Enhanced Efficiency, High Repeatability, and Precise Task Execution
Achieve Product Consistency	Elimination of Errors Caused by Human Fatigue and Human Error
Increased Flexibility	Versatile and Easy Application to Various Tasks with Reconfigurability
Improved Efficiency	Optimized Processes Resulting in Increased Yield

IV. Summary

The purpose of the Machine is to minimize the involvement of humans and reduce the time required in the production process. The ultimate goal is to enable the production of halwa through a conventional method using a single piece of machinery that can handle all the necessary tasks. While the Machine is primarily designed for large-scale industries, unfortunately, there is currently no smaller version available for domestic use. However, its availability in large-scale industries allows for the production of halwa both in households and small-scale industries**.**

REFERENCES

1. Nayi, P., Kumar, N. Development of ready to reconstitute dehydrated traditional sweet corn halwa. *J Food Sci Technol* 58, 4486–4494 (2021)
2. Sunil Patel and A. G. Bhadania. Mechanized Production of Traditional Indian Dairy Products: Present Status, Opportunities and Challenges.
3. A. K. Agrawal, K. K. Sandey, K. Dewangan. Introspection on mechanization of traditional indian diary products 2017.
4. A. Manickavasagan, J.N. Al-Sabahi. Reduction of saturated fat in traditional foods by substitution of ghee with olive and sunflower oils – A case study with halwa
5. Swiny Sandhvi and Vishakha Singh. Standardization, nutritional and sensory analysis of Proso Millet Halwa. The Pharma Innovation Journal 2022; 11(2): 2250-2252
6. Pai Kotebagilu, N., Umralkar, S., Shivanna, L.M. *et al.* Impact of *Stevia rebaudiana* substitution on physico-chemical characteristics, sensory profile and microstructure in selected Indian desserts. *J Food Sci Technol* **59**, 2992–3001 (2022).
7. SV Anadani, SH Akbari, N Kumar and Amee Ravani. Processing and mechanization of Indian traditional food products. J Pharmacogn Phytochem 2020;9(1):2313-2315.
8. Ramesh, A. (2006) Challenges in machinery design for heritage foods of india. Indian Food Industry, 25 (6). pp. 78-82
9. Flavius kehr, Marc hassenzahl. The chocolate making machine. Proceedings of the SIGCHI Conference on Human Factors in Computing Systems 2012, 689-694.
10. Daniela Huppenkothen, Gwendolyn Eadie Proceedings of the First Teaching Machine Learning and Artificial Intelligence Workshop, PMLR 141:29-35, 2021.
11. Sanket Kedar, Mangesh Saraf, Pranav Niturkar and Pratik Badhan. Application of microcontroller for accurate control and safety of SPMA Case study on sweet making machine. International Journal of Current Engineering and Technology 2017, 2347 – 5161
12. Tejas Bhalani, Sameer Gondaliya, Smit Gajera. Design of Ice candy machine. International Research Journal of Engineering and Technology (IRJET) 2020, 2395-0056
13. Shyam Darewar, Shivani Borawake, Mayuri Chopade, Shweta Khose , Yogita Terave. Automated Laddu Making Machine. JETIR April 2019, 2349-5162