Abstract Sample

Title: Gastrointestinal Tracking of Self-unfolding Foils for Oral Insulin Delivery

Presenting Author: Rolf B. Kjeldsen[a]
Co-Authors: Mahdi Ghavami[a], Lasse H. E. Thamdrup[a], Kinga Zór[a], Line H. Nielsen[a] and Anja Boisen[a]

[a] The Danish National Research Foundation and Villum Foundation's Center for Intelligent Drug Delivery and Sensing Using Microcontainers and Nanomechanics (IDUN), Department of Health Technology, Technical University of Denmark, Kgs. Lyngby, Denmark.

Introduction: Oral delivery of insulin is challenging due to a variety of chemical, biological and physiological barriers, e.g. pH, enzymes and the intestinal wall, found throughout the gastrointestinal (GI) tract [1]. One of numerous approaches to overcome these barriers is enteric coated self-unfolding foils (SUFs) with microscale cavities which ensure unidirectional drug release in close proximity to the intestinal wall [2]. In order to track the SUFs in the GI tract, x-ray imaging could be a useful tool as this method has previously been utilized for GI tracking [3].

Methods: Polydimethylsiloxane (PDMS) foils were produced from a mixture of base resin and curing agent (9:1 ratio) that was spin coated onto a silicon master with microscale structures followed by 1 min baking on a 200 °C hot plate. SUFs were made by cutting 7x7 mm patches from the PDMS foils. SUFs with an incorporated x-ray contrast agent, barium sulfate ($BaSO_4$), were made using the same procedure with 1 g/mL $BaSO_4$ dispersed into the curing agent by sonication. The x-ray contrast from SUFs with and without $BaSO_4$ was investigated by orally administering them to a euthanized rat, using a size 9 gelatin capsule, which was subsequently examined with x-ray imaging. A pilot study for GI tracking of SUFs with $BaSO_4$ was carried out by oral administration to two living rats, using enteric coated size 9 gelatin capsules, that were euthanized and examined with x-ray imaging after 10 h.

Results: The SUF without $BaSO_4$ only exhibited slight contrast in the planar x-ray images, whereas it completely disappeared in the CT scan images when adjusting the contrast threshold because its contrast is similar to that of the rat skin and tissue. The SUF with $BaSO_4$ showed an increased contrast in the planar x-ray images and additionally, it was easily observed in the CT scan images. The pilot study showed that SUFs with $BaSO_4$ were located in the cecum and stomach, respectively, 10 h post-administration (Figure 1).

Conclusion: SUFs with an incorporated x-ray contrast agent, $BaSO_4$, were successfully fabricated and x-ray imaging was used for localizing them in the GI tract of two rats 10 h post-administration. The SUFs were located in the cecum and stomach, respectively. These observations are currently being further investigated by including more replicates and time points and by varying the size of the SUFs and the enteric coated gelatin capsules used for oral administration.

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References (up to five): [1] Drucker, Daniel J., Nature reviews Drug discovery (2020), 19.4, 277-289. [2] Jørgensen, Jacob R., et al., Journal of Controlled Release (2020). [3] Gómez-Lado, Noemí et al., Pharmaceutics (2020), 12, 81.

Presenter biography: Rolf Bech Kjeldsen is a PhD student at the Technical University of Denmark. He obtained a bachelor's and master's degree in Nanoscience from iNANO at Aarhus University, Denmark, and carries out interdisciplinary research within the fields of natural science and applied science.

Example of Learning Objectives

Understand the working principles of the SUFs for oral insulin delivery.
Explain the challenges associated with oral administration of the SUFs.
Evaluate the usage of x-ray imaging for gastrointestinal tracking of the SUFs.

Figure(s)

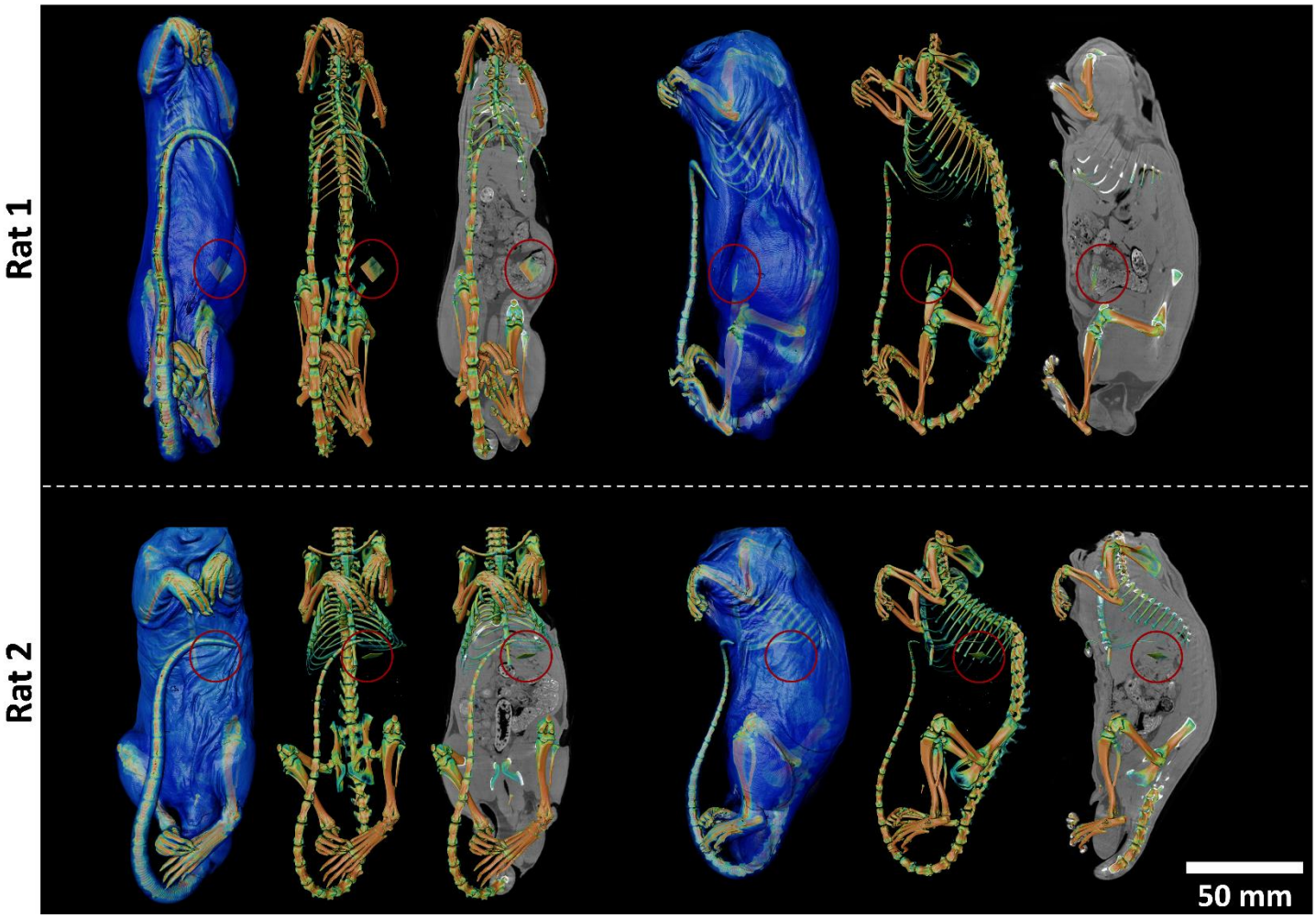

Figure 1. CT scan images showing SUFs with $BaSO_4$ located in cecum and stomach, respectively, 10 h post-administration.