Application Note RACCT9007

View on rigaku.com

Bread Dough Rising Process Observed by X-ray CT

About the sample: Bread

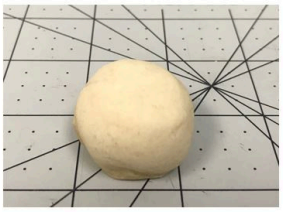
Factors such as the quality of the wheat protein and yeast and the amount of salt, fat, and sugar can affect the microstructure and total volume of the bread (Mayo et al, (2016) API Conf. Proc., 1696, 020006). To understand how each factor affects the resulting product, we need to understand the dynamic changes happening in the dough during the proving (rising) and the baking process. X-ray CT (computed tomography) can be used to visualize the microstructure during the process in-situ and to quantify the volume change, porosity, etc.

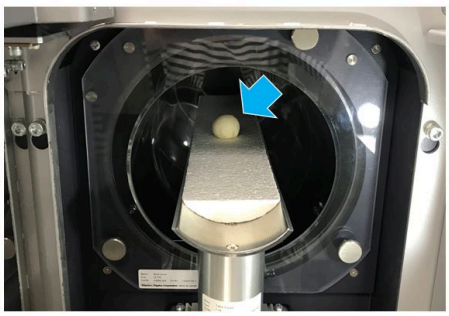
Analysis procedure

1. In this example, the rising process of bread dough was monitored using a high-speed-CT scanner, CT Lab GX.
2. The resulting images were segmented into dough and air using the thresholding technique.
3. The change of the total volume, dough volume, and void percentage were calculated for a 110 minutes period.

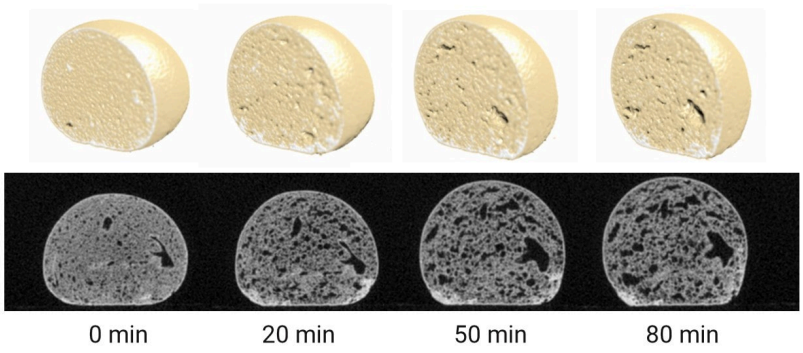
1. CT scan

A little over an inch size bread dough was prepared. The sample was placed in the gantry geometry CT scanner so that the dough doesn't move during a fast scan.





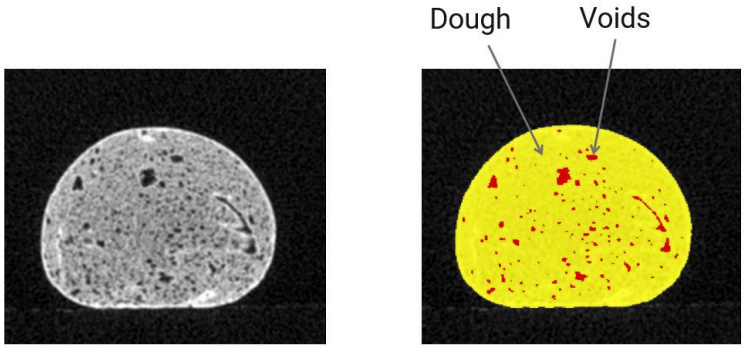
While the dough rises at room temperature, four 18-second scans were collected over 80 minutes to produce the 3D grayscale CT images. The 3D rendered images (top) and CT cross-sections (bottom) are shown. In the CT cross-sections, the dough is gray and the air is black. You can see the dough is rising and large voids are forming.



7

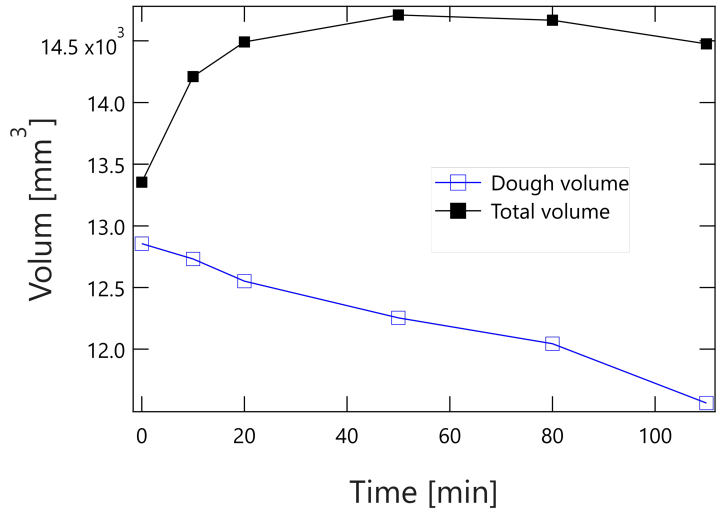
2. Segmentation

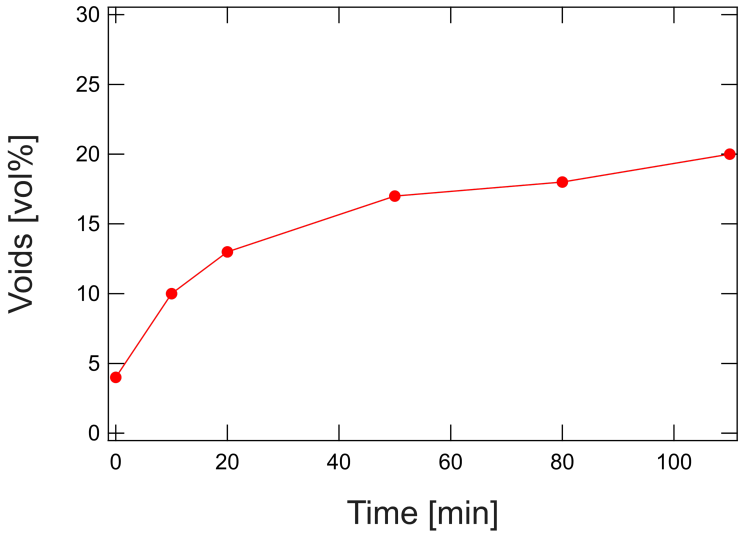
The resulting images were segmented into the dough (yellow) and the air (red) by the thresholding method.



3. Volume fraction analysis

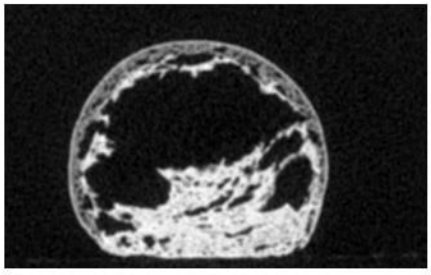
The change of the total volume (black solid square) and dough volume (blue open square) are shown followed by the void volume percentage (red solid circle) over a 110 minutes period. The total volume peaks at 50 minutes when the dough has fully risen, and it decreases as the dough over-rises. The dough volume decreases partly because the dough was not covered during the experiment and the moisture evaporated. You can also see the void percentage increases during this process.





Extra: 18 hours later

The dough was left in the CT scanner overnight. Here is how it looked 18 hours later.



18 hrs.

Related products

CT Lab GX

High-speed, stationary sample microtomography of mediu
m-size samples