

Popular science summary of the PhD thesis

PhD student	Lukas Vaut
Title of the PhD thesis	Additive Manufacturing and Characterization of Mini-Devices for Oral Drug Delivery
PhD school/Department	Life Science/Department of Health Technology

Science summary

* Please give a short popular summary in Danish or English (approximately half a page) suited for the publication of the title, main content, results and innovations of the PhD thesis also including prospective utilizations hereof. The summary should be written for the general public interested in science and technology:

Most of the time when we are sick, we would probably think: "Keep calm and take a pill". But what if there is no pill? And what is the alternative? Many people have to go through painful injections, sometimes even multiple times on a daily basis, because the medicine they need is not available for oral ingestion. This is due to the fact that many drugs, especially biomolecules (e.g. insulin for diabetes treatment), are very susceptible to the harsh environmental conditions present in the gastro-intestinal tract, and are, for example, destroyed and inactivated. After all, the function of the gastro-intestinal tract is to chemically and enzymatically degrade ingested nutrients, making them readily available for absorption into the blood stream, and to protect from ingested pathogens and toxins. The unfortunate consequence for oral drug delivery is that many drugs fail to be absorbed in their active form and thus do not produce a pharmacological effect. Microfabricated carrier devices, such as microcontainers, which serve to protect the drug from the gastro-intestinal environment and to transport the drug to their absorption site have been suggest as a potential solution to cope with this challenge.

The objective of this PhD project was to implement 3D printing technology as a tool for the rapid prototyping of different sizes and shapes of carrier devices in order to improve their functionality and consequently their aptitude for oral drug delivery. After developing a particular 3D printing workflow based on the use of exchangeable sacrificial release substrates, we were able to realize the fabrication of several different designs. Following the characterization of the latter for their mucoadhesive (adhesion to the intestinal mucosa) properties, obtained results indicate that only by tailoring the design of the devices, drastic improvements of their mucoadhesiveness can be reached. Mucoadhesion was a desired property in this case, as it promotes a longer intestinal residence time and keeps the drug close to the intestinal mucosa, which is the absorption site. All in all, the conducted research reveals that 3D printing is a method with high potential for the fabrication of oral drug delivery devices.