Scanning Electron Microscopy Case Study:

Probiotic Coatings – Pan Bread

Chris Parmenter

Nottingham Nanotechnology and Nanoscience Centre, University of Nottingham
Probiotics are live organisms that when administered (in adequate amounts) confer health benefits to the host.

Current Probiotic delivery systems are dairy based BUT processing conditions during production can lead to significant losses of probiotic viability (due to heat, mechanical or osmotic stress induced cellular injuries).

Edible films (thin layer biopolymers) as carriers for probiotics are a novel concept under research.

Baked goods are another staple food source and attractive for probiotic loading.
Edible Film Characterisation

Research Case Study

- A test system was produced with the probiotic Lactobacillus rhamnosus GG
- The bacteria were protected by one of two films: 1% w/w sodium alginate (ALG) or 0.5% alginate / 2% whey protein (WPC).
- There is a need to characterise these films, and understand the impact of production variables (e.g. drying temperature).
- Scanning Electron Microscopy (SEM) is an imaging technique capable of visualising sample surfaces with high depth of field and lateral resolutions of around 1-20nm.
- SEM was used to check the presence of the films, and characterise the morphology with changes to composition and drying conditions.
SEM analysis of the crust of conventional (a) and probiotic pan bread loaves dried at 60°C after film application (b,c).

Probiotic breads were coated with either sodium alginate (b) or sodium alginate/whey protein (c) probiotic edible films.
Research Case Study

**Sodium Alginate**

- **Lactobacillus rhamnosus**
- **GG rods**

**60°C**

**180°C**

**Sodium Alginate / Whey Protein**

**SEM**
The presence of the film forming components was verified with SEM and compositional differences in thickness measured (Alginate, 0.8-1.3 µm), (Alginate/Whey, 1.7-2.9 µm).

The application of the edible films did not modify the main structural aspects of the bread crust.

The presence of bacteria was observed in both cases but the thicker alginate/whey protein coating provided more protection.

No difference seen with drying temperatures.

The presence of whey proteins in the film forming solution reduced L. rhamnosus GG viability losses throughout drying and storage as seen by SEM and backed up by microbiological analysis.
For further information on how SEM, or the Nottingham Nanotechnology and Nanoscience Centre could help with your applications, systems and designs please contact:

isac@nottingham.ac.uk
+44(0)781 645 3130

ISAC is a University of Nottingham Centre of Excellence in partnership with the National Physical Laboratory

For more details on the work showcased in this case study see the following publications: