Multi-disciplinary training environment for next generation hydrogel-based smart bio-interactive materials

Reporting

Project Information

NEOGEL

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Closed project

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Final Report Summary - NEOGEL (Multi-disciplinary training environment for next generation hydrogel-based smart bio-interactive materials)

NeoGel has trained 4 Early Stage Researcher (ESR) in the development of smart resorbable hydrogels as platform materials for tissue engineering. As these materials have potential to address a wide range of medical conditions, significant growth for the biomedical materials industry is forecast. To explore this opportunity and exploit the potential, highly-qualified and well-trained biomaterials experts are urgently required. NeoGel addresses this need by providing cross-disciplinary training to four ESRs in an exciting academia-industry collaboration focused on novel hydrogels.
During the NeoGel project 4 ESRs worked on individual projects in areas of novel hydrogels based on polypeptides, the NMR analysis of industrial hydrogels to elucidate network structures as well as novel nanoparticles incorporated hydrogels. In one project, detailed NMR supported structure property studies

provided new insights into how microscopic order/dynamics produce the emergent structural and release properties of industrially relevant hydrogels. The NMR results were correlated with material properties and that information was used to guide the development of next generation gels. The properties of the materials prepared are currently being considered for industrial applications at DSM, and the methodological innovations developed are being applied more generally in the study of other hydrogels.
In another project the incorporation of magnetic nanoparticles in industrially relevant hydrogels was investigated to obtain magnetically responsive gels. Protocols for the fabrication of suitable magnetic particles as well as modification of their surface chemistry to facilitate enhanced interaction with the hydrogel were successfully developed. These could be incorporated into acrylic hydrogels. It is envisaged that the expertise generated will support the development of novel responsive hydrogels for the release of active ingredients (e.g. drugs) triggered by an external magnetic field.
Polypeptide hydrogels were successfully developed in another project. First generation gels based on polypeptide tyrosine cross-linking suffered from low reactivity and only weak hydrogels were obtained. This was overcome by the design of polypeptide tryptophan materials, which could be efficiently cross-linked and afford mechanically more stable and biocompatible hydrogels. The methodology was applied in the design of macroscopic polypeptide hybrid gels comprising a hydrophobic core and a hydrophilic poly(lysine) hydrogel shell. These materials are envisaged for dual release devices combining hydrophobic and hydrophilic drugs.
Finally, a new route to polypeptide synthesis by UV-initiation was developed. This allowed the clean synthesis of polypeptide hydrogel pre-cursors with high structural control. Proof of concept was obtained for the feasibility of this approach for the surface decoration of planar and particulate materials.
All ESRs have gained significant experience through long-term placement in industry advancing their individual projects as well as contributing to their career development by private sector experience. Moreover, dissemination of project results in scientific publications and at conferences increased the visibility of the ESRs and the NeoGel project.

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