

# 3D FOOD PRINTING ENGINEERING THE FUTURE OF EDIBLE INNOVATION

*A Technological Recipe for Tomorrows Food*

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**E**VERY so often, an invention reshapes not only the way we eat our food but the way we understand food itself. Fire brought us cooking, refrigeration gave us preservation, and today, 3D food printing is opening the door to meals crafted with unprecedented precision.

Let us imagine a kitchen countertop where a compact printer extrudes all our favourite items like chocolate, cheese, or vegetable puree layer by layer into intricate edible shapes customised in texture, nutrition, and aesthetics, instead of cooking, baking, or frying the food. What once seemed like science fiction is now an active field of research across food technology, materials science, and digital engineering, so, yes! Even the food has not remained untouched by digital. 3D food printing or additive manufacturing of food combines the principles of mechanical design, properties of ingredients, and end products, for example, rheology, texture, and nutrition science, to produce foods that are not only appealing to the eyes but also sustainable and personalised.

### The Science of Additive Food Manufacturing

3D food printing is based on the principle of additive manufacturing, in which three-dimensional objects are constructed layer by layer from a computer-generated design. Unlike traditional subtractive cooking processes, where common methods like cutting, moulding, or shaping are done, additive methods build precisely where they are actually needed, minimising waste and allowing complex geometries. In the food manufacturing process, the materials often called edible inks are pastes, purees, and powders prepared from common ingredients such as dough, chocolate, cheese, vegetable pulps, or plant-based proteins.

The 3D printing process starts by modelling the desired shape of the product, like a cookie, snack, or decorative pattern, using Computer-aided Design (CAD). The CAD file is then converted into G-code using slicer software, where the model is divided into layers and defines toolpaths for the printer's nozzle. A food printer then deposits the material through an extrusion system, building the food layer by layer. Finally, the printed structure may undergo post-processing such as



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3D-printed plant-based meat showing realistic texture and detail