

Structural characterization of food materials through small-angle X-ray scattering at NanoTerasu

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Abstract

Bread, made from wheat, one of the world's three major grains, is an essential food in our diet. The properties of bread are controlled by the moisture-retaining ability of gluten and the crystallization of starch. While it is understood that emulsifiers play a crucial role in controlling these properties, the mechanisms behind this remain unclear. Therefore, we are investigating the mechanisms by which emulsifiers prevent the degradation of bread from the perspective of materials chemistry by using various synchrotron X-ray measurements. We focus mainly on "water" and are advancing our analysis using small-angle X-ray scattering combined with X-ray spectroscopy, exploring different structure and electronic structure scales. There have been very few studies applying synchrotron X-ray spectroscopy analysis to food, and we are attempting to discuss the mechanisms of emulsifier action by correlating the bulk structure and the electronic states of oxygen and nitrogen.

As an example of the results, Fig. 1(a) shows the changes in the WAXS profile with the preserved time measured for bread made without emulsifiers. The peak intensity associated with B-type starch increases with time, indicating that aging is occurring. In contrast, the SAXS profile shown in Fig. 1(b) does not exhibit any apparent trends, suggesting that structural changes at different hierarchies may occur independently.

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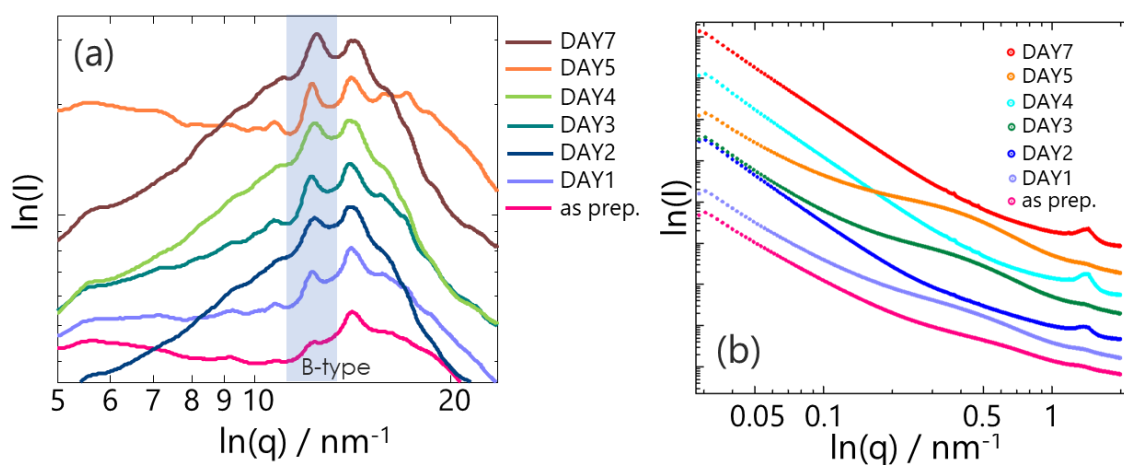


Fig.1 (a) WAXS and (b) SAXS observation of aging due to storage duration. Measurements were performed at NanoTerasu BL08W.