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nmRC CASE STUDY

IMAGING PROBIOTIC COATINGS – PAN BREAD

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Probiotic Coatings – Pan Bread

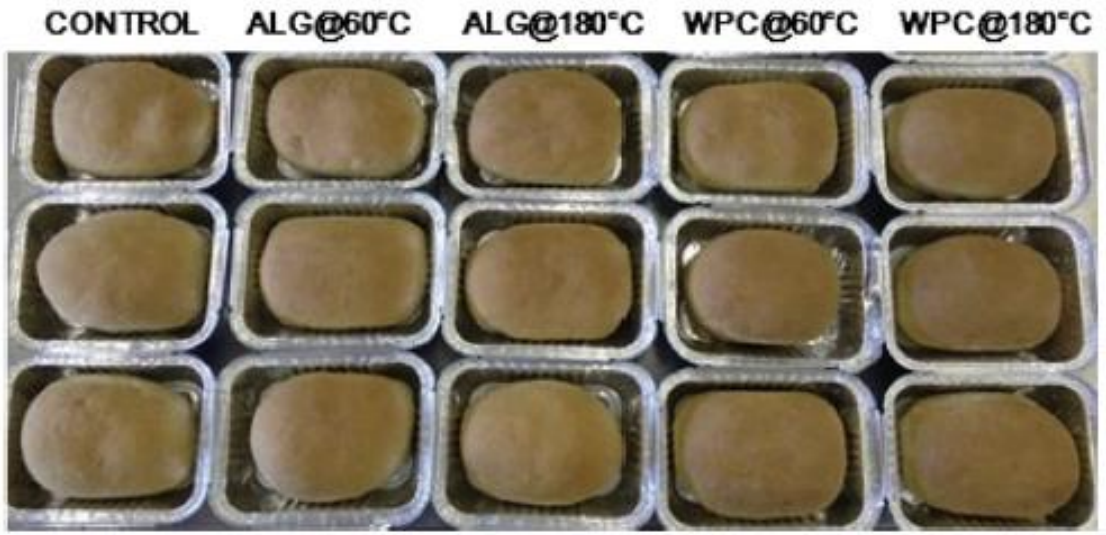
Scanning Electron Microscopy (SEM) Case Study

PROBIOTICS

- 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 a staple food source and attractive for probiotic loading.

EDIBLE FILM CHARACTERISATION

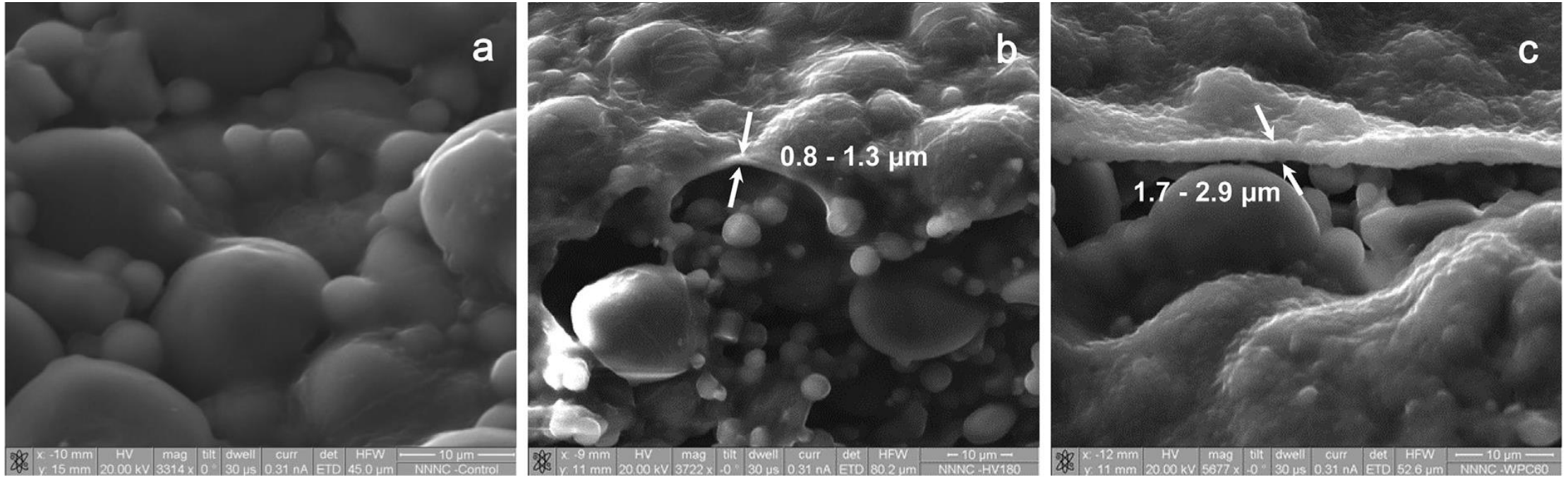
- A test system was produced with the probiotic Lactobacillus rhamnosus GG
- The bacteria were protected by one of two films:
  - 1% w/w sodium alginate (ALG)
  - 0.5% alginate / 2% whey protein (WPC).
- There is a desire to characterise these films, and understand the impact of production variables (e.g. drying temperature) on the film structure and viability.



SCANNING ELECTRON MICROSCOPY (SEM)

- 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.

CRUST IMAGING



Control **Sodium Alginate Film** **Sodium Alginate/Whey Protein Film**

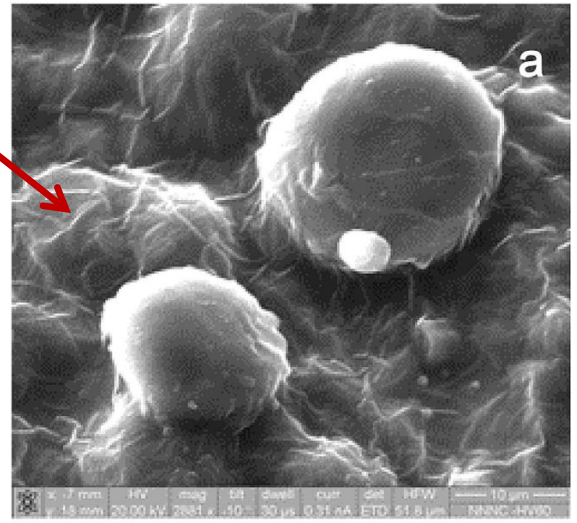
- SEM analysis of the crust of (a) conventional pan bread loaf with (b,c) probiotic pan bread loaves dried at 60˚C after film application.
- The probiotic breads were coated with either sodium alginate (b) or sodium alginate/whey protein (c) probiotic edible films.

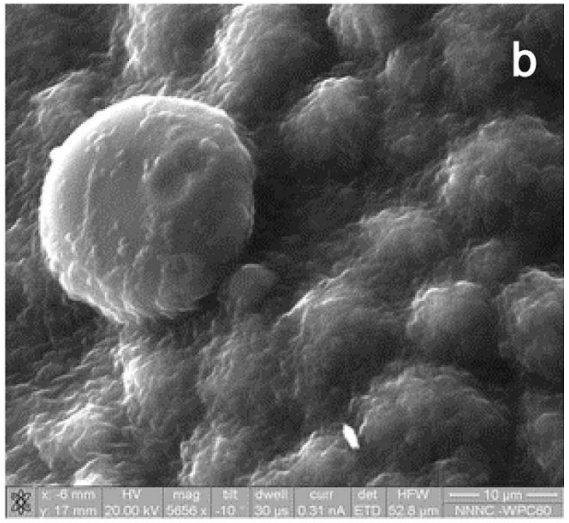
CRUST IMAGING

Lactobacillus rhamnosus GG rods

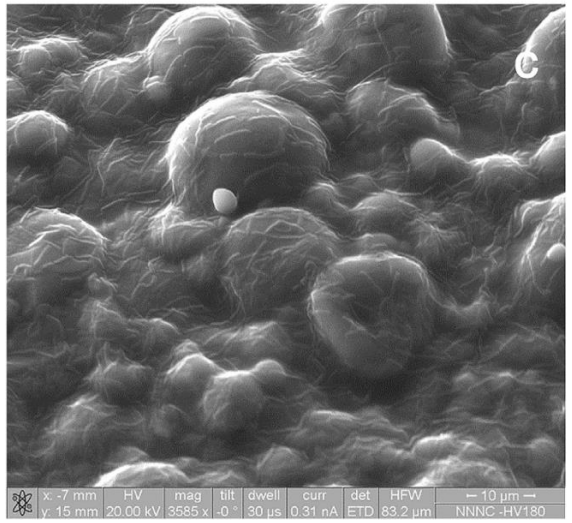
Sodium Alginate | **Sodium Alginate / Whey Protein**

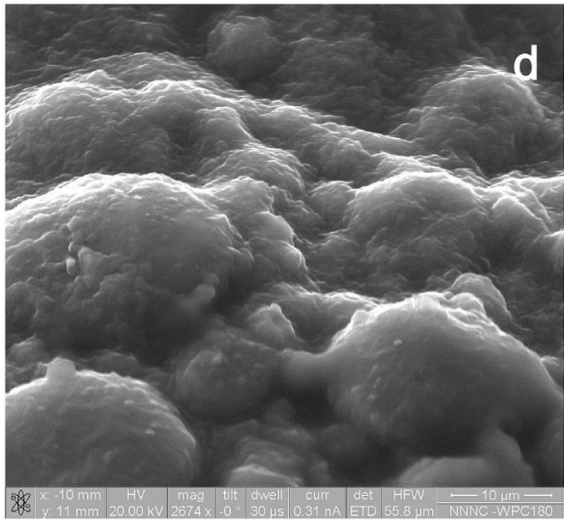
60˚C





180˚C





- SEM allows for the similarities / differences in the film structure and presentation to be assessed.
- Variance due to the probiotic film type and with differing drying temperatures can be seen.

SUMMARY

- Scanning electron microscopy (SEM) is a very useful tool for microscale imaging. Here it has been used to assess the production of probiotic films on pan bread loaves.
- The presence of film forming components was verified with SEM and compositional differences in thickness were able to be measured (Alginate, 0.8-1.3 um), (Alginate/Whey, 1.7-2.9 um).
- 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.

REFERENCES / ACKNOWLEDGEMENTS

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

C.Soukoulis, L. Yonekura, H. Gan, S. Behboudi-Jobbehdar, C.Parmenter, I.Fisk. Probiotic edible films as a new strategy for developing functional bakery products: The case of pan bread. Food Hydrocolloids 39 (2014) 231-242

The scanning electron microscopy analysis documented here was performed using instrumentation at the Nanoscale and Microscale Research Centre (nmRC) at the University of Nottingham. www.nottingham.ac.uk/nmrc

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ADDITIONAL INFORMATION

- We hope the information provided in this case study is of interest.
- If you wish to get in touch with us to discuss any of the information provided, raise a query/concern or provide feedback then please use any of the methods listed below:

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