

# Abstract

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The aim of this work was to analyse the surface of biomedically relevant polymers with a range of surface sensitive techniques both in the interest of improving our knowledge of such polymeric delivery systems and the techniques used. Specifically time of flight- secondary ion mass spectrometry (ToF-SIMS) was a focus of this work complemented by a range of supportive surface and bulk analytical techniques. The new technique of X-ray photoelectron spectroscopy (XPS) depth profiling of organics was scrutinised through its application to a thin film blend of poly(L-lactic acid) (PLA) and the analgesic codeine in Chapter 3. Surface depletion of drug was observed in these films and was quantified for the first time with XPS.

A multilayer model was created containing alternating layers of the codeine/PLA blend and biodegradable hydroxypropyl methylcellulose (HPMC) to test the application of SIMS to such formulations described in Chapter 4. Codeine was found to diffuse into a HPMC layer below it but not above due to a solubilisation of the bottom HPMC layer by the chloroform allowing small mobile codeine molecules to penetrate the layer below where the larger PLA chains were unable to. Interface widths observed when casting HPMC above a codeine/PLA layer was far broader than those observed when reversing layer order. This observation suggests HPMC is more sensitive to ion beam induced damage effects than PLA.

The detailed characterisation of protein drug loaded polymeric microspheres was undertaken described in Chapter 5 revealing the discontinuous presence of surfactant at the surface and allowed for inferences to be made as to how the production process could be amended to tailor desired attributes.

The work describes the thorough characterisation of biomedically relevant polymers with an array of surface sensitive techniques in the interest of improving the future description of such increasingly important formulations.