WHEY PROTEIN ISOLATE HYDROGEL-BASED BIOMATERIALS

TIMOTHY E.L DOUGLAS[1,2]*

[1] ENGINEERING DEPT., LANCASTER UNIVERSITY, UK
[2] MATERIALS SCIENCE INSTITUTE (MSI), LANCASTER UNIVERSITY, UK
*E-MAIL: T.DOUGLAS@LANCASTER.AC.UK

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Introduction
Whey Protein Isolate (WPI) is a byproduct from the dairy industry whose main component is beta-lactoglobulin (β-LG). When added to cell culture medium, WPI has stimulated the proliferation and osteogenic differentiation of human-derived adipose stem cells and also osteoblastic cell lines [1,2].
Hence, we hypothesized that biomaterials fabricated from WPI would support cell growth.
Upon heating of a WPI solution, hydrogels form thanks to formation of crosslinks between β-LG molecules. Importantly, these hydrogels can be sterilized by autoclaving, an important practical advantage.
A range of cells have been successfully cultivated on WPI hydrogels in the concentration range 20-50% (w/v). Furthermore, it is possible to improve the biological performance of WPI hydrogels by incorporation of a mineral phase, e.g. by addition of particles of aragonite [3] or alpha-tricalcium phosphate (α-TCP) [4]. It is also possible to induce mineralization of WPI hydrogels with calcium and magnesium carbonates using urease [5] or with phosphates by using alkaline phosphatase (ALP) immobilized on particles to prevent heat denaturation. By adding other particles, such as carbon nanotubes (CNT), it is possible to impart antibacterial activity. Furthermore, it is possible to solubilize hydrophobic molecules with biological activity (e.g. polyphenols such as Tannic Acids (TAs), phenolic compounds like phloroglucinol (PG), the phenolic subunit of phlorotannins, which are polyphenols found in brown seaweeds) within the WPI hydrogel network to endow hydrogels with antimicrobial activity.
This work will summarize several of the strategies mentioned above.

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