Single-injection HPLC method for rapid analysis of a combination drug delivery system.

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Public Summary:
The goal for creating medical devices with the capability of delivering multiple drug therapies is a rapidly growing interest among healthcare providers. This project involved the characterization of regenerative, micro-sized medical devices aimed at repairing cardiac tissue following a heart attack. The devices were both biodegradable and complex in nature to address the challenging demands of a damaged heart. A single method was developed to characterize a half dozen components emitting from the devices simultaneously, including 3 model medicines. This effort aides in the movement towards personalized medicine, where different combinations of drug therapies can be used on specific patient populations to optimize care. In the growing complexity of today's delivery of medicines, this project sits at the heart of the demands for innovative, regenerative, and multi-tasked solutions.

Scientific Abstract:
Developing combination drug delivery systems (CDDS) is a challenging but necessary task to meet the needs of complex therapy regimes for patients. As the number of multi-drug regimens being administered increases, so does the difficulty of characterizing the CDDS as a whole. We present a single-step method for quantifying three model therapeutics released from a model hydrogel scaffold using high-performance liquid chromatography (HPLC). Poly(ethylene glycol) dimethacrylate (PEGDMA) hydrogel tablets were fabricated via photoinitiated crosslinking and subsequently loaded with model active pharmaceutical ingredients (APIs), namely, porcine insulin (PI), fluorescein isothiocyanate-labeled bovine serum albumin (FBSA), prednisone (PSE), or a combination of all three. The hydrogel tablets were placed into release chambers and sampled over 21 days, and APIs were quantified using the method described herein. Six compounds were isolated and quantified in total. Release kinetics based on chemical properties of the APIs did not give systematic relationships; however, PSE was found to have improved device loading versus PI and FBSA. Rapid analysis of three model APIs released from a PEGDMA CDDS was achieved with a direct, single-injection HPLC method. Development of CDDS platforms is posited to benefit from such analytical approaches, potentially affording innovative solutions to complex disease states.