FOOD TECHNOLOGY

TEXTURE ANALYSIS

WAGENINGEN UNIVERSITY & RESEARCH

TU Delft Delft University of Technology

Using neutrons to improve meat replacers

THE PROBLEM TO SOLVE:

Meat production has huge global environmental impact via land and water use, and contributes considerably to the generation of greenhouse gases. However, in order to encourage consumers to switch to more preferable plant-based meat-analogues, this alternative needs to be cheap and accurately resemble the real thing. The key to this is understanding its internal microstructure as this leads to the macroscopic properties (texture, taste, etc.) of the food.

A STEP TOWARDS THE SOLUTION

To obtain a fully qualitative and quantitative 3D picture of food composite materials, several complementary characterization techniques should be utilised. Often this includes microscopy or x-ray tomography. Less well-known, but just as enlightening, are neutron refraction or scattering techniques e.g. Spin-Echo Small Angle Neutron Scattering (SESANS). These techniques can really help look at the microstructure inside the bulk of the food composite gaining important information.

THE RESULTS

Scientists at Delft University of Technology and Wageningen University in the Netherlands have used neutrons to study two possible meat analogues: calcium caseinate and an anisotropic Soy Protein Isolate - vital wheat gluten biopolymer blend.

One study investigated the size and shape of air bubbles in calcium caseinate. Neutron techniques allowed a relatively large sample size to be probed providing information on bubble width and deformation direction that agreed well with the same results obtained from the other techniques employed on smaller samples.

Another study was on the bulk and surface structure of the Soy protein Isolate biopolymer blend. Neutrons were able to determine the orientation distribution of the fibres and the number of fibre layers. The measured fibre thickness also confirmed results from another technique used.

"A combined use of several characterization techniques is necessary for better understanding of the nature of plant-based meat replacers as well as their functionality and structuring mechanisms." G.A. Krintiras et al.

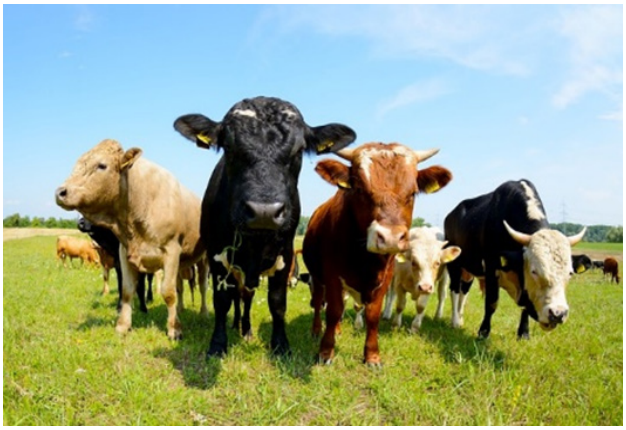

Fig.1 Livestock-based food production is an important and pervasive way humans impact the environment. It causes about one-fifth of global greenhouse gas emissions, and is the key land user and source of water pollution by nutrient overabundance. It also competes with biodiversity, and promotes species extinctions. Source: Eshel et. al. PNAS, 111 (33) 11996-12001.

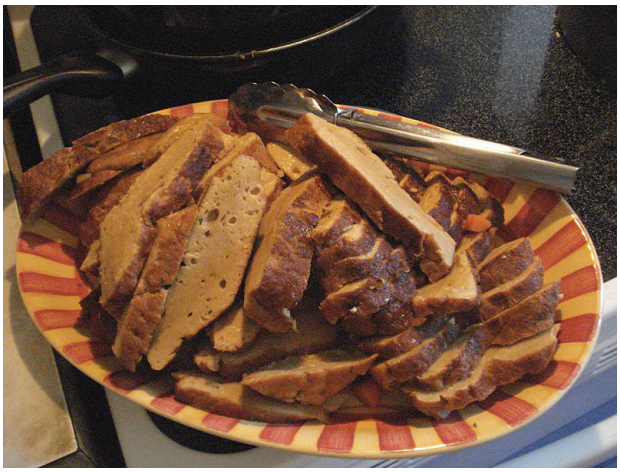

Fig.2 Meat replacers e.g. seitan made from wheat (pictured above), need to look and taste like the real thing for them to appeal to consumers. Using neutrons to study meat analogue textures can help food producers emulate the texture that helps meat taste like meat. Credit: Amy Stephenson, Wikipedia

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References:
B. Tian et. al. Food Hydrocolloids 83 287-295 (2018)
DOI: 10.1016/j.foodhyd.2018.05.006
G.A. Krintiras et. al. Food & Function 5 3233-3240 (2014)
DOI: 10.1039/C4FO00537F

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