Application Note RACCT9044

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Rapid-release Pain Medication Capsule Comparison by X-ray CT

About the sample: Rapid-release capsules

Small holes in the coating of capsules can help release the active ingredients, and they are applied to some pain medication gel capsules although its effectiveness is controversial (K. Kucera et al. (2018), *Adv. Inv. Pha. The. Medic.*, 1:63-71). X-ray CT (computed tomography) can visualize the details of these types of holes and different types of coatings and capsules in detail. The drug release process can be simulated in water and monitored.

Analysis procedure

1. In this example, premium brand and store brand capsules were scanned using a micro-CT scanner, CT Lab HX.
2. The details of the rapid-release capsule structures were compared.
3. The premium brand capsule was exposed to water and its dissolving process was monitored.

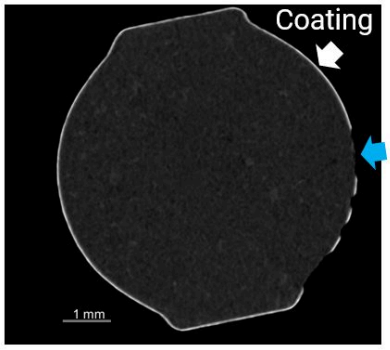
1. CT scan

Premium brand and store brand capsules were scanned to produce the 3D grayscale CT image. The gray level in CT data (left) represents the relative density. The bright coating has a higher density than that of the rest of the tablet appearing dark gray.

2. Image comparison

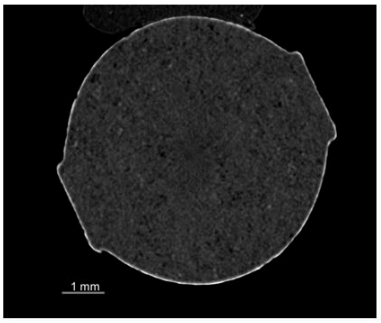
The premium brand capsule appeared to have a protective coating with about millimeter size holes, exposing the internal active ingredients.

Premium brand

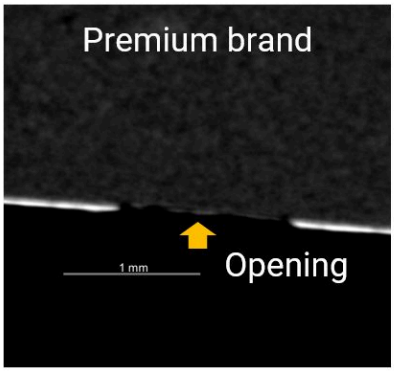


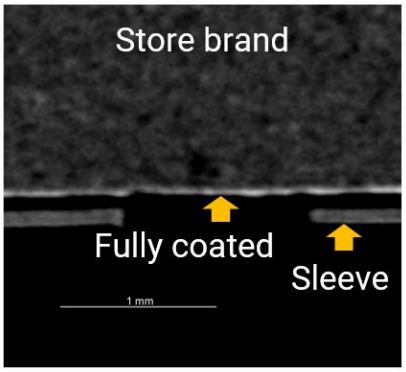
The store brand capsule appeared to have a similar protective coating, but no holes were found.

Store brand



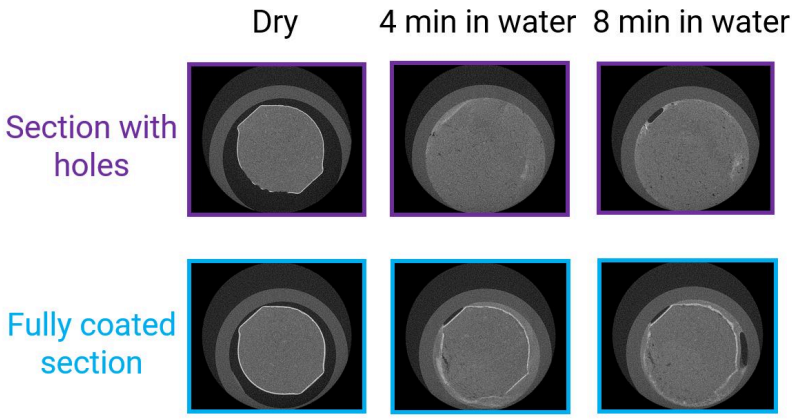
A closer look around the hole (opening of the coating) revealed that the store brand capsule had sleeves that created the appearance of an opening or thinner coating at the center of the capsule while the active ingredients were fully coated.





3. Dissolving process monitoring

The premium brand capsule was exposed to water and its dissolving process was monitored over 32 minutes. The figure shows the CT cross-sections from the region with holes (top) and the fully coated region (bottom) for the dry state and first 4 and 8 minutes in water. Those images show that the section with holes released the active ingredients within the first 4 minutes while the fully coated section stayed mostly intact even after 8 minutes.



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