

3D FOOD PRINTING: AN ART OF CREATING NOVEL FOOD PRODUCTS

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3D food printing is a relatively new technology that is rapidly gaining popularity in the food industry. It involves the use of computer-aided design (CAD) software to create 3D models of food products, which are then printed layer by layer using a 3D printer. 3D food printing, also known as additive manufacturing of food, is a process of creating three-dimensional edible objects or structures using specialized 3D printers. It involves depositing layers of food materials one on top of another to build up the final product. The technology behind 3D food printing is similar to traditional 3D printing, but instead of using plastics or metals as printing materials, it utilizes edible substances such as purees, pastes, gels or powders made from various food ingredients. These materials are often prepared and loaded into cartridges or syringes that are then mounted on the printer. Additionally, 3D printing has the potential to be

a new cooking method. It's projected that traditional meals like chocolate, cookies, cakes and ice cream will undergo increasingly radical alterations. Although the recipes for these typical sweet food products don't alter much, this new manufacturing technology can provide innovative food textures and flavours to increase people's affinity for certain foods. The 3D food printer follows a digital design or a computer-generated model and it dispenses the edible materials layer by layer, gradually building the desired food item. The printer's nozzle or extruder precisely controls the placement and shape of the food materials, allowing for intricate and customizable designs. There are several techniques used in 3D food printing, each employing different principles and technologies.

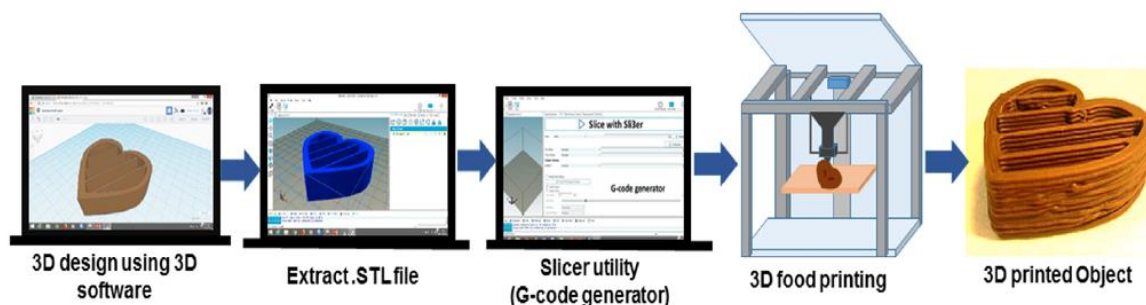


Fig. 1. Schematic representation of steps from CAD design to final 3D printed construct.

EXTRUSION-BASED PRINTING

Extrusion-based 3D food printing is the most prevalent technique and involves the deposition of food materials through an extruder nozzle. The material is typically in a semi-solid or paste-like state, allowing it to be extruded in layers to form the desired shape. This technique is suitable for a wide range of food materials, including dough, chocolate, cheese, and various purees. The extrusion process can be controlled to adjust factors such as flow rate, nozzle diameter and layer thickness.

POWDER-BASED PRINTING

Powder-based 3D food printing involves using food powders as the printing material. A thin layer of food powder is spread over a build platform and a binder or liquid is selectively jetted onto the powder surface, binding the particles together to form solid layers. The process is repeated layer by layer until the final object is created. This technique allows for the use of various food powders, such as sugar, cocoa or powdered fruits, to produce intricate designs or customized textures.

INKJET PRINTING

Inkjet-based 3D food printing involves the use of inkjet print heads to deposit tiny droplets of edible inks or liquid food materials onto a surface. The droplets are jetted onto the printing surface, forming each layer of the final object. The process can be repeated layer by layer until the desired structure is achieved. Inkjet printing allows for precise control over the droplet size and placement, enabling the creation of complex patterns or multi-layered food structures.

3D FOOD PRINTING OFFERS SEVERAL POTENTIAL BENEFITS

Customization and Personalization

One of the significant advantages of 3D food printing is the ability to create highly customized and personalized food items. By using digital designs, individuals can create unique shapes, textures and flavours tailored to their preferences or dietary needs. This level of customization is particularly valuable for people with specific dietary restrictions, allergies or nutritional requirements.

Creative Food Designs

3D food printing opens up new possibilities for culinary creativity and artistic presentation. It allows chefs, food designers and home cooks to experiment with intricate and visually appealing food designs that may not be easily achievable using traditional cooking methods. This can enhance the dining experience and add novelty to food preparation.

Enhanced Nutrition and Food Innovation

3D food printing has the potential to optimize the nutritional composition of food items. It enables precise control over ingredient placement, portion sizes and nutrient distribution. This level of control can be beneficial for creating nutritionally balanced meals, incorporating specific functional ingredients or developing specialized diets for individuals with unique nutritional requirements.

Food Customization for Medical Purposes

3D food printing has promising applications in healthcare, particularly for patients with specific medical conditions or dietary needs. It can be used to create meals that are easier to swallow or digest, cater to specific nutrient requirements or address food

allergies or intolerances. This level of customization can contribute to better patient outcomes and improved quality of life.

Reduction of Food Waste

3D food printing has the potential to reduce food waste by utilizing ingredients more efficiently. It enables precise ingredient control, allowing for portioning and layering only what is needed for the desired food item. By reducing waste, it can contribute to a more sustainable food system.

Alternative Food Sources

3D food printing opens up possibilities for using alternative food sources and ingredients. It can utilize ingredients that are not conventionally used or are less known, such as plant-based proteins or sustainable food sources like algae or insects. This promotes food diversity, reduces environmental impact and encourages exploration of new food options.

CONCLUSION

While these benefits are promising, it's important to note that 3D food printing is still a developing technology and there are challenges to overcome, such as cost, availability of food-safe materials and ensuring food safety and quality. However, ongoing research and advancements in the field continue to expand the potential applications and benefits of 3D food printing.