

X-RAY MICROSCOPY

X4 POSEIDON – Food and Pharmaceutical

Application Report 10

X-Ray Microscopy (XRM) provides a non-destructive method of being able to analyze food and pharmaceuticals samples at high resolution. Whether it's for research and development, quality control, or more, XRM gives us the insight and ability to see the internal structures of these materials in 2D and 3D.

In both the food and pharmaceuticals industries, consistency is key. XRM allows the user to visualize and maintain consistency and quality of the product at all phases of the manufacturing process. For example, while evaluating absorption rates of drugs, being able to quantitatively assess variances can help determine drug efficacy.

In the food industry, micro-structure changes through processes such as lyophilization can result in changes in mouth-feel and texture for the consumer. XRM allows the user to visualize these changes and how different phases are affected by these processes.

The new X4 Poseidon offers a modular platform ideal for any lab environment. It is capable of high quality, fast scan times for QC and routine type analyses. It can also be configured for high resolution scans, making it extremely effective for an R&D lab as well. Combined with a powerful software package, XRM provides the ability to qualitatively and quantitatively interpret the data. This gives users the ability to not only identify features, but isolate, quantify, and visualize those features.

In this application note, a readily available candy is evaluated in 2 forms. The first form is the pristine form and the second is a freeze dried form.

The X4 POSEIDON microCT imaging workstation is a 3D imaging core facility on your desktop. The following settings were used for this study:

- 7 Mpixel Flat-panel X-ray camera
- Pristine power settings: 40kV, 200 μ A
Freeze dried power settings: 40 kV, 200 μ A
- Pristine scan duration: 1 hour 17 min
Freeze dried scan duration: 1 hour 20 min
- Pristine voxel resolution: 6 μ m
Freeze dried voxel resolution: 8 μ m

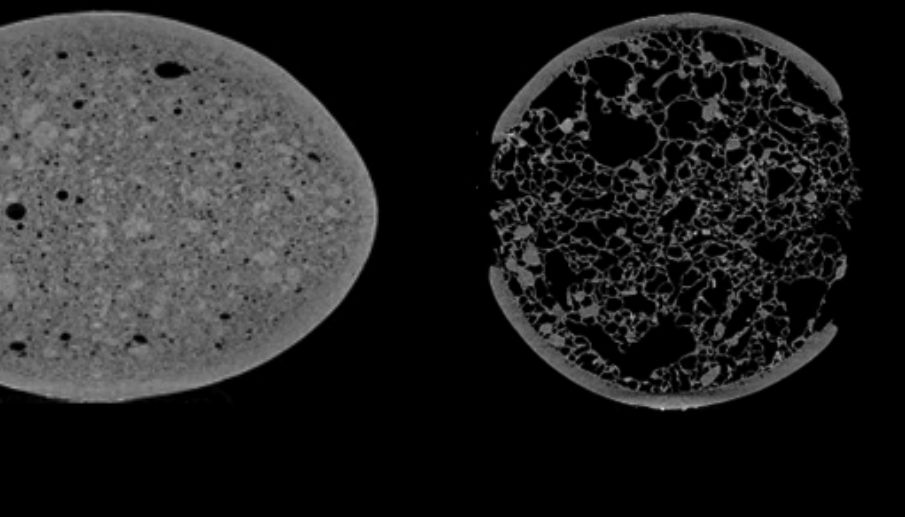


Figure 1
2D cross section of pristine sample (left) and freeze dried sample (right).

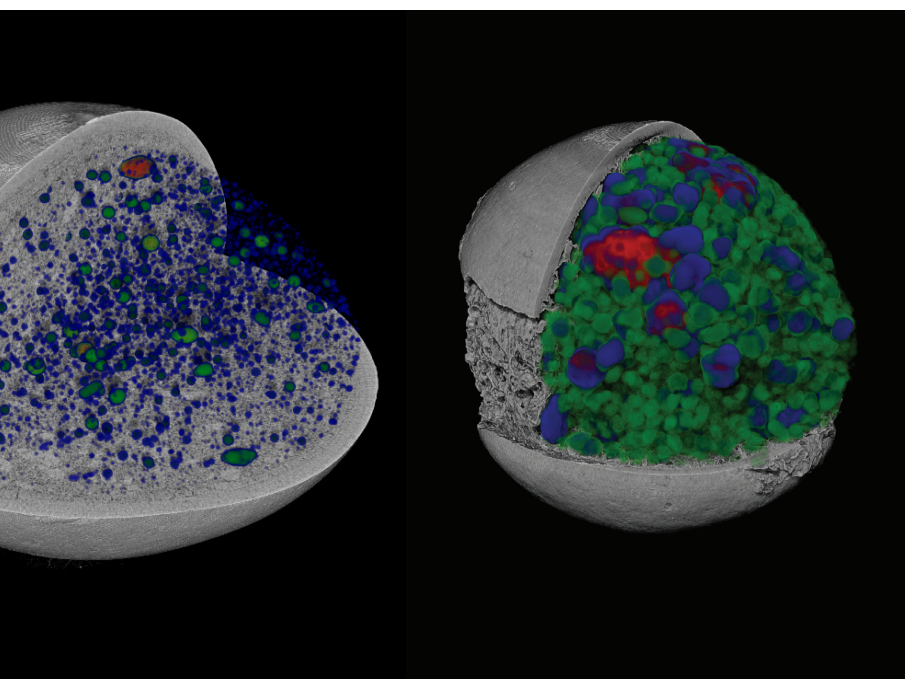


Figure 2
Thickness analysis of internal voids. Pristine (left), freeze dried (right).

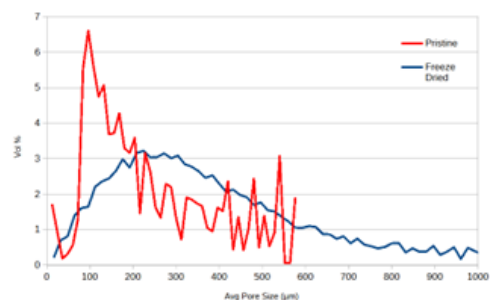


Figure 3
Volume percent vs average pore size.

Figure 3 shows that in the pristine sample the average pore size is more concentrated towards the lower end, peaking at 128µm. While the average pore size of the freeze dried sample is more broadly distributed, peaking at 224µm.

Data Viewer allows the user to visualize the data in 2D as seen in Figure 1. This visualization can help show the difference between the chewier texture of the pristine sample vs the crunchier texture of the freeze dried sample.

Utilizing Bruker's powerful image analysis software, CT Analyzer (CTAn) various quantitative analyses can be performed allowing the user to confidently answer problems that arise.

In Figure 2 a structure thickness analysis was applied to the voids for each sample using CTAn. 3D visualization allows users to see and better understand the details of their samples. This also allows for better presentation of the analysis being performed.

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