3D Printing of Edible Materials

Division of Food Sciences, University of Nottingham, Loughborough LE12 5RD

INTRODUCTION : Additive Manufacturing (AM) is the direct fabrication of end use products and components using technologies that deposit materials layer-by-layer – the term 3D printing is used interchangeably with AM as the processes use this layer-by-layer point-by-point methodology.
For the CIM, this emerging technology has the potential to deliver personalised nutrition, localised manufacture, upscaling of ingredients, utilisation of alternative ingredients, waste management through on-demand production and novel food properties as a function of design freedom; enabling complete control of microstructure and macrostructure.

INGREDIENT FORM :

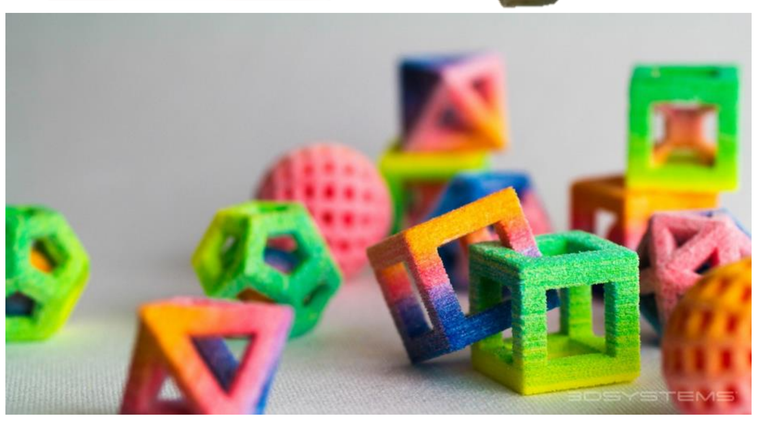
- Liquid/Paste
- Particulate
- Adhesive Laminate

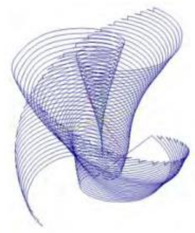
SETTING MECHANISM:

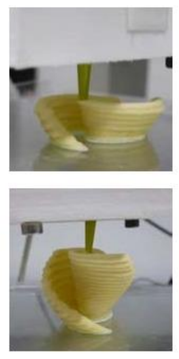
- Hardens in atmosphere
- Particles sintered by energy source
- Particles melted by energy source
- Printer jets binding material
- Fused by heat and pressure

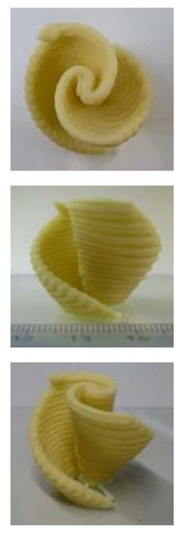
3D PRINTING TECHNIQUE:

- Stereolithography (SLA)
- Fused Deposition Modelling (FDM)
- Selective Laser Sintering/Melting (SLS/SLM)
- Electron Beam
- Hot Air
- Binder Jetting
- Laminated Object Manufacturing









Left : 3D Systems

Above : TNO and Barilla Pasta

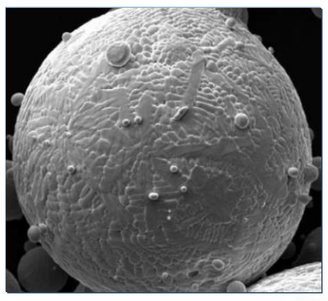
Currently, the majority of edible 3D printing outputs are for decorative effect.
Could we identify a 'set' of ingredients that can be used to create a variety of novel products, or replicate known ones?

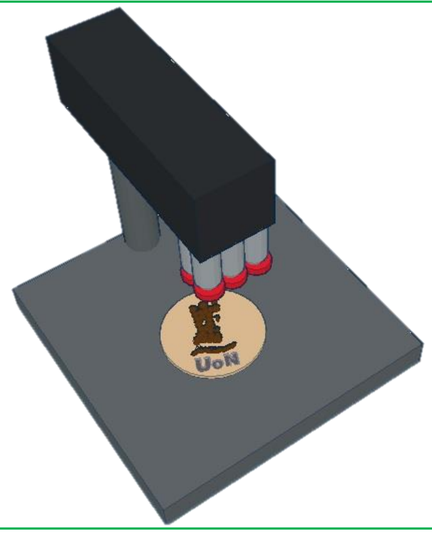
Particle design exploiting different glass transition temperatures of materials to control adhesion

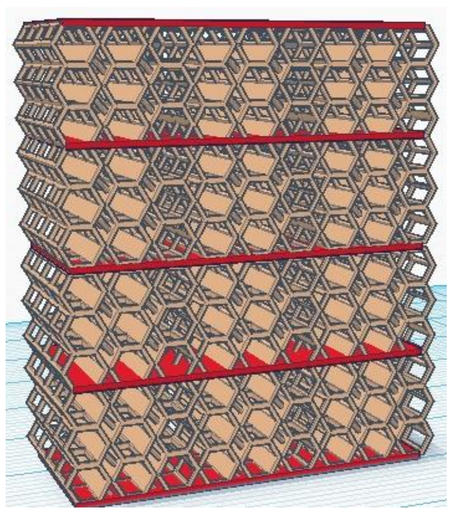
'Cooking' mechanism incorporated into the printer for truly ready to eat, complex products

Control microstructure to create novel food textures or introduce functionality

Utilise alternative ingredients for both structural and nutritional purposes







Devise 'recipes' which may be downloaded directly to print at home

PROJECT OUTLOOK : Great potential for this technology as it is becoming more affordable and attracting a lot of interest globally. The benefits are numerous, not only to consumers but also manufacturers who can now offer bespoke products or a 'batch size' of 1 unit due to the process flexibility.

The University of Nottingham
UNITED KINGDOM · CHINA · MALAYSIA
Loughborough University
UNIVERSITY OF BIRMINGHAM