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Layer-by-layer coated microcontainers for colon-targeted oral drug delivery

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Introduction: Colon targeted oral drug delivery requires the drug carrier to overcome all the physiological obstacles in the gastrointestinal tract until reaching the colon and the drug can be released from the carrier¹. Microcontainers have been introduced previously as new drug carriers, which are able to protect the drug from the harsh environment of the stomach and enhance bioavailability and absorption in the small intestine². Moreover, polysaccharide based particle systems (e.g. chitosan, alginate, pectin) have been used previously for colon targeted drug delivery due to enzymatic biodegradation in the large intestine³.

Aim: In this project, we have investigated the possibility of fabricating an enzyme-sensitive coating, stable at intestinal pH. For this matter, we implement a multi-layer polymeric complex fabricated from chitosan and alginate layer-by-layer assemblies, as enteric coating for microcontainers.

Method: Microcontainers were loaded with the model drug, indomethacin. The loaded microcontainers were spray-coated layer-by-layer with chitosan and alginate. Quartz crystal microbalance with dissipation monitoring (QCM-D) was employed to investigate the fabrication of the layer-by-layer assemblies of chitosan and alginate and disintegration of these assemblies at intestinal pH. Release from the coated microcontainers was then tested in medium with intestinal pH with a μ -Diss profiler to investigate the stability of the coating.

Results: Figure 1 shows the loaded microcontainers with indomethacin and layer-by-layer coatings of chitosan and alginate. QCM-D experiments show the mechanism through which inter-polymer complexes of chitosan and alginate are formed and investigation of disintegration in intestinal pH reveals the stability of the assemblies. SEM images from release study at intestinal pH (Figure 2) and data obtained by release studies gathered from experiments with the μ -Diss profiler confirms the stability of the coating in medium at intestinal pH.

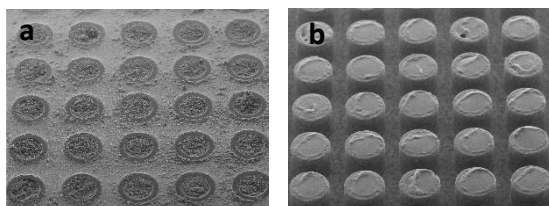


Figure 1- Microcontainers loaded with indomethacin (a) and coated with four layers of chitosan and alginate (b). Scale bar represents 1 mm.

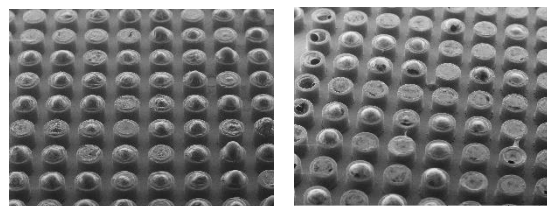


Figure 2- SEM images after release studies after 4 h in pH of 6.5 (a) and 7.5 (b). Scale bar represents 2 mm.

Conclusion: Microcontainers coated with layer-by-layer polymer assemblies as enteric coating show promising results for a new colon targeted oral drug delivery system.

References

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