The Synthesis and Characterization of EGCG-PLGA Conjugates and Mixtures: A Novel Biomaterial for Tissue Engineering

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The engineering of biomaterials with suitable biochemical, physicochemical, and mechanical properties is a major challenge in tissue engineering. While many synthesized materials have have had the desired physical properties, the incorporation of biomolecules is necessary to enhance biological response and successful tissue regeneration. Epigallocatechin gallate, or EGCG, has successfully been used in several medical applications, such as in cancer therapeutic drugs. The goal of this project is to explore EGCG's potential as a biomolecule for enhancing the cell interaction of structures called scaffolds for tissue repair and regeneration. EGCG was encapsulated into scaffolds made of a well established polymer called poly(lactic-co-glycolic acid), or PLGA, of three types: microparticles, electrospun matrices, and thin films. Analytical techniques, including loading efficiency analysis, Fourier Transform Infrared Spectroscopy, and Scanning Electron Microscopy imaging, confirmed the successful incorporation of EGCG in the PLGA scaffolds. In addition, a chemical conjugation of EGCG and PLGA was performed and supported using Differential Scanning Calorimetry. Cartilage cell studies were conducted with electrospun matrices infused with EGCG, wherein the increased hydrophilicity and decreased diameter of the fibers, that increased the surface area of the matrix, created a more favorable environment for cells to grow on. The cell studies showed that cartilage cells exhibited greater confluency on EGCG-PLGA electrospun matrices than on electrospun matrices of only PLGA. These results suggest that EGCG improves cartilage cell growth on PLGA scaffolds. Future studies will include assessing cartilage cell performance on electrospun matrices of EGCG-PLGA chemical conjugates.