LOOKING AHEAD FOR SAVVY SOLUTIONS

Figure NUMBER ONE

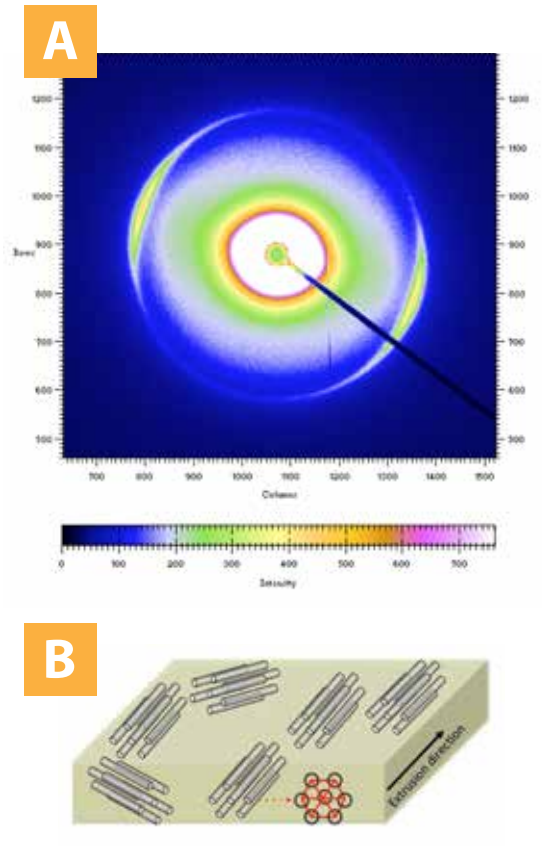

Figure 1 A) 2D SAXS pattern and B) proposed model, for the HCP scattering objects in extruded wheat gluten bioplastic films containing ammonium hydroxide and salicylic acid.

Research with neutrons and photons has contributed to the development of a wide variety of products such as plastics, cosmetics, chemicals, building materials, life science and of course packaging materials. For example the paper wrapping of your hamburger or the milk carton in your fridge.

Plant proteins such as wheat gluten (WG) are promising alternatives to current petroleum based packaging materials. These proteins are biodegradable and are relatively low-cost by-products from the bioethanol fuel industry. They can be polymerized by processing into bioplastic films or foams for various applications such as building insulation.

The morphology (shape and form) of packaging materials can be correlated with functions that are important for food-packaging applications, for example mechanical strength and air barrier properties.

Researchers at the Swedish University of Agricultural Sciences (SLU) and the Royal Institute of Technology (KTH) are regular visitors at the MAX IV Laboratory where they use X-ray scattering techniques (SAXS and WAXS) to understand the morphology of materials based on WG proteins. Two different materials have recently been investigated; bioplastic (WG-glycerol-additives) films and WG foams.

The properties of bioplastic WG films are strongly affected by manufacturing processes and film composition. For future applications it is therefore important to understand how these properties can be

changed in a controlled manner. SAXS measurements at the MAX IV Laboratory helped researchers improve their understanding of the relationship between the morphology and the function of different types of bioplastic films. The experiments showed how the film morphology could be tailored by blending the bioplastics with various chemicals including sodium hydroxide, ammonium hydroxide and salicylic acid during manufacturing.

The most important finding was the observation of hexagonal (HCP) structures in some of the films, which influence the strength of the material.
In addition, foams made from wheat gluten were developed and showed different density and strength depending on the fractions of different proteins they contained (for example gliadin- or glutenin-rich). The X-ray scattering experiments were of the highest importance in gaining information on how the foam morphology can be tailor-made for packaging applications.

Figure NUMBER TWO

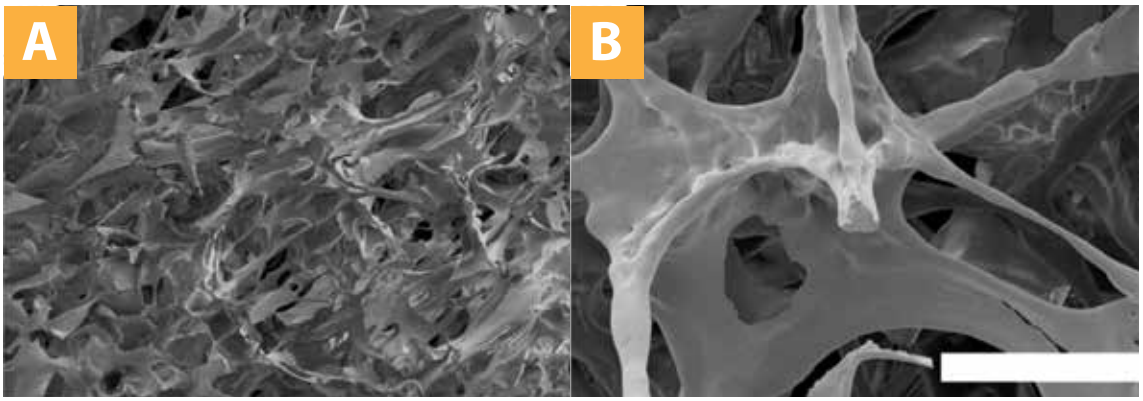

Figure 2 Freeze-dried WG foams with different protein mixtures observed by Scanning Electron Microscopy (SEM). The gliadin content is higher in B). The scale bar in B is 300µm.

Science Link is a network between leading research facilities of photon and neutron sources and its users. The project aims to support and encourage innovation and entrepreneurship in the Baltic Sea Region. Apart from the research facilities, the network also includes scientific institutes, universities and regional organisations that serve as service and promoting units. Science Link is part-financed by the European Union (Baltic Sea Region Programme) and involves 20 partners from 9 countries during the project period 2012 to 2014.

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