Preparation and Characterization of an Oral Vaccine Formulation Using Electrosprayed Chitosan Microparticles

Chitosan particles loaded with the antigen ovalbumin (OVA) and the adjuvant Quil-A were produced by electrospray, using mixtures of water/ethanol/acetic acid as a solvent. Three different chitosans designed as HMC+70, HMC+85, and HMC+90 (called as 705010, 855010, and 905010) were tested and its efficacy to be used in oral vaccine delivery applications was investigated. The morphology, size, and zeta potential of the produced particles were investigated, together with the encapsulation efficiency and release of OVA from the three chitosan formulations. Moreover, the mucoadhesion and cytotoxicity of the chitosan microparticles was examined. All the three formulations with OVA and Quil-A were in the micrometer size range and had a positive zeta potential between 46 and 75 mV. Furthermore, all the three formulations displayed encapsulation efficiencies above 80% and the release of OVA over a period of 80 h was observed to be between 38 and 47%. None of the developed formulations exhibited high mucoadhesive properties, either cytotoxicity. The formulation prepared with HMC+70, OVA, and Quil-A had the highest stability within 2 h in buffer solution, as measured by dynamic light scattering. The electrosprayed formulation consisting of HMC+70 with OVA and Quil-A showed to be the most promising as an oral vaccine system.
Biopolymers for the Nano-microencapsulation of Bioactive Ingredients by Electrohydrodynamic Processing

Electrohydrodynamic processing, including electrospinning and electrospraying, is an emerging technique for the encapsulation of bioactive ingredients (e.g. omega-3, vitamins, antioxidants, probiotics) with interest for the functional food industry. This chapter presents the fundamentals of electrohydrodynamic processes for the production of nano-microstructures (fibers or capsules) loaded with bioactive compounds. Particularly, it focuses on the properties as well as electrospinning and electrospray processing of food-grade polymers. The physicochemical characteristics of the resulting nano-microencapsulates will also be discussed. Electrospun and electrospray food-grade polymers include biopolymers such as proteins (e.g. zein, gelatin, whey, casein, amaranth, soy, egg and fish protein) and polysaccharides (e.g. pullulan, dextran, chitosan, starch, alginate, cellulose, cyclodextrin, xanthan gum), as well as blends of biopolymers with biocompatible synthetic polymers (e.g. poly-vinyl alcohol).

General information
State: Published
Organisations: National Food Institute, Research Group for Bioactives – Analysis and Application, Research Group for Nano-Bio Science
Contributors: García Moreno, P. J., Mendes, A. C. L., Jacobsen, C., Chronakis, I. S.
Pages: 447-479
Publication date: 2018

Host publication information
Title of host publication: Polymers for Food Applications
Publisher: Springer
Editor: T. J. G.
ISBN (Print): 978-3-319-94624-5
ISBN (Electronic): 978-3-319-94625-2
Bladder biomechanics and the use of scaffolds for regenerative medicine in the urinary bladder

The urinary bladder is a complex organ with the primary functions of storing urine under low and stable pressure and micturition. Many clinical conditions can cause poor bladder compliance, reduced capacity, and incontinence, requiring bladder augmentation or use of regenerative techniques and scaffolds. To replicate an organ that is under frequent mechanical loading and unloading, special attention towards fulfilling its biomechanical requirements is necessary. Several biological and synthetic scaffolds are available, with various characteristics that qualify them for use in bladder regeneration in vitro and in vivo, including in the treatment of clinical conditions. The biomechanical properties of the native bladder can be investigated using a range of mechanical tests for standardized assessments, as well as mathematical and computational bladder biomechanics. Despite a large body of research into tissue engineering of the bladder wall, some features of the native bladder and the scaffolds used to mimic it need further elucidation. Collection of comparable reference data from different animal models would be a helpful tool for researchers and will enable comparison of different scaffolds in order to optimize characteristics before entering preclinical and clinical trials.

General information

State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science, Karolinska Institutet, Uppsala University
Contributors: Ajalloueian, F., Lemon, G., Hilborn, J., Chronakis, I. S., Fossum, M.
Pages: 155-174
Publication date: 2018
Peer-reviewed: Yes

Publication information

Volume: 15
Issue number: 3
ISSN (Print): 1759-4812
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.85 SJR 1.581 SNIP 2.006
Web of Science (2017): Impact factor 8.089
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.64 SJR 1.427 SNIP 1.581
Web of Science (2016): Impact factor 7.735
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.6 SJR 1.305 SNIP 1.243
Web of Science (2015): Impact factor 5.957
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.46 SJR 1.166 SNIP 1.099
Web of Science (2014): Impact factor 4.84
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.66 SJR 1.008 SNIP 1.047
Web of Science (2013): Impact factor 4.522
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.64 SJR 0.798 SNIP 0.79
Web of Science (2012): Impact factor 4.793
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.51 SJR 0.659 SNIP 0.62
Web of Science (2011): Impact factor 4.415
Scopus rating (2010): SJR 0.577 SNIP 0.679
Bladder wall biomechanics: A comprehensive study on fresh porcine urinary bladder

Regenerative medicine for reconstructive urogenital surgery has been widely studied during the last two decades. One of the key factors affecting the quality of bladder regeneration is the mechanical properties of the bladder scaffold. Insight into the biomechanics of this organ is expected to assist researchers with functional regeneration of the bladder wall. Due to extensive similarities between human bladder and porcine bladder, and with regard to lack of comprehensive biomechanical data from the porcine bladder wall (BW), our main goal here was to provide a thorough evaluation on viscoelastic properties of fresh porcine urinary BW. Three testing modes including Uniaxial tensile, Ball-burst (BB) and Dynamic Mechanical Analyses (DMA) were applied in parallel. Uniaxial tests were applied to study how different circumferential and longitudinal cut-outs of lateral region of BW behave under load. DMA was used to measure the viscoelastic properties of the bladder tissue (storage and loss modulus) tested in a frequency range of 0.1 to 3 Hz. BB was selected as a different technique replicating normal physiological conditions where the BW is studied in whole. According to uniaxial tests, the anisotropic behavior of bladder was evident at strain loads higher than 200%. According to DMA, storage modulus was found to be consistently higher than loss modulus in both directions, revealing the elasticity of the BW. The stress-strain curves of both uniaxial and BB tests showed similar trends. However, the ultimate stress measured from BB was found to be around 5 times of the relevant stress from uniaxial loading. The ultimate strain in BB (389.9 ± 59.8) was interestingly an approximate average of longitudinal (358 ± 21) and circumferential (435 ± 69) rupture strains. Considering that each testing mode applied here reveals distinct information, outcomes from the combination of the three can be considered as a helpful data-base to refer to for researchers aiming to regenerate the bladder.

General information
State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science, Research Group for Food Production Engineering, University of Copenhagen
Contributors: Sami Jokandan, M., Ajalloueian, F., Edinger, M., Stubbe, P. R., Baldursdottir, S., Chronakis, I. S.
Pages: 92-103
Publication date: 2018
Peer-reviewed: Yes

Publication information
Journal: Journal of the Mechanical Behavior of Biomedical Materials
Volume: 79
ISSN (Print): 1751-6161
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 3.49 SJR 0.958 SNIP 1.426
Web of Science (2017): Impact factor 3.239
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.33 SJR 0.917 SNIP 1.404
Web of Science (2016): Impact factor 3.11
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 3.28 SJR 1.089 SNIP 1.496
Web of Science (2015): Impact factor 2.876
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 3.55 SJR 1.103 SNIP 1.82
Composite nanofibers/water photosplitting and photocatalytic degradation of dairy effluent

Photocatalytic removal of Dairy effluent (DE) was studied using TiO2-GeO2 and TiO2-CdO nanofibers (NFs), produced by electrospinning method. These NFs were characterized by SEM, TEM and XRD studies. The TiO2-GeO2 and TiO2-CdO NFs were smooth and continuous, with an average diameter of about 273 nm and 256 nm respectively, and held their nanofibrous morphology even after more than 9 h of photocatalytic removal of DE under visible light irradiation. TiO2-GeO2 and TiO2-CdO NFs were effective materials for removal of DE, even after many runs and cycles. TiO2-GeO2 and TiO2-CdO NFs showed a maximum removal of 65% and 75%, respectively, after 3 h. The TiO2-GeO2 and TiO2-CdO NFs also showed excellent results in hydrogen release.
Scopus rating (2016): CiteScore 3.78 SJR 1.024 SNIP 1.4
Web of Science (2016): Impact factor 3.359
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 3.75 SJR 1.07 SNIP 1.499
Web of Science (2015): Impact factor 3.299
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.5 SJR 1.261 SNIP 1.532
Web of Science (2014): Impact factor 3.091
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 3.62 SJR 1.327 SNIP 1.674
Web of Science (2013): Impact factor 3.065
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 3.2 SJR 1.394 SNIP 1.718
Web of Science (2012): Impact factor 2.894
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 3.48 SJR 1.352 SNIP 1.633
Web of Science (2011): Impact factor 2.921
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.386 SNIP 1.58
Web of Science (2010): Impact factor 2.775
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.386 SNIP 1.536
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.108 SNIP 1.426
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.959 SNIP 1.439
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.218 SNIP 1.657
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.006 SNIP 1.432
Scopus rating (2004): SJR 1.035 SNIP 1.343
Scopus rating (2003): SJR 0.85 SNIP 1.092
Scopus rating (2002): SJR 0.919 SNIP 1.022
Scopus rating (2001): SJR 0.59 SNIP 0.993
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.238 SNIP 0.671
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 0.459 SNIP 1.084
Original language: English
Keywords: Electrospinning, Dairy effluent, Nanofibers, Photodegradation, Water photosplitting
DOIs:
10.1016/j.seppur.2017.10.015
Source: FindIt
Source-ID: 2391894537
Compressed collagen constructs with optimized mechanical properties and cell interactions for tissue engineering applications

In this study, we are introducing a simple, fast and reliable add-in to the technique of plastic compression (PC) to obtain collagen sheets with decreased fibrillar densities, representing improved cell-interactions and mechanical properties. Collagen hydrogels with different initial concentrations (1.64mg/mL-0.41mg/mL) were compressed around an electrospun sheet of PLGA. The scaffolds were then studied as non-seeded, or seeded with 3T3 fibroblast cells and cultured for 7 days. Confocal microscopy and TEM imaging of non-seeded scaffolds showed that by decreasing the share of collagen in the hydrogel formula, collagen sheets with similar thickness but lower fibrous densities were achieved. Nanomechanical characterization of compressed collagen sheets by AFM showed that Young's modulus was inversely proportional to the final concentration of collagen. Similarly, according to SEM, MTS, and cell nuclei counting, all the scaffolds supported cell adhesion and proliferation, whilst the highest metabolic activities and proliferation were seen in the scaffolds with lowest collagen content in hydrogel formula. We conclude that by decreasing the collagen content in the formula of collagen hydrogel for plastic compression, not only a better cell environment and optimum mechanical properties are achieved, but also the application costs of this biopolymer is reduced.

General information
State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science, Department of Mechanical Engineering, Materials and Surface Engineering, Isfahan University of Technology, Karolinska Institutet
Contributors: Ajalloueian, F., Nikogeorgos, N., Ajalloueian, A., Fossum, M., Lee, S., Chronakis, I. S.
Pages: 158-166
Publication date: 2018
Peer-reviewed: Yes

Publication information
Journal: International Journal of Biological Macromolecules
Volume: 108
ISSN (Print): 0141-8130
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 4.11 SJR 0.917 SNIP 1.307
Web of Science (2017): Impact factor 3.909
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.84 SJR 0.882 SNIP 1.294
Web of Science (2016): Impact factor 3.671
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 3.38 SJR 0.808 SNIP 1.303
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 3.13 SJR 0.864 SNIP 1.32
Web of Science (2014): Impact factor 2.858
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 3.48 SJR 0.848 SNIP 1.431
Web of Science (2013): Impact factor 3.096
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.77 SJR 0.787 SNIP 1.302
Web of Science (2012): Impact factor 2.596
ISI indexed (2012): ISI indexed yes
Crosslinking of milk proteins by microbial transglutaminase: Utilization in functional yogurt products

Key modifying roles of microbial transglutaminase (MTGase) in the development of innovative probiotic and non-probiotic yogurts with improved functional and quality characteristics have been comprehensively reviewed. MTGase crosslinking reactions with milk proteins stabilize the three-dimensional structure of yogurt. Yogurts treated with MTGase showed decreased syneresis, increased water-holding capacity and viscosity, homogeneous structure, desired texture, and physicochemical high stability during storage time. The utilization of MTGase does not affect negatively the sensory attributes of yogurt. Inclusion of MTGase into acidified yogurt drinks reduces the serum separation with an improved viscoelasticity. This multi-functional enzyme also protects the viable starter and probiotic cells in yogurts. Further studies are required to assess the viability of probiotics in yogurts protected using MTGase-mediated microcapsules.
Development of electrosprayed mucoadhesive chitosan microparticles

The efficacy of chitosan (CS) to be used as drug delivery carrier has previously been reported. However, limited work has been pursued to produce stable and mucoadhesive CS electrosprayed particles for oral drug delivery, which is the aim of this study. Various CS types with different molecular weight (MW), degree of deacetylation (DD), and degree of polymerization (DP) were assessed. In addition, the effect of the solvent composition was also investigated. Results showed that stable CS electrosprayed particles can be produced by dissolving 3% w/v of low MW CS in mixtures of aqueous acetic acid and ethanol (50/50% v/v). The stable CS particles displayed diameters of approximately 1 μm as determined by dynamic light scattering. The zeta potential of these particles was found to be approximately 40 mV confirming the mucoadhesion properties of these CS electrosprayed particles and its potential to be used as drug delivery carrier.

General information
State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science, Department of Micro- and Nanotechnology, Nanoprobes, University of Münster
Contributors: Moreno, J. A. S., Mendes, A. C., Stephansen, K., Engwer, C., Goycoolea, F. M., Boisen, A., Nielsen, L. H., Chronakis, I. S.
Pages: 240-247
Publication date: 2018
Peer-reviewed: Yes

Publication information
Journal: Carbohydrate Polymers
Volume: 190
ISSN (Print): 0144-8617
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 5.58 SJR 1.428 SNIP 1.733
Web of Science (2017): Impact factor 5.158
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 5.15 SJR 1.419 SNIP 1.75
Web of Science (2016): Impact factor 4.811
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 4.86 SJR 1.44 SNIP 1.819
Web of Science (2015): Impact factor 4.219
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 4.69 SJR 1.587 SNIP 1.955
Electrospun Xanthan gum-Chitosan nanofibers as delivery carrier of hydrophobic bioactives

Viscoelastic gels of xanthan gum-chitosan (X-Ch) were electrospun to produce nanofibers, stable in aqueous media, for the encapsulation and release of curcumin (Cu). After 120h, the nanofibers released lower amount of curcumin (~20%) at pH 2.2 comparatively to the release in neutral media (~50%), suggesting that X-Ch nanofibers could be used as a carrier for the encapsulation of hydrophobic bioactive compounds with long-term pH-stimulated release properties.

General information
State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science, Danish National Metrology Institute
Contributors: Shekarforoush, E., Ajalloueian, F., Zeng, G., Mendes, A. C. L., Chronakis, I. S.
Pages: 322-326
Fabrication, characterization, and biocompatibility assessment of a novel elastomeric nanofibrous scaffold: A potential scaffold for soft tissue engineering

With regard to flexibility and strength properties requirements of soft biological tissue, elastomeric materials could be more beneficial in soft tissue engineering applications. The present work investigates the use of an elastic polymer, (polycaprolactone fumarate [PCLF]), for fabricating an electrospun scaffold. PCLF with number-average molecular weight of 13,284 g/mol was synthesized, electrospun PCLF:polycaprolactone (PCL) (70:30) nanofibrous scaffolds were fabricated and a novel strategy (in situ photo-crosslinking along with wet electrospinning) was applied for crosslinking of PCLF in the structure of PCLF:PCL nanofibers was presented. Sol fraction results, Fourier-transform infrared spectroscopy, and mechanical tests confirmed occurrence of crosslinking reaction. Strain at break and Young's modulus of crosslinked PCLF:PCL nanofibers fabricated was found to be 114.5±3.9% and 0.6±0.1 MPa, respectively, and dynamic mechanical analysis results revealed elasticity of nanofibers. MTS assay showed biocompatibility of PCLF:PCL (70:30) nanofibrous scaffolds. Our overall results showed that electrospun PCLF:PCL nanofibrous scaffold could be considered as a candidate for further in vitro and in vivo experiments and its application for engineering of soft tissues subjected to in vivo cyclic mechanical stresses.

General information
State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science, Isfahan University of Technology
Contributors: Shamirzaei Jeshvaghani, E., Ghasemi-Mobarakeh, L., Mansurnezhad, R., Ajalloueian, F., Kharaziha, M., Dinari, M., Sami Jokandan, M., Chronakis, I. S.
Number of pages: 13
Pages: 2371-2383
Publication date: 2018
Peer-reviewed: Yes

Publication information
Volume: 106
Issue number: 6
ISSN (Print): 1552-4973
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.8 SJR 0.715 SNIP 0.958
Web of Science (2017): Impact factor 3.373
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.69 SJR 0.745 SNIP 1.049
Web of Science (2016): Impact factor 3.189
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.74 SJR 0.868 SNIP 1.15
Web of Science (2015): Impact factor 2.881
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.82 SJR 0.793 SNIP 1.218
Web of Science (2014): Impact factor 2.759
Web of Science (2014): Indexed yes
Immobilization of silk fibroin on the surface of PCL nanofibrous scaffolds for tissue engineering applications

Poly(ɛ-caprolactone) (PCL) is explored in tissue engineering (TE) applications due to its biocompatibility, processability, and appropriate mechanical properties. However, its hydrophobic nature and lack of functional groups in its structure are major drawbacks of PCL-based scaffolds limiting appropriate cell adhesion and proliferation. In this study, silk fibroin (SF) was immobilized on the surface of electrospun PCL nanofibers via covalent bonds in order to improve their hydrophilicity. To this end, the surface of PCL nanofibers was activated by ultraviolet (UV)–ozone irradiation followed by carboxylic functional groups immobilization on their surface by their immersion in acrylic acid under UV radiation and final immersion in SF solution. Furthermore, morphological, mechanical, contact angle, and Attenuated total reflection- Fourier transform infrared (ATR-FTIR) were measured to assess the properties of the surface-modified PCL nanofibers grafted with SF. ATR-FTIR results confirmed the presence of SF on the surface of PCL nanofibers. Moreover, contact angle measurements of the PCL nanofibers grafted with SF showed the contact angle of zero indicating high hydrophilicity of modified nanofibers. In vitro cell culture studies using NIH 3T3 mouse fibroblasts confirmed enhanced cytocompatibility, cell adhesion, and proliferation of the SF-treated PCL nanofibers.

General information
State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science, Colloids and Biological Interfaces, Isfahan University of Technology
Number of pages: 8
Publication date: 2018
Peer-reviewed: Yes

Publication information
Journal: Journal of Applied Polymer Science
Volume: 135
Article number: 46684
ISSN (Print): 0021-8995
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.87 SJR 0.543 SNIP 0.742
Web of Science (2017): Impact factor 1.901
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.73 SJR 0.588 SNIP 0.792
Web of Science (2016): Impact factor 1.86
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.74 SJR 0.587 SNIP 0.846
Web of Science (2015): Impact factor 1.866
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.76 SJR 0.664 SNIP 0.972
Web of Science (2014): Impact factor 1.768
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.71 SJR 0.629 SNIP 1.085
Web of Science (2013): Impact factor 1.64
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.57 SJR 0.657 SNIP 1.075
Web of Science (2012): Impact factor 1.395
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.45 SJR 0.604 SNIP 0.969
Web of Science (2011): Impact factor 1.289
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.685 SNIP 0.913
Web of Science (2010): Impact factor 1.24
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.701 SNIP 0.824
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.652 SNIP 0.821
Scopus rating (2007): SJR 0.675 SNIP 0.924
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.783 SNIP 1.131
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.778 SNIP 0.896
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.775 SNIP 0.951
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.82 SNIP 1.057
Web of Science (2003): Indexed yes
In vitro permeability enhancement of curcumin across Caco-2 cells monolayers using electrospun xanthan-chitosan nanofibers

Xanthan-Chitosan (X-Ch) polysaccharides nanofibers were prepared using electrospinning processing as an encapsulation and delivery system of curcumin (Cu). The X-Ch-Cu nanofibers remained stable in aqueous HBSS medium at pH 6.5 and pH 7.4, mainly due to the ability of oppositely charged xanthan-chitosan polyelectrolytes to form ioni-}

cally associated electrospun nanofibers. The xanthan-chitosan-curcumin nanofibers were incubated with Caco-2 cells, and the cell viability, transepithelial transport and permeability properties across cell monolayers were investigated. After 24 h of incubation, the exposure of Caco-2 cell monolayers to X-Ch-Cu nanofibers resulted in a cell viability of ~80%. A 3.4-fold increase of curcumin permeability was observed when the polyphenol was loaded into X-Ch nanofibers, compared to the free curcumin. This increased in vitro transepithelial permeation of curcumin without compromising cellular viability was induced by interactions upon contact between the nanofibers and the Caco-2 cells, leading to the opening of the tight junctions. The results obtained revealed that X-Ch nanofibers can be used for oral delivery applications of poorly water-soluble compounds at the gastrointestinal tract.

General information
State: Accepted/In press
Organisations: National Food Institute, Research Group for Nano-Bio Science
Contributors: Faralli, A., Shekarforoush, E., Ajalloueian, F., Mendes, A. C. L., Chronakis, I. S.
Publication date: 2018
Peer-reviewed: Yes

Publication information
Journal: Carbohydrate Polymers
ISSN (Print): 0144-8617
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 5.58 SJR 1.428 SNIP 1.733
Web of Science (2017): Impact factor 5.158
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 5.15 SJR 1.419 SNIP 1.75
Web of Science (2016): Impact factor 4.811
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 4.86 SJR 1.44 SNIP 1.819
Web of Science (2015): Impact factor 4.219
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 4.69 SJR 1.587 SNIP 1.955
Web of Science (2014): Impact factor 4.074
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 4.39 SJR 1.346 SNIP 1.945
Microbial Transglutaminase in Noodle and Pasta Processing

Nowadays, there is an aggressive rate in consumption of noodles and pasta products throughout the world. Consumer acceptability and preference of these functional products can be promoted by the discovery of novel knowledge to improve their formulation and quality. The development of fortified-formulations for noodles and pasta products based on microbial transglutaminase (MTGase) can guarantee the shelf life extension with minimum quality losses. The current review focuses on recent trends and future prospects of MTGase utilization in the structural matrix of noodles and pasta products and represents the quality changes of cooking loss, texture, microstructure, color and sensory attributes of the MTGase-incorporated products. Digestibility, nutritional and health aspects of the MTGase-enriched formulations are also reviewed with a vision toward physical functions and safety outcomes of MTGases isolated from new microbial sources. The high potential of MTGase in developing commercial noodles and pasta products is successfully demonstrated. MTGase by modifying the crystallinity or molecular structure via covalent crosslinks between protein molecules strengthens the doughs stability and the textural characteristics of final products with the low- or high-protein flour. Compared with the control samples, the MTGase-supplemented products indicate slower digestion rates and better sensory and cooking properties without any remarkable color instability.
Mineralization of gellan gum hydrogels with calcium and magnesium carbonates by alternate soaking in solutions of calcium/magnesium and carbonate ion solutions

Mineralization of hydrogels is desirable prior to applications in bone regeneration. CaCO3 is a widely used bone regeneration material and Mg, when used as a component of calcium phosphate biomaterials, has promoted bone-forming cell adhesion and proliferation and bone regeneration. In this study, gellan gum (GG) hydrogels were mineralized with carbonates containing different amounts of calcium (Ca) and magnesium (Mg) by alternate soaking in, firstly, a calcium and/or magnesium ion solution and, secondly, a carbonate ion solution. This alternate soaking cycle was repeated five times. Five different calcium and/or magnesium ion solutions, containing different molar ratios of Ca to Mg ranging from Mg-free to Ca-free were compared. Carbonate mineral formed in all sample groups subjected to the Ca:Mg elemental ratio in the carbonate mineral formed was higher than in the respective mineralizing solution. Mineral formed in the absence of Mg was predominantly CaCO3 in the form of a mixture of calcite and vaterite. Increasing the Mg content in the mineral formed led to the formation of magnesian calcite, decreased the total amount of the mineral formed and its crystallinity. Hydrogel mineralization and increasing Mg content in mineral formed did not obviously improve proliferation of MC3T3-E1 osteoblast-like cells or differentiation after 7 days.

General information
State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science, Université de Lille, AGH University of Science and Technology, Ghent University, Institute for Chemical Processing of Coal (ICHPW)
Pages: 1825-1834
Publication date: 2018
Peer-reviewed: Yes
Morphological, Mechanical and Mucoadhesive Properties of Electrospun Chitosan/Phospholipid Hybrid Nanofibers
This study aimed to develop hybrid electrospun chitosan–phospholipid nanofibers and investigate the effect of phospholipid (P) content and chitosans (Ch) molecular weights (Mw) and degree of acetylation (DA), on the morphological, mechanical and mucoadhesive properties of the nanofibers. Electrospun Ch/P nanofibers exhibited a smooth and uniform surface with average diameters ranging from 300 to 1000 nm, as observed by scanning electron microscopy (SEM). The average diameter of the nanofibers was observed to increase with the increase of the Mw and degree of deacetylation of Ch, and phospholipid content. The elastic and adhesive properties of the nanofibers were determined by atomic force microscopy, and displayed higher values for higher Mw and lower DA Ch used. The elastic modulus of electrospun Ch/P hybrid fibers determined for the different conditions tested was found to be in the range of 500 and 1400 MPa. Furthermore, electrospun Ch/P nanofibers displayed mucoadhesive properties expressed by the work of adhesion calculated after the compression of the nanofibers against a section of pig small intestine. Our results showed that the increase in phospholipid content and DA of Ch decrease the work of adhesion, while the increase of Mw resulted in slightly higher work of adhesion of the nanofibers.

General information
State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science, Department of Micro- and Nanotechnology, Nanoprobes, Aarhus University, Lancaster University
Number of pages: 16
Publication date: 2018
Peer-reviewed: Yes

Publication information
Journal: International Journal of Molecular Sciences
Volume: 19
Issue number: 8
Article number: 2266
ISSN (Print): 1661-6596
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 3.86 SJR 1.26 SNIP 1.124
Physicochemical characterization and oxidative stability of fish oil-loaded electrospayed capsules: Combined use of whey protein and carbohydrates as wall materials

The encapsulation of fish oil in electrospayed capsules using whey protein and carbohydrates (pullulan and dextran or glucose syrup) mixtures as glassy wall materials was studied. Capsules with fish oil emulsified by using only a rotor-stator emulsification exhibited higher oxidative stability than capsules where the oil was emulsified by high-pressure.
homogenization. Moreover, glucose syrup capsules (with a peroxide value, PV, of 19.7±4.4 meq/kg oil and a content of 1-penten-3-ol of 751.0±69.8ng/g oil) were less oxidized than dextran capsules after 21 days of storage at 20°C (PV of 24.9±0.4 meq/kg oil and 1-penten-3-ol of 1161.0±222.0ng/g oil). This finding may be attributed to differences in oxygen permeability between both types of capsules. These results indicated the potential of both combinations of whey protein, pullulan, and dextran or glucose syrup as shell materials for the encapsulation of omega-3 PUFA in nano-microcapsules obtained by electrospraying.
Hydrogels mineralized with calcium phosphate (CaP) are increasingly popular bone regeneration biomaterials. Mineralization can be achieved by phosphatase enzyme incorporation and incubation in calcium glycerophosphate (CaGP). Gellan gum (GG) hydrogels containing the enzyme phytase and chitosan oligomer were mineralized in CaGP solution and characterized with human osteoblast-like MG63 cells and adipose tissue-derived stem cells (ADSC). Phytase-induced CaP formation. Chitosan concentration determined mineralization extent and hydrogel mechanical reinforcement. Phytase-induced mineralization promoted MG63 adhesion and proliferation, especially in the presence of chitosan, and was non-toxic to MG63 cells (with and without chitosan). ADSC adhesion and proliferation were poor without mineralization. Chitosan did not affect ADSC osteogenic differentiation.

**General information**

State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science, Czech Academy of Sciences, Ghent University
Number of pages: 4
Pages: 186-189
Publication date: 2018
Peer-reviewed: Yes
In this study, a composite of poly (ethylene terephthalate) (PET) fabric and soy protein isolate (SPI) hydrogel loaded with gabapentin was developed. For covalent attachment of SPI on the surface of PET fabric, graft polymerization of acrylic acid (AA) on the surface of PET fabric was performed and then carboxyl groups available in the structure of AA were activated using EDAC and then SPI was coated on the surface of PET fabric. The results revealed appropriate connection between hydrogel and modified fabric. The hydrogel was characterized by swelling test and the drug release behavior was investigated. It was found that the casting temperature affects the swelling ratio of the hydrogel and an appropriate release...
profile of the drug was observed. The surface of fabric was characterized by contact angle measurement, electron microscopy, and infrared spectroscopy. In vitro cell culture study was performed using NIH 3T3 mouse fibroblasts to investigate the biocompatibility of final composite and MTS results along with morphology of cells on the surface of PET fabric coated with SPI revealed the biocompatibility of final product and no cell cytotoxicity was observed in modified PET fabric.

**General information**
State: Accepted/In press
Organisations: National Food Institute, Research Group for Nano-Bio Science, Isfahan University of Technology
Contributors: Norouzi, M., Ghasemi-Mobarakeh, L., Gharibi, H., Meamar, R., Ajalloueian, F., Chronakis, I. S.
Number of pages: 9
Publication date: 2018
Peer-reviewed: Yes

**Publication information**
Journal: International Journal of Polymeric Materials and Polymeric Biomaterials
ISSN (Print): 0091-4037
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.88 SJR 0.489 SNIP 0.593
Web of Science (2017): Impact factor 2.127
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.47 SJR 0.401 SNIP 0.545
Web of Science (2016): Impact factor 1.515
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.63 SJR 0.427 SNIP 0.718
Web of Science (2015): Impact factor 1.667
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.78 SJR 0.79 SNIP 1.113
Web of Science (2014): Impact factor 3.568
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.41 SJR 0.827 SNIP 1.167
Web of Science (2013): Impact factor 2.784
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.62 SJR 0.695 SNIP 1.038
Web of Science (2012): Impact factor 1.865
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.03 SJR 0.374 SNIP 0.854
Web of Science (2011): Impact factor 1.204
ISI indexed (2011): ISI indexed no
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.261 SNIP 0.469
Web of Science (2010): Impact factor 0.458
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.289 SNIP 0.419
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.22 SNIP 0.497
Scopus rating (2007): SJR 0.197 SNIP 0.403
Scopus rating (2006): SJR 0.216 SNIP 0.347
Scopus rating (2005): SJR 0.265 SNIP 0.465
Use of Electrohydrodynamic Processing for Encapsulation of Sensitive Bioactive Compounds and Applications in Food

The use of vitamins, polyphenolic antioxidants, omega-3 polyunsaturated fatty acids (PUFAs), and probiotics for the fortification of foods is increasing. However, these bioactive compounds have low stability and need to be protected to avoid deterioration in the food system itself or in the gastrointestinal tract. For that purpose, efficient encapsulation of the compounds may be required. Spray drying is one of the most commonly used encapsulation techniques in the food industry, but it uses high temperature, which can lead to decomposition of the bioactive compounds. Recently, alternative technologies such as electrospaying and electrospinning have received increasing attention. This review presents the principles of electrohydrodynamic processes for the production of nano-microstructures (NMSs) containing bioactive compounds. It provides an overview of the current use of this technology for encapsulation of bioactive compounds and discusses the future potential of the technology. Finally, the review discusses advanced microscopy techniques to study the morphology of NMSs.
Utilizing cocoyam (Xanthosoma sagittifolium) for food and nutrition security: A review

The critical role of indigenous crops in the socioeconomic growth of developing nations has necessitated calls for accelerated exploitation of staples. Cocoyam, Xanthosoma sagittifolium, is food for over 400 million people worldwide and is the most consumed aroid in West Africa. However, it remains an underexploited food resource. This study reviews existing literature and also makes use of primary data from interviews with indigenous cocoyam farmers, processors, consumers, and cocoyam scientists in the research Institutes of Ghana, to provide insight into existing nomenclature of the species, indigenous knowledge on food uses, nutritional value, and potential novel food applications of cocoyam. Adaptable technologies in conformity to new trends in food science that could be employed for in-depth molecular studies and further exploitation of the crop are also discussed. It is envisaged that the provided information would contribute to global efforts aimed at exploiting the full potential of indigenous crops for sustainable food and nutrition security.

General information

State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science, Kwame Nkrumah University of Science and Technology, University of Iceland, Technical University of Denmark
Contributors: Boakye, A. A., Wireko-Manu, F. D., Oduro, I., Ellis, W. O., Gudjónsdóttir, M., Chronakis, I. S.
Number of pages: 11
Publication date: 2018
Peer-reviewed: Yes

Publication information

Journal: Food Science & Nutrition
ISSN (Print): 2048-7177
Ratings:
Web of Science (2018): Indexed yes
Scopus rating (2017): CiteScore 1.62 SJR 0.489 SNIP 0.892
Web of Science (2017): Impact factor 1.521
Web of Science (2017): Indexed yes
Scopus rating (2016): CiteScore 0.2 SJR 0.643 SNIP 0.922
Scopus rating (2015): SJR 0.327 SNIP 0.735
Web of Science (2015): Indexed yes
Scopus rating (2014): SJR 0.179 SNIP 1.011
ISI indexed (2013): ISI indexed no
Original language: English
Keywords: Adaptable technologies, Cocoyam, Food use, Xanthosoma sagittifolium
Electronic versions:
In press
DOIs:
10.1002/fsn3.602
Source: FindIt
Source-ID: 2397457631
Research output: Research - peer-review » Review – Annual report year: 2018

Characteristics of Xanthosoma sagittifolium roots during cooking, using physicochemical analysis, uniaxial compression, multispectral imaging and low field NMR spectroscopy

To effectively promote the industrial utilization of cocoyam (Xanthosoma sagittifolium) roots for enhanced food sustainability and security, there is a need to study their molecular, mechanical and physicochemical properties in detail. The physicochemical and textural characteristics of the red and white varieties of cocoyam roots were thus analysed by low field nuclear magnetic resonance relaxometry, multispectral imaging, uniaxial compression testing, and relevant physicochemical analysis in the current study. Both varieties had similar dry matter content, as well as physical and mechanical properties. However, up to four fast-interacting water populations were observed in the roots, dependent on the root variety and their degree of gelatinization during cooking. Changes in the relaxation parameters indicated weak
gelatinization of starch at approximately 80 °C in both varieties. However, shorter relaxation times and a higher proportion of restricted water in the white variety indicated that this variety was slightly more sensitive towards gelatinization. A strong negative correlation existed between dry matter and all multispectral wavelengths >800 nm, suggesting the potential use of that spectral region for rapid analysis of dry matter and water content of the roots. The small, but significant differences in the structural and gelatinization characteristics of the two varieties indicated that they may not be equally suited for further processing, e.g. to flours or starches. Processors thus need to choose their raw materials wisely dependent on the aimed product characteristics. However, the spectroscopic methods applied in the study were shown to be effective in assessing important quality attributes during cooking of the roots.

General information
State: Published
Organisations: National Food Institute, Research Group for Food Production Engineering, Research Group for Nano-Bio Science, Technical University of Denmark, University of Iceland, Kwame Nkrumah University of Science and Technology
Number of pages: 14
Pages: 2670-2683
Publication date: 8 Jul 2017
Peer-reviewed: Yes

Publication information
Journal: Journal of Food Science and Technology
Volume: 54
Issue number: 9
ISSN (Print): 0022-1155
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.93 SJR 0.689 SNIP 1.072
Web of Science (2017): Impact factor 1.797
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.43 SJR 0.585 SNIP 0.935
Web of Science (2016): Impact factor 1.262
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.08 SJR 0.483 SNIP 0.903
Web of Science (2015): Impact factor 1.241
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.34 SJR 0.627 SNIP 1.557
Web of Science (2014): Impact factor 2.203
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.55 SJR 0.523 SNIP 1.092
Web of Science (2013): Impact factor 2.024
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 0.71 SJR 0.386 SNIP 0.817
Web of Science (2012): Impact factor 1.123
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 0.51 SJR 0.345 SNIP 0.667
Web of Science (2011): Impact factor 0.498
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.32 SNIP 0.535
Web of Science (2010): Impact factor 0.477
BFI (2009): BFI-level 1
Bioinspired, biomimetic, double-enzymatic mineralization of hydrogels for bone regeneration with calcium carbonate

Hydrogels are popular materials for tissue regeneration. Incorporation of biologically active substances, e.g., enzymes, is straightforward. Hydrogel mineralization is desirable for bone regeneration. Here, hydrogels of Gellan Gum (GG), a biocompatible polysaccharide, were mineralized biomimetically with CaCO3 using a double enzymatic approach. The enzymes urease (U) and carbonic anhydrase (CA) were incorporated in GG hydrogels. Hydrogels were incubated in a mineralization solution containing U substrate (urea) and calcium ions. U converts urea to ammonia (which raises pH) and CO2. CA catalyses the reaction of CO2 with water to form HCO3−, which undergoes deprotonation to form CO32−, which react with Ca2+ to form insoluble CaCO3. All hydrogels containing U+CA were mineralized more with calcite and stiffer than hydrogels containing U. Mineralization with calcite promoted proliferation and spreading of osteoblast-like cells.
Biomechanical study of porcine urinary bladder wall: matter of isotropy or anisotropy

General information
State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science
Contributors: Ajalloueian, F., Sami Jokandan, M., Chronakis, I. S.
Development of carbohydrate-based nano-microstructures loaded with fish oil by using electrohydrodynamic processing

The encapsulation of fish oil in carbohydrate-based nanomicrostructures obtained by electrohydrodynamic processing was investigated. Solutions of pullulan 200 kDa (15 wt%) and dextran 70 kDa (25 wt%) presented appropriate properties (viscosity, surface tension and conductivity) to allow the formation of nano-microfibers and nano-microcapsules, respectively. Although dextran 70 kDa exhibited antioxidant properties in solution, their capsules produced at lab and pilot-plant scales showed a low oxidative stability both with emulsified and neat oil. Phase separation of solution and opened capsules indicated a poor interaction between dextran and fish oil, which suggested that further optimization of the electrospraying solution is necessary. On the contrary, pullulan solutions were optimized to work even at pilot-plant scale. In this case, in spite of the prooxidant effect of pullulan in solution, oxidatively stable pullulan fibers (PV = 12.3 ± 0.9 meq O2/kg and 15.5 ± 5.1 ng/g of 1-penten-3-ol) were obtained when oil was incorporated as neat oil and when producing batches during short time (30 or 10 min). This superior oxidative stability when compared to fibers with emulsified oil is mainly attributed to a higher fish oil entrapment and to the location of the oil in large bead-structures with a reduced specific surface area. These results indicated the feasibility of producing omega-3 nanodelivery systems by encapsulating fish oil in pullulan nano-microfibers using electrospinning processing.

General information
State: Published
Organisations: National Food Institute, Research Group for Bioactives – Analysis and Application, Research Group for Nano-Bio Science, Center for Electron Nanoscopy, Technical University of Denmark, CSIC
Contributors: García Moreno, P. J., Özdemir, N., Boutrup Stephansen, K., Mateiu, R. V., Echegoyend, Y., Lagaron, J., Chronakis, I. S., Jacobsen, C.
Pages: 273-285
Publication date: 2017
Peer-reviewed: Yes

Publication information
Journal: Food Hydrocolloids
Volume: 69
ISSN (Print): 0268-005X
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 5.25 SJR 1.991 SNIP 1.892
Web of Science (2017): Impact factor 5.089
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.1 SJR 2.03 SNIP 2.045
Web of Science (2016): Impact factor 4.747
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.53 SJR 1.802 SNIP 1.924
Web of Science (2015): Impact factor 3.858
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 5.21 SJR 2.232 SNIP 2.554
Web of Science (2014): Impact factor 4.09
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Development of fish oil-loaded nano-microcapsules by co-axial electrospraying: physical characterization and oxidative stability

General information
State: Published
Organisations: National Food Institute, Research Group for Bioactives – Analysis and Application, Research Group for Nano-Bio Science
Contributors: García Moreno, P. J., Chronakis, I. S., Jacobsen, C.
Number of pages: 1
Publication date: 2017
Peer-reviewed: Yes
Electronic versions:
Abstract_PJGarciaMoreno.pdf

Bibliographical note
Development of silk fibroin weft-knitted fabric for tissue engineering applications

General information
State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science, Isfahan University of Technology
Contributors: Khademolqorani, S., Ajalloueian, F., Chronakis, I. S., Tavanai, H.
Number of pages: 1
Publication date: 2017

Host publication information
Title of host publication: Book of Abstracts, Sustain 2017
Publisher: Technical University of Denmark (DTU)
Article number: H-14
Electronic versions:
SustainAbstracts2017c.compressed_96.pdf
Research output: Research - peer-review › Conference abstract in proceedings – Annual report year: 2017

Electrospinning of food proteins and polysaccharides
Nano-microfibrous structures of biopolymers with a wide range of compositions, morphologies, mechanical properties and bioactivities could be developed using electrospinning technology. This review focuses on the processing, properties, functionalization and potential applications of electrospun biopolymers. Biopolymers include proteins (gelatin, collagen, elastin, silk, soy zein, gliadin, hordein, amaranth, casein, wheat, whey, marine sources proteins), and polysaccharides (chitosan, starch, alginates, cellulose and cellulose derivatives, pullulan, dextran, cyclodextrins).

General information
State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science
Contributors: Mendes, A. C. L., Boutrup Stephansen, K., Chronakis, I. S.
Pages: 53-68
Publication date: 2017
Peer-reviewed: Yes

Publication information
Journal: Food Hydrocolloids
Volume: 68
ISSN (Print): 0268-005X
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 5.25 SJR 1.991 SNIP 1.892
Web of Science (2017): Impact factor 5.089
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.1 SJR 2.03 SNIP 2.045
Web of Science (2016): Impact factor 4.747
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.53 SJR 1.802 SNIP 1.924
Web of Science (2015): Impact factor 3.858
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 5.21 SJR 2.232 SNIP 2.554
Web of Science (2014): Impact factor 4.09
Web of Science (2014): Indexed yes
Electrospinning of Xanthan Polysaccharide

Electrospun pure xanthan polysaccharide nanofibers are prepared using formic acid as a solvent. Morphological studies by scanning electron microscopy show that uniform fibers with average diameters ranging from 128 ± 36.7 to 240 ± 80.7 nm are formed depending on the polysaccharide concentration (0.5 to 2.5 wt/vol%). The correlation between the concentration and the rheological properties of xanthan solutions, with the morphology of the nanofibers is investigated. At the polysaccharide concentrations where nanofiber formation is observed, an increase of the elastic modulus and first normal stress differences is observed. The typical “weak gel-like” and thixotropic properties known for aqueous xanthan solutions, are not observed for the xanthan solutions in formic acid. The Fourier transform infrared spectroscopic and circular dichroism studies verify that an esterification reaction takes place, where formic acid reacts with the pyruvic acid groups of xanthan. Hence, formate groups neutralize the pyruvic charges which in turn stabilize the helical conformation of xanthan. The results obtained from size-exclusion chromatography reveal a small difference in the molecular weight of the polysaccharide when dissolved in distilled water or in formic acid.

General information
State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science, Center for Nanostructured Graphene, Department of Micro- and Nanotechnology, Self-Organized Nanoporous Materials
Electrospun Phospholipid Fibers as Micro-Encapsulation and Antioxidant Matrices

Electrospun phospholipid (asolectin) microfibers were investigated as antioxidants and encapsulation matrices for curcumin and vanillin. These phospholipid microfibers exhibited antioxidant properties which increased after the encapsulation of both curcumin and vanillin. The total antioxidant capacity (TAC) and the total phenolic content (TPC) of curcumin/phospholipid and vanillin/phospholipid microfibers remained stable over time at different temperatures (refrigerated, ambient) and pressures (vacuum, ambient). ¹H-NMR confirmed the chemical stability of both encapsulated curcumin and vanillin within phospholipid fibers. Release studies in aqueous media revealed that the phenolic bioactives were released mainly due to swelling of the phospholipid fiber matrix over time. The above studies confirm the efficacy of electrospun phospholipid microfibers as encapsulation and antioxidant systems.

General information
State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science, Department of Chemistry, Organic Chemistry
Contributors: Shekarforoush, E., Mendes, A. C. L., Baj, V., Beeren, S. R., Chronakis, I. S.
Number of pages: 16
Publication date: 2017
Peer-reviewed: Yes

Publication information
Journal: Molecules
Volume: 22
Issue number: 10
Article number: 1708
ISSN (Print): 1420-3049
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 3.27 SJR 0.855 SNIP 1.146
Web of Science (2017): Impact factor 3.098
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.09 SJR 0.825 SNIP 1.257
Web of Science (2016): Impact factor 2.861
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.65 SJR 0.57 SNIP 1.164
Web of Science (2015): Impact factor 2.465
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.62 SJR 0.738 SNIP 1.3
Web of Science (2014): Impact factor 2.416
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.61 SJR 0.719 SNIP 1.268
Web of Science (2013): Impact factor 2.095
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
Electrospun Polymer Fiber Lasers for Applications in Vapor Sensing

A sensing approach based on laser emission from polymer fiber networks is presented. Poly(methyl methacrylate) (PMMA) fibers doped with a laser dye are fabricated by electrospinning. They form random loop resonators, which show laser emission upon optical pumping. The shift of the spectral position of the narrow lasing modes upon uptake of alcohol vapors (model vapors are methanol and ethanol) serves as sensor signal. Thus, the high sensitivity related to the spectral line shifts of cavity-based transducers can be combined with the fiber's large surface to volume ratio. The resulting optical sensors feature excellent sensing performance due to the large overlap (more than 80%) of light field and transducer. The shift of the laser modes results from the swelling of the polymer when exposed to solvent vapors. Due to distinctly different diffusion coefficients in polymers, the uptake dynamics reflected in the transient shift of the lasing peaks can be used to discriminate ethanol and methanol vapor in mixtures of them. The sensing mechanism is expected to be applicable to other solvent vapors that cause polymer swelling.

General information
State: Published
Organisations: Department of Micro- and Nanotechnology, National Food Institute, Research Group for Nano-Bio Science, Center for Nanostructured Graphene, Optofluidics, Karlsruhe Institute of Technology
Number of pages: 5
Publication date: 2017
Peer-reviewed: Yes
Electrostatic Self-Assembly of Polysaccharides into Nanofibers

In this study, the anionic polysaccharide Xanthan gum (X) was mixed with positively charged Chitosan oligomers (ChO), and used as building blocks, to generate novel nanofibers by electrostatic self-assembly in aqueous conditions. Different concentrations, ionic strength and order of mixing of both components were tested and observed to affect the diameter, which ranged from 100 to 500 nm, and morphology of the self-assembled nanofibers. The release of diclofenac, as model drug, from self-assembled xanthan-chitosan nanofibers was demonstrated, suggesting that these nanostructures can be used in applications within life sciences such as drug delivery.

General information

State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science, Westfälische Wilhelms-Universität Münster
Contributors: Mendes, A. C. L., Strohmenger, T., Goycoolea, F., Chronakis, I. S.
Number of pages: 7
Pages: 182-188
Publication date: 2017
Peer-reviewed: Yes
Enzymatic, urease-mediated mineralization of gellan gum hydrogel with calcium carbonate, magnesium-enriched calcium carbonate and magnesium carbonate for bone regeneration applications
Mineralization of hydrogel biomaterials is considered desirable to improve their suitability as materials for bone regeneration. Calcium carbonate (CaCO₃) has been successfully applied as a bone regeneration material, but hydrogel-CaCO₃ composites have received less attention. Magnesium (Mg) has been used as a component of calcium phosphate biomaterials to stimulate bone-forming cell adhesion and proliferation and bone regeneration in vivo, but its effect as a component of carbonate-based biomaterials remains uninvestigated. In the present study, gellan gum (GG) hydrogels were mineralized enzymatically with CaCO₃, Mg-enriched CaCO₃ and magnesium carbonate to generate composite biomaterials for bone regeneration. Hydrogels loaded with the enzyme urease were mineralized by incubation in mineralization media containing urea and different ratios of calcium and magnesium ions. Increasing the magnesium concentration decreased mineral crystallinity. At low magnesium concentrations calcite was formed, while at higher concentrations magnesian calcite was formed. Hydromagnesite (Mg₅(CO₃)₄(OH)₂.4H₂O) formed at high magnesium concentration in the absence of calcium. The amount of mineral formed and compressive strength decreased with increasing magnesium concentration in the mineralization medium. The calcium:magnesium elemental ratio in the mineral formed was higher than in the respective mineralization media. Mineralization of hydrogels with calcite or magnesian calcite promoted adhesion and growth of osteoblast-like cells. Hydrogels mineralized with hydromagnesite displayed higher cytotoxicity. In conclusion, enzymatic mineralization of GG hydrogels with CaCO₃ in the form of calcite successfully reinforced hydrogels and promoted osteoblast-like cell adhesion and growth, but magnesium enrichment had no definitive positive effect. Copyright © 2017 John Wiley & Sons, Ltd.
Gastric mucus and mucuslike hydrogels: Thin film lubricating properties at soft interfaces

Mucus is a viscous slime that plays a vital role in protecting and lubricating biological tissues, in particular, soft epithelium interfaces such as in the stomach, intestines, and esophagus. Previous attempts to generate mucus models that mimic or simulate its characteristics have been predominantly focused on the rheological properties. This study investigates both rheological and tribological shear properties of thin films of gastric mucus from a porcine source and its mimics at compliant soft interfaces. The lubricating efficacy of biological mucus and its mimics was observed to be superior at hydrophilic tribological interfaces compared to hydrophobic ones. Facile spreading of all mucus samples at hydrophilic steel–polydimethylsiloxane (PDMS) interfaces allowed for the retainment of the lubricating films over a wide range of speed, slide/roll ratio, and external load. In contrast, poor wetting at hydrophobic PDMS–PDMS interfaces led to depletion of the mucus samples from the interface with increasing speed. Among the different mucus models investigated in this study, fluid mixtures of commercially available porcine gastric mucin (PGM) and polyacrylic acid (PAA) displayed the most persistent lubricating effects under various tribological experimental conditions. A mixture of PGM and PAA holds a high potential as mucus mimic, not only for its rheological similarity, but also for its excellent lubricity in soft compliant and hydrophilic contacts.

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, National Food Institute, Research Group for Nano-Bio Science, Università della Calabria
Number of pages: 11
Publication date: 2017
Peer-reviewed: Yes

Publication information
Journal: Biointerphases
Volume: 12
Issue number: 5
ISSN (Print): 1934-8630
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.92 SJR 0.558 SNIP 0.677
Web of Science (2017): Impact factor 2.455
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.65 SJR 0.536 SNIP 0.676
Web of Science (2016): Impact factor 2.603
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.62 SJR 0.708 SNIP 0.751
Web of Science (2015): Impact factor 2.105
Hybrid hydrogels by the co-assembly of chitosan with phospholipids

General information
State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science, Westfälische Wilhelms-Universität Münster
Contributors: Shekarforoush, E., Mendes, A. C. L., Engwer, C., Goycoolea, F., Chronakis, I. S.
Number of pages: 1
Publication date: 2017
Peer-reviewed: Yes
Event: Abstract from The Annual European Rheology Conference (AERC2017), Copenhagen, Denmark.
Electronic versions: Elham_Abstract_.pdf
Research output: Research - peer-review › Journal article – Annual report year: 2017

Innovative Methods and Applications in Mucoadhesion Research
The present review is aimed at elucidating relatively new aspects of mucoadhesion/mucus interaction and related phenomena that emerged from a Mucoadhesion workshop held in Munster on 2–3 September 2015 as a satellite event of the ICCC 13th—EUCHIS 12th. After a brief outline of the new issues, the focus is on mucus description, purification, and mucus/mucin characterization, all steps that are pivotal to the understanding of mucus related phenomena and the choice of the correct mucosal model for in vitro and ex vivo experiments, alternative bio/mucomimetic materials are also presented. Then a selection of preparative techniques and testing methods are described (at molecular as well as micro and macroscale) that may support the pharmaceutical development of mucus interactive systems and assist formulators in the scale-up and industrialization steps. Recent applications of mucoadhesive systems (including medical devices) intended for different routes of administration (oral, gastrointestinal, vaginal, nasal, ocular, and intravesical) and for the treatment of difficult to treat pathologies or the alleviation of symptoms are described.

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Research Group for Nano-Bio Science, National Food Institute, University of Leeds, Friedrich-Alexander University Erlangen-Nürnberg, University of Pavia, University of Oslo, S.I.I.T. S.r.l Pharmaceutical & Health Food Supplements, University of Copenhagen
Number of pages: 32
Interfacial Shear Rheology of β-Lactoglobulin - Bovine Submaxillary Mucin Layers Adsorbed at Air/Water Interface

The interfacial rheological properties of solutions of β-lactoglobulin (BLG), as a model food compound, mixed with bovine submaxillary mucin (BSM), a major salivary protein, have been investigated. Time, frequency, stress sweep and flow measurements have been performed at different pHs (7.4, 5.0 and 3.0), to investigate the air/water interfacial properties. All protein layers (BLG, BSM, and BLG-BSM mixtures) formed an elastic network at the air/water interface with low frequency dependence of the interfacial modulus. The results indicated that BLG moves faster as smaller molecule than mucin, and dominate the surface adsorption and the network formation for the BLG-BSM mixtures. Moreover, BLG-BSM protein mixtures exhibited interfacial properties with lower elastic and viscous moduli than BLG, as a result of competitive displacement of BLG proteins with BSMs from the interface. It is suggested that hydrophobic patches of BSM can be imbedded into the BLG monolayer as driven by a strong hydrophobic interaction with air and disrupt the cohesive assembly of BLG, whereas the hydrophilic (negatively charged) parts of the BSM chain are protruding from the interface towards the bulk water.

General information
State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science, Department of Mechanical Engineering, Materials and Surface Engineering, Technical University of Denmark
Contributors: Celebioglu, H. Y., Kmiecik-Palczewska, J., Lee, S., Chronakis, I. S.
Number of pages: 11
Pages: 857-867
Publication date: 2017
Peer-reviewed: Yes

Publication information
Journal: International Journal of Biological Macromolecules
Volume: 102
ISSN (Print): 0141-8130
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 4.11 SJR 0.917 SNIP 1.307
Web of Science (2017): Impact factor 3.909
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.84 SJR 0.882 SNIP 1.294
Web of Science (2016): Impact factor 3.671
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 3.38 SJR 0.808 SNIP 1.303
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 3.13 SJR 0.864 SNIP 1.32
Web of Science (2014): Impact factor 2.858
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 3.48 SJR 0.848 SNIP 1.431
Web of Science (2013): Impact factor 3.096
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.77 SJR 0.787 SNIP 1.302
Investigation of the molecular level interactions between mucins and food proteins: Spectroscopic, tribological and rheological studies

The thesis investigated the structure and molecular-level interaction of β-lactoglobulin (BLG) and mucins, representing major components of the dairy products and saliva/digestion systems, respectively. Mucins are long glycoprotein molecules responsible for the gel nature of the mucous layer covers epithelial surfaces throughout the body. A literature review of the interactions of different mucin types and saliva mucins with several food proteins and food protein emulsions, as well as their functional properties related to the food oral processing is presented at the first chapter of the thesis (Paper V). Most of the studies suggest an electrostatic attraction between positively charged food proteins with negatively charged moieties of mucins (mainly on glycosylated region of mucins).

The structural changes occurring during the interaction between BLG, the major whey protein, and bovine submaxillary mucin (BSM), a major salivary protein, were studied using high and low field Nuclear Magnetic Resonance (NMR), Dynamic Light Scattering (DLS), and Circular Dichroism (CD) spectroscopy. The zeta potentials of the proteins were also measured to provide information on the role of electrostatic forces in the interaction. These spectroscopic results suggested that the interaction between BSM and BLG led to a compact aggregation. The interaction between the two proteins was concluded to be mostly of hydrophilic origin (Paper I). The interaction characteristics between mucins and BLG under tribological stress were investigated by comparing the lubricity of mixed solutions of mucin-BLG with that of neat protein solutions at compliant hydrophobic interfaces. BSM and porcine gastric mucin (PGM) showed distinctly higher adsorbed masses compared to BLG onto polydimethylsiloxane (PDMS) or polystyrene (PS) surfaces. The adsorbed masses of the mixed protein solutions, namely BLG-BSM and BLG-PGM, reduced significantly. The dominant lubrication mechanism of the protein solutions was boundary lubrication. The pH
dependent lubricating properties of BLG-BSM mixed solutions appeared to be determined by competitive adsorption of the two proteins onto the substrates, which suggests that they do not form as strong aggregates as BLG-saliva, especially under tribological stress (Paper II). Moreover, the interfacial rheological properties of solutions of BLG mixed with BSM have been investigated. BLG-BSM protein mixtures exhibited interfacial properties with lower elastic and viscous moduli than BLG, as a result of competitive displacement of BLG proteins with BSMs from the interface. It is suggested that hydrophobic patches of BSM can be imbedded into the BLG monolayer as driven by a strong hydrophobic interaction with air and disrupt the cohesive assembly of BLG, whereas the hydrophilic (negatively charged) parts of the BSM chain are protruding from the interface towards the bulk water (Paper III). To elucidate the interaction mechanisms of BLG and two types of mucins, BSM and PGM, specifically focusing on the role of hydrophobic residues of the proteins at different pH conditions, intrinsic fluorescence spectroscopy, the fluorescent dye ANS techniques and high field NMR spectroscopy were used. Results from intrinsic fluorescence spectroscopy indicated stronger hydrophobic interactions of BLG with PGM than with BSM, which was further supported by extrinsic fluorescence spectroscopy. Stronger interactions of BLG with PGM also suggest a more abundant presence of hydrophobic moieties in PGM than BSM. Furthermore, HF-NMR studies indicated that the hydrophilic interaction also contributed to the interactions with both mucins, especially at acidic conditions (Paper IV). In the final Chapter VI, the tribological and physicochemical properties (emulsion particle size, viscosity, contact angle measurements, microscopy) of a model mucus compound, namely highly concentrated BSM, with the negatively charged BLG-stabilized emulsion (at pH 6.8) were determined as an attempt to understand the physicochemical basis of BLG-stabilized emulsion in the oral environment.

Nanofibrous nonwovens based on dendritic-linear-dendritic poly(ethylene glycol) hybrids
Dendritic-linear-dendritic (DLD) hybrids are highly functional materials combining the properties of linear and dendritic polymers. Attempts to electrospin DLD polymers composed of hyperbranched dendritic blocks of 2,2-bis(hydroxymethyl)propionic acid on a linear poly(ethylene glycol) core proved unsuccessful. Nevertheless, when these DLD hybrids were blended with an array of different biodegradable polymers as entanglement enhancers, nanofibrous nonwovens were successfully prepared by electrospinning. The pseudogeneration degree of the DLDs, the nature of the co-electrospun polymer and the solvent systems used for the preparation of the electrospinning solutions exerted a significant effect on the diameter and morphology of the electrospun fibers. It is worth-noting that aqueous solutions of the DLD polymers and only 1% (w/v) poly(ethylene oxide) resulted in the production of smoother and thinner nanofibers. Such dendritic nanofibrous scaffolds can be promising materials for biomedical applications due to their biocompatibility, biodegradability, multifunctionality, and advanced structural architecture.
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.87 SJR 0.543 SNIP 0.742
Web of Science (2017): Impact factor 1.901
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.73 SJR 0.588 SNIP 0.792
Web of Science (2016): Impact factor 1.86
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.74 SJR 0.587 SNIP 0.846
Web of Science (2015): Impact factor 1.866
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.76 SJR 0.664 SNIP 0.972
Web of Science (2014): Impact factor 1.768
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.71 SJR 0.629 SNIP 1.085
Web of Science (2013): Impact factor 1.64
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.57 SJR 0.657 SNIP 1.075
Web of Science (2012): Impact factor 1.395
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.45 SJR 0.604 SNIP 0.969
Web of Science (2011): Impact factor 1.289
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.685 SNIP 0.913
Web of Science (2010): Impact factor 1.24
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.701 SNIP 0.824
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.652 SNIP 0.821
Scopus rating (2007): SJR 0.675 SNIP 0.924
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.783 SNIP 1.131
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.778 SNIP 0.896
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.775 SNIP 0.951
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.82 SNIP 1.057
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.909 SNIP 1.066
Scopus rating (2001): SJR 0.975 SNIP 1.141
Web of Science (2001): Indexed yes
The effect of oil content and addition of natural antioxidants on the morphology and oxidative stability of pullulan ultra-thin fibers loaded with fish oil and obtained by electrospinning was investigated. Pullulan sub-micron fibers containing 10 and 30wt% fish oil were prepared and both presented beads where the oil accumulated. The number of beads was significantly higher in 30wt% oil-loaded fibers. Moreover, fibers containing 30wt% fish oil had a higher oxidative stability when compared to 10wt% oil-loaded fibers, despite its lower encapsulation efficiency (EE) value (67.1±3.1%). The oxidative stability of fibers loaded with 10wt% fish oil (EE=88.5±0.7%) was significantly improved when adding δ-tocopherol (500ppm) and rosemary extract (500ppm) as antioxidants. However, higher concentration of antioxidants (2000ppm δ-tocopherol and 1000ppm rosemary extract) did not further improve the oxidative stability of 10wt% oil-loaded fibers, but had a pro-oxidant effect. Finally, the production of pullulan fibers containing 10wt% fish oil from fumaric acid solutions increased the oxidative stability of the fibers when compared to the same type of fibers obtained from water solutions. The latter was observed for fibers without and with antioxidants (500ppm of δ-tocopherol and 500ppm of rosemary extract). Practical applications: Encapsulation of omega-3 polyunsaturated fatty acids and addition of antioxidants are the most efficient strategies to protect these lipids against oxidation when incorporating them into food matrices. These results show the feasibility to encapsulate fish oil in pullulan ultra-thin fibers and to improve their oxidative stability by adding natural antioxidants such as δ-tocopherol and rosemary extract. Therefore, this study might open up new opportunities for further technological development in the production of omega-3 nanodelivery systems, which have potential applications in different types of fortified foods. Encapsulation of fish oil in electrospun pullulan fibers stabilized by natural antioxidants.

**General information**

State: Published
Organisations: National Food Institute, Research Group for Bioactives – Analysis and Application, Research Group for Nano-Bio Science, Technical University of Denmark
Contributors: García Moreno, P. J., Damberg, C., Chronakis, I. S., Jacobsen, C.
Number of pages: 11
Publication date: 2017
Peer-reviewed: Yes

**Publication information**

Journal: European Journal of Lipid Science and Technology
Volume: 119
Issue number: 12
Article number: 1600305
ISSN (Print): 1438-7697

Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.22 SJR 0.776 SNIP 1.05
Web of Science (2017): Impact factor 2.2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.06 SJR 0.712 SNIP 1.042
Web of Science (2016): Impact factor 2.145
Web of Science (2016): Indexed yes
Protein-polysaccharide Mixtures as Wall Material in Fish Oil-loaded Nano-microcapsules Obtained by Electrospraying

General information
State: Published
Organisations: National Food Institute, Research Group for Bioactives – Analysis and Application, Department of Chemical and Biochemical Engineering, CHEC Research Centre, The Hempel Foundation Coatings Science and Technology Centre (CoaST), Research Group for Nano-Bio Science
Contributors: García Moreno, P. J., Pelayo, A., Mateiu, R. V., Chronakis, I. S., Jacobsen, C.
Pages: 12-12
Publication date: 2017

The electrospinning of xanthan gum: from solution to nanofiber formation

General information
State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science
Contributors: Shekarforoush, E., Mendes, A. C. L., Chronakis, I. S.
Pages: 235-235
Publication date: 2017

Trefoil factor peptide 3 is positively correlated with the viscoelastic properties of the cervical mucus plug

General information
State: Published
Organisations: National Food Institute, Research Group for Food Production Engineering, Research Group for Nano-Bio Science, Aarhus University Hospital
Pages: 47-52
Publication date: 2017
A full-layer bladder wall patch by mincing both porcine bladder mucosa and detrusor in a natural-synthetic scaffold

General information
State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science, Karolinska Institutet, Uppsala University
Contributors: Ajalloueian, F., Chamorro, C. I., Chronakis, I. S., Hilborn, J., Fossum, M.
Pages: 84-84
Publication date: 2016
Peer-reviewed: Yes

Publication information
Journal: European Cells & Materials
Volume: 31
Issue number: 1
ISSN (Print): 1473-2262
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 4.5 SJR 1.345 SNIP 1.299
Web of Science (2017): Impact factor 3.667
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.52 SJR 1.403 SNIP 1.283
Web of Science (2016): Impact factor 4
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.91 SJR 1.795 SNIP 1.666
Web of Science (2015): Impact factor 4.56
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.14 SJR 0.66 SNIP 0.614
Web of Science (2014): Impact factor 4.886
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 0.88 SJR 0.391 SNIP 0.306
Web of Science (2013): Impact factor 4.887
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 0.5 SJR 0.294 SNIP 0.183
Web of Science (2012): Impact factor 4.558
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 0.31 SJR 0.234 SNIP 0.18
Web of Science (2011): Impact factor 3.028
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.192 SNIP 0.193
Chitosan/Phospholipids Hybrid Nanofibers and Hydrogels for Life Sciences Applications

General information
State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science
Contributors: Mendes, A. C. L., Shekarforoush, E., Sevilla Moreno, J. A., Chronakis, I. S.
Number of pages: 1
Publication date: 2016
Peer-reviewed: Yes
URLs:
http://www.sustain.dtu.dk/

Bibliographical note
Sustain Abstract H-8
Research output: Research - peer-review > Conference abstract for conference – Annual report year: 2016

Co-assembly of chitosan and phospholipids into hybrid hydrogels
Novel hybrid hydrogels were formed by adding chitosan (Ch) to phospholipids (P) self-assembled particles in lactic acid. The effect of the phospholipid concentration on the hydrogel properties was investigated and was observed to affect the rate of hydrogel formation and viscoelastic properties. A lower concentration of phospholipids (0.5% wt/v) in the mixture, facilitates faster network formation as observed by Dynamic Light Scattering, with lower elastic modulus than the hydrogels formed with higher phospholipid content. The nano-porous structure of Ch/P hydrogels, with a diameter of 260±20 nm, as observed by cryo-scanning electron microscopy, facilitated the penetration of water and swelling. Cell studies revealed suitable biocompatibility of the Ch/P hydrogels that can be used within life sciences applications.

General information
State: Published
Contributors: Mendes, A. C. L., Shekarforoush, E., Engwer, C., Beeren, S., Goycoolea, F. M., Chronakis, I. S.
Pages: 905-916
Publication date: 2016
Peer-reviewed: Yes

Publication information
Journal: Pure and Applied Chemistry
Volume: 88
Issue number: 9
ISSN (Print): 0033-4545
Ratings:
BFI (2018): BFI-level 1
Original language: English

Keywords: biomaterials, carbohydrates, chitosan, colloids, EUCHIS-12, hydrogel, ICCC-13, phospholipids, self-assembly

DOIs:
10.1515/pac-2016-0708

Source: PublicationPreSubmission

Source-ID: 127118690

Research output: Research - peer-review › Conference article – Annual report year: 2016
Comparing Hybrid Nano-microfibrous Constructs of Plastic Compressed Collagen - Electrospun PLGA: Collagen Content Percentage as Variable

**General information**
State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science, Karolinska Institutet
Contributors: Ajalloueian, F., Fossum, M., Chronakis, I. S.
Pages: 128-128
Publication date: 2016

**Host publication information**
Title of host publication: 2016 Termis-Ap - Abstract book
Place of publication: Taipei, Taiwan
Article number: S18-06
Electronic versions:

**Abstract book**
Source: PublicationPreSubmission
Source-ID: 127377449
Research output: Research - peer-review › Conference abstract in proceedings – Annual report year: 2016

Electrospinning of Chitosan-Xanthan Nanofibers
Electrospun chitosan-xanthan gum nanofibers were produced and the correlation between the rheological properties of chitosan-xanthan solutions and electrospinability were investigated at different xanthan gum concentrations. Uniform chitosan-xanthan nanofibers with diameters ranging from 382±182 to 842±296 nm were developed based on the chitosan-xanthan gum content. Overall chitosan-xanthan gum solutions exhibited shear thinning behavior for all the concentrations tested, which tended to increase with the increase of concentration of xanthan. Furthermore the electrical conductivity of the chitosan-xanthan solutions was observed to increase with the increase of xanthan gum concentrations. We can conclude that the optimal electrospinning process is directed by the apparent viscosity properties and the electrical conductivity of the chitosan-xanthan solutions. We are currently investigating the utilisation of these electrospun chitosan-xanthan nanofibers as a carrier for bioactive compounds.

**General information**
State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science
Contributors: Shekarforoush, E., Mendes, A. C. L., Chronakis, I. S.
Number of pages: 1
Publication date: 2016
Peer-reviewed: Yes
URLs:
http://www.sustain.dtu.dk/

**Bibliographical note**
Sustain Abstract H-7
Research output: Research - peer-review › Conference abstract for conference – Annual report year: 2016

Electrospraying Chitosan Particles for Oral Vaccine Delivery

**General information**
State: Published
Organisations: Department of Micro- and Nanotechnology, Nanoprobes, National Food Institute, Research Group for Nano-Bio Science
Publication date: 2016
Peer-reviewed: Yes
Event: Abstract from 2016 AAPS Annual Meeting and Exposition, Denver, CO, United States.
Electronic versions:
Abstract_AAPS_2016_electrospray.pdf

**Bibliographical note**
For poster presentation
Source: PublicationPreSubmission
Source-ID: 127315854
Research output: Research - peer-review › Conference abstract for conference – Annual report year: 2016
Electrospraying particles for loading into microcontainers for drug delivery

General information
State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science, Department of Micro- and Nanotechnology, Nanoprobes
Contributors: Sevilla Moreno, J. A., Boutrup Stephansen, K., Nielsen, L. H., Chronakis, I. S., Boisen, A.
Publication date: 2016
Peer-reviewed: Yes
Event: Abstract from 42nd International conference on Micro and Nano Engineering, Vienna, Austria.
Electronic versions:
Electrospraying_particles_for_loading_into_microcontainers_for_drug_delivery.pdf

Bibliographical note
For poster presentation
Source: PublicationPreSubmission
Source-ID: 127315846
Research output: Research - peer-review › Conference abstract for conference – Annual report year: 2016

Encapsulation of fish oil in nanofibers by emulsion electrospinning: Physical characterization and oxidative stability
The encapsulation of fish oil in poly(vinyl alcohol) (PVA) nanofibers by emulsion electrospinning was investigated. Independently of the emulsifier used, whey protein isolate (WPI) or fish protein hydrolysate (FPH), PVA concentration had a high influence on fiber morphology. Fibers without bead defects were only produced for solutions with 10.5% (w/w) PVA, which presented sufficient number of polymer chain entanglements. On the other hand, increasing oil load from 1.5 to 3% (w/w) resulted in fibers with larger diameters containing spindle-like enlargements interspersed. High omega-3 encapsulation efficiency (92.4 ± 2.3%) was obtained for fibers produced from 10.5% (w/w) PVA-5% (w/w) emulsion blend stabilized with WPI, resulting in an oil load capacity of 11.3 ± 0.3%. Moreover, the encapsulated oil was randomly distributed as small droplets inside the fibers. However, the electrospun fibers presented a higher content of hydroperoxides and secondary oxidation products (e.g. 1-penten-3-ol, hexanal, octanal and nonanal) compared to emulsified and unprotected fish oil.

General information
State: Published
Organisations: National Food Institute, Research Group for Bioactives – Analysis and Application, Research Group for Nano-Bio Science, Technical University of Denmark, University of Granada
Contributors: García Moreno, P. J., Boutrup Stephansen, K., van der Kruijs, J., Guadix, A., Guadix, E. M., Chronakis, I. S., Jacobsen, C.
Pages: 39-49
Publication date: 2016
Peer-reviewed: Yes

Publication information
Journal: Journal of Food Engineering
Volume: 183
ISSN (Print): 0260-8774
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 3.54 SJR 1.279 SNIP 1.671
Web of Science (2017): Impact factor 3.197
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.71 SJR 1.476 SNIP 1.837
Web of Science (2016): Impact factor 3.099
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 3.58 SJR 1.475 SNIP 1.858
Web of Science (2015): Impact factor 3.199
Web of Science (2015): Indexed yes
Enzymatic, urease-mediated mineralization of gellan gum hydrogel with calcium carbonate, magnesium-enriched calcium carbonate and magnesium carbonate for bone regeneration applications

Introduction: Mineralization of hydrogel biomaterials is considered desirable to improve their suitability as materials for bone regeneration[1],[2]. Hydrogels have been most commonly mineralized with calcium phosphate (CaP), but hydrogel-CaCO3 composites have received less attention. Magnesium (Mg) has been added to CaP to stimulate cell adhesion and proliferation and bone regeneration in vivo, but its effect as a component of carbonate-based biomaterials remains uninvestigated. In this study, gellan gum (GG) hydrogels were mineralized enzymatically with (CaCO3), Mg-enriched CaCO3 and magnesium carbonate to generate composite biomaterials for bone regeneration. GG is an inexpensive, biotechnologically produced anionic polysaccharide, from which hydrogels for cartilage regeneration have been formed by crosslinking with divalent ions[3].
Methods: GG hydrogels were loaded with the enzyme urease by incubation in 5% (w/v) urease solution and mineralized for 5 days in five different media denoted as UA, UB, UC, UD and UE, which contained urea (0.17 M) and different concentrations of CaCl2 and MgCl2 (270:0, 202.5:67.5, 135:135, 67.5:202.5 and 0:250, respectively (mmol dm-3)). Discs were autoclaved and subjected to physicochemical, mechanical and cell biological characterization.

Results: FTIR, SEM, TGA and XRD analysis revealed that increasing magnesium concentration decreased mineral crystallinity. At low magnesium concentrations calcite was formed, while at higher concentrations magnesian calcite was formed. Hydromagnesite formed at high magnesium concentration in the absence of calcium. Amount of mineral formed and compressive strength decreased with increasing magnesium concentration in the mineralization medium. ICP analysis revealed that Ca:Mg elemental ratio in the mineral formed was higher than in the respective mineralization media. Mineralization of hydrogels promoted adhesion and growth of osteoblast-like cells, which were supported best on mineralized hydrogels containing no or little magnesium. Hydrogels mineralized with hydromagnesite displayed higher cytotoxicity.

Discussion: Enzymatic mineralization of GG hydrogels with CaCO3 in the form of calcite successfully reinforced hydrogels and promoted osteoblast-like cell adhesion and growth, but Mg enrichment had no positive effect. This is in contrast with other studies reporting that incorporation of Mg into GG mineralized with CaP promotes cell adhesion and proliferation[4].

Conclusion: Sample groups UA and UB seem to be the most promising due to the superior amount of mineral formed and cell adhesion and proliferation.

General information
State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science, Ghent University, AGH University of Science and Technology
Number of pages: 2
Publication date: 2016
Peer-reviewed: Yes
Event: Abstract from 10th World Biomaterials Congress, Montreal, Canada.
Keywords: Hydrogel, Enzyme, Biomimetic, Composite

Hybrid electrospun chitosan-phospholipids nanofibers for transdermal drug delivery
Chitosan (Ch) polysaccharide was mixed with phospholipids (P) to generate electrospun hybrid nanofibers intended to be used as platforms for transdermal drug delivery. Ch/P nanofibers exhibited average diameters ranging from 248 +/- 94 nm to 600 +/- 201 nm, depending on the amount of phospholipids used. Fourier Transformed Infra-Red (FTIR) spectroscopy and Dynamic Light Scattering (DLS) data suggested the occurrence of electrostatic interactions between amine groups of chitosan with the phospholipid counterparts. The nanofibers were shown to be stable for at least 7 days in Phosphate Buffer Saline (PBS) solution. Cytotoxicity studies (WST-1 and LDH assays) demonstrated that the hybrid nanofibers have suitable biocompatibility. Fluorescence microscopy, also suggested that L929 cells seeded on top of the CH/P hybrid have similar metabolic activity comparatively to the cells seeded on tissue culture plate (control). The release of curcumin, diclofenac and vitamin B12, as model drugs, from Ch/P hybrid nanofibers was investigated, demonstrating their potential utilization as a transdermal drug delivery system.

General information
State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science, Heidelberg University
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Number of pages: 9
Pages: 48-56
Publication date: 2016
Peer-reviewed: Yes
Hybrid matrices of TiO2 and TiO2–Ag nanofibers with silicone for high water flux photocatalytic degradation of dairy effluent

TiO2 and TiO2–Ag nanofibers were produced by electrospinning technique and surface coated on silicone elastomer (diameter: 10.0 mm; thickness: 2.0 mm) by dipcoating method. These coated hybrid nanoporous matrices were characterized by various morphological and physicochemical techniques (like SEM, TEM, XRD, FTIR, EDS and UV). These characterizations reveal that the surface morphology of electrospun nanofibers remain intact by the dipcoating technique. The produced hybrid matrices of TiO2 and TiO2–Ag silicone were utilized as photocatalysts to degrade dairy waste water with an efficient water flux and water photosplitting properties.
Hybrid matrices of ZnO nanofibers with silicone for high water flux photocatalytic degradation of dairy effluent

Zinc oxide (ZnO) nanofibers were produced by electrospinning technique and surface coated on silicone elastomer substrate (diameter: 10.0 mm; thickness: 2.0 mm) by a dipcoating method. The obtained hybrid nanoporous matrices were investigated by scanning and transmission electron microscopy (SEM, TEM), X-ray diffraction (XRD) and Fourier transformation infrared techniques (FTIR). These characterizations reveal that the surface morphology of electrospun nanofibers remained intact by the dipcoating technique. The produced hybrid matrices showed high water flux of 9407 L/m²h, 38% removal rate of dairy effluent (DE) and 2298 ml/g h rate of hydrogen production. (C) 2016 Elsevier B.V. All rights reserved.

General information
State: Published
Contributors: Kanjwal, M. A., Shawabkeh, A. Q., Alm, M., Thomsen, P., Barakat, N. A. M., Chronakis, I. S.
Number of pages: 6
Pages: 495-500
Publication date: 2016
Peer-reviewed: Yes

Publication information
Journal: Materials Chemistry and Physics
Volume: 181
ISSN (Print): 0254-0584
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.18 SJR 0.615 SNIP 0.833
Web of Science (2017): Impact factor 2.21
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.14 SJR 0.651 SNIP 0.918
Interactions between Surfactants in Solution and Electrospun Protein Fibers: Effects on Release Behavior and Fiber Properties

Intermolecular interaction phenomena occurring between endogenous compounds, such as proteins and bile salts, and electrospun compounds are so far unreported, despite the exposure of fibers to such biorelevant compounds when applied for biomedical purposes, e.g., tissue engineering, wound healing, and drug delivery. In the present study, we present a systematic investigation of how surfactants and proteins, as physiologically relevant components, interact with insulin-loaded fish sarcoplasmic protein (FSP) electrospun fibers (FSP-Ins fibers) in solution and thereby affect fiber
properties such as accessible surface hydrophilicity, physical stability, and release characteristics of an encapsulated
drug. Interactions between insulin-loaded protein fibers and five anionic surfactants (sodium taurocholate, sodium
taurodeoxycholate, sodium glycocholate, sodium glycodeloxycholate, and sodium dodecyl sulfate), a cationic surfactant
(benzalkonium chloride), and a neutral surfactant (Triton X-100) were studied. The anionic surfactants increased the
insulin release in a concentration-dependent manner, whereas the neutral surfactant had no significant effect on the
release. Interestingly, only minute amounts of insulin were released from the fibers when benzalkonium chloride was
present. The FSP-Ins fibers appeared dense after incubation with this cationic surfactant, whereas high fiber porosity was
observed after incubation with anionic or neutral surfactants. Contact angle measurements and staining with the
hydrophobic dye 8-anilino-1-naphthalenesulfonic acid indicated that the FSP-Ins fibers were hydrophobic, and showed
that the fiber surface properties were affected differently by the surfactants. Bovine serum albumin also affected insulin
release in vitro, indicating that also proteins may affect the fiber performance in an in vivo setting.

General information
State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science, Research Group for Food Production
Engineering, University of Copenhagen
Contributors: Boutrup Stephansen, K., García-Díaz, M., Jessen, F., Chronakis, I. S., Nielsen, H. M.
Number of pages: 8
Pages: 748-755
Publication date: 2016
Peer-reviewed: Yes

Publication information
Journal: Molecular Pharmaceutics
Volume: 13
Issue number: 3
ISSN (Print): 1543-8384
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 4.86 SJR 1.572 SNIP 1.24
Web of Science (2017): Impact factor 4.556
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.84 SJR 1.538 SNIP 1.213
Web of Science (2016): Impact factor 4.44
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 4.88 SJR 1.605 SNIP 1.221
Web of Science (2015): Impact factor 4.342
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 4.92 SJR 1.641 SNIP 1.291
Web of Science (2014): Impact factor 4.384
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 5.26 SJR 1.903 SNIP 1.324
Web of Science (2013): Impact factor 4.787
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 5.41 SJR 2.152 SNIP 1.474
Web of Science (2012): Impact factor 4.57
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 5.62 SJR 2.351 SNIP 1.532
Web of Science (2011): Impact factor 4.782
ISI indexed (2011): ISI indexed yes
Investigation of the Interaction between Mucins and β-Lactoglobulin under Tribological Stress

The interaction characteristics between mucins and beta-lactoglobulin (BLG) under tribological stress were investigated by comparing the lubricity of mixed solutions of mucineBLG with that of neat protein solutions at compliant hydrophobic interfaces. Surface adsorption properties of the proteins as characterized by bicinchoninic acid (BCA) assay revealed that both bovine submaxillary mucin (BSM) and porcine gastric mucin (PGM) showed distinctly higher adsorbed masses compared to BLG onto polydimethylsiloxane(PDMS) or polystyrene (PS) surfaces. The adsorbed masses of the mixed protein solutions, namely BLGeBSM and BLGePGM, reduced significantly, and BLG appeared to dominate the surface adsorption event, presumably due to the reduced concentration of mucins and the Vroman effect. While pin-on-disk tribometry and mini-traction machine (MTM) were employed to provide the tribological contacts with varying contact pressure, speed range, and slide/roll ratio, the dominant lubrication mechanism of the protein solutions was boundary lubrication. BLGeBSM mixture showed the highest level of degradation in the lubricity of BSM at pH 5, although BLGesaliva interaction is known to degrade the lubricity most rapidly at more acidic pH, such as at pH 3.5. More importantly, pH dependent lubricating properties of BLGeBSM mixed solutions appeared to be determined by competitive adsorption of the two proteins onto the substrates, which suggests that they do not form as strong aggregates as BLGesaliva, especially under tribological stress.

General information
State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science, Department of Mechanical Engineering, Materials and Surface Engineering
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Pages: 57-65
Publication date: 2016
Peer-reviewed: Yes

Publication information
Journal: Food Hydrocolloids
Volume: 54
Issue number: Part A
ISSN (Print): 0268-005X
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 5.25 SJR 1.991 SNIP 1.892
Web of Science (2017): Impact factor 5.089
Web of Science (2017): Indexed yes
Optical sensors from electrohydrodynamic jetted polymer fiber resonators

Electrohydrodynamic jetting is used to manufacture dye-doped polymer fiber resonators. We present comb-like laser emission from different polymer/dye combinations and report the use of these structures as sensitive detection of ethanol and methanol.

General information
State: Published
Organisations: Department of Micro- and Nanotechnology, Optofluidics, National Food Institute, Research Group for Nano-Bio Science, Center for Nanostructured Graphene, Karlsruhe Institute of Technology
Number of pages: 2
Publication date: 2016

Host publication information
Title of host publication: CLEO: Applications and Technology 2016
Place of publication: San Jose, California United States
Publisher: OSA Publishing
Article number: JTu5A.146
DOIs: 10.1364/CLEO_AT.2016.JTu5A.146

Bibliographical note
Source: PublicationPreSubmission
Source-ID: 127114515
Research output: Research - peer-review › Conference abstract in proceedings – Annual report year: 2016

Oxidative Stability of Nano-Microstructures containing fish oil

Electrohydrodynamic processing is a straightforward and versatile encapsulation technique suitable for the production of nano-microstructures (NMS) (e.g. fibers and capsules) containing bioactive compounds. The process is very gentle and does not require the use of heat, avoiding deterioration of thermolabile active compounds such as fish oil. Moreover, encapsulates produced present a decreased size, which allows their incorporation into food systems without affecting product sensory qualities.

In this work, electrohydrodynamic processing and oxidative stability of NMS containing fish oil were investigated. For that purpose, three different biopolymers namely pullulan, dextran and whey protein concentrate (WPC) were evaluated as encapsulating materials. First, the influence of biopolymer concentration on the physical properties (e.g. viscosity, conductivity and surface tension) of the biopolymer solutions and on the morphology of NMS was assayed. Secondly, the oxidative stability of the biopolymer solutions containing emulsified fish oil during storage (14 days at 40 °C) and of NMS loaded with fish oil (e.g. pullulan fibers and dextran and WPC capsules) was determined. Finally, to improve the oxidative status of the NMS, pullulan fibers, dextran capsules and WPC capsules were produced by adding neat fish oil instead of emulsified fish oil to the biopolymer solutions. These latter NMS presented a higher oxidative stability, which may be due to a better entrapment of the fish oil into biopolymer encapsulates.

General information
State: Published
Organisations: National Food Institute, Research Group for Bioactives – Analysis and Application, Center for Electron Nanoscopy, Research Group for Nano-Bio Science, Ankara University, CSIC
Number of pages: 1
Publication date: 2016
Peer-reviewed: Yes
Event: Abstract from 1st International Symposium on Lipid Oxidation and Antioxidants, Porto, Portugal.
Electronic versions:
Abstract.pdf
Source: PublicationPreSubmission
Source-ID: 124170521
Research output: Research - peer-review › Conference abstract for conference – Annual report year: 2016
Oxidative stability of pullulan nanofibers loaded with fish oil: effect of oil content and antioxidants addition

Electrospinning processing is a promising technique for the encapsulation of thermolabile bioactive compounds (e.g. fish oil) since it does not require the use of heat. Furthermore, the nano-microfibers (NMF) obtained present a reduced size, which makes them easier to disperse in food matrices compared to traditional encapsulates (e.g. microcapsules produced by spray-drying). Biopolymers such as proteins and polysaccharides are required for the production of food-grade NMF. In this sense, pullulan, which is a food-approved polysaccharide, is an interesting encapsulating material due to its high electrospinnability and low oxygen permeability.

In light of the above, the aim of this work was to investigate the oxidative stability of omega-3 enriched pullulan NMF. First, the influence of fish oil content (10-20-30 %) on the properties of the electrospinning solutions (e.g. viscosity, conductivity and surface tension) as well as on the morphology of NFM and oxidative stability of NMF during storage (20 days at 20 °C and relative humidity of 33%) was studied. Secondly, the effect on the oxidative stability of the NMS of incorporating hydrophilic antioxidants (e.g. EDTA) to pullulan solutions and/or lipophilic antioxidants (e.g. tocopherols) to fish oil was evaluated. Preliminary results show that neat fish oil can be incorporated into pullulan NMS by adding 30% Tween20 (by weight to respect to fish oil content), leading to NMS not containing antioxidants with a peroxide value lower that 20 meq O2/kg oil at day 0.

General information
State: Published
Organisations: National Food Institute, Research Group for Bioactives – Analysis and Application, Research Group for Nano-Bio Science
Contributors: Garcia Moreno, P. J., Damberg, C., Stephansen, K., Chronakis, I. S., Jacobsen, C.
Number of pages: 1
Publication date: 2016
Peer-reviewed: Yes
Electronic versions:
Abstract_3.pdf
Source: PublicationPreSubmission
Source-ID: 126531506
Research output: Research - peer-review » Conference abstract for conference – Annual report year: 2016

Slippery when sticky: Lubricating properties of thin films of Taxus baccata aril mucilage

Mucilage is hydrogel produced from succulent plants and microorganisms displaying unique adhesiveness and slipperiness simultaneously. The objective of this study is to establish an understanding on the lubricating mechanisms of the mucilage from Taxus baccata aril as thin, viscous lubricant films. Oscillation and flow rheological studies revealed that T. baccata mucilage is shear-thinning, thixotropic, and weak hydrogel that is highly stretchable under shear stress due to its high density physical crosslinking characteristics. In addition, T. baccata mucilage showed a distinct Weissenberg effect, i.e., increasing normal force with increasing shear rate, and thus it contributes to deplete the lubricant from tribological interfaces. Lubrication studies with a number of tribopairs with varying mechanical properties and surface wettability have shown that the lubricity of T. baccata mucilage is most effectively manifested at soft, hydrophilic, and rolling tribological contacts. Based on tenacious spreading on highly wettingsurfaces, slip plane can be formed within mucilage hydrogel network even when the lubricating films cannot completely separate the opposing surfaces. Moreover, highly stretchable characteristics of mucilage under high shear enhance smooth shearing of two opposing surfaces as lubricating film.

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, National Food Institute, Research Group for Nano-Bio Science
Contributors: Ran, T., Sankaranarayanan, R., Chronakis, I. S., Lee, S.
Number of pages: 12
Publication date: 2016
Peer-reviewed: Yes

Publication information
Journal: Biointerphases
Volume: 11
Issue number: 1
Article number: 011010
ISSN (Print): 1934-8630
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Spectroscopic and tribological studies of the interactions between β-lactoglobulin and mucins

Proteins are important ingredients for food products in terms of providing desirable textural, sensory, and nutritional properties. In oral processing, food products are continuously mixed with saliva and it is the resulting aggregates that are ultimately consumed by human body. In order to understand the interaction mechanisms of food proteins-saliva/gastrointestinal fluid on a molecular level, we have selected β-lactoglobulin (BLG) and mucins (bovine submaxillary mucin (BSM) and porcine gastric mucin (PGM)) as representative macromolecules of food proteins and saliva/gastric juice, respectively. Various spectroscopic approaches, including Dynamic Light Scattering (DLS), circular dichroism (CD) spectroscopy, fluorescence spectroscopy, and low and high field Nuclear Magnetic Resonance (NMR) spectroscopy were employed to understand the structural changes upon interaction. Additionally, tribological techniques were applied to investigate the interaction of BLG with mucins under tribological stress. To understand the pH effect, three pH values, pH 3.0, 5.0, 7.4, were used. The most interestingly, the changes in the size distribution of the mixture as studied by DLS suggested attractive interaction between BLG and BSM molecules to form a more compact conformation of the BSM molecules. Moreover, high field NMR showed stronger interactions at lower pH due to electrostatic attraction of the protonated amino groups of BLG to the negatively charged mucin. The High field NMR results for the BSM-BLG mixture indicated that spectral differences were mostly observed for solvent exposed groups, especially the mucin glycanchains, while hydrophobic core residues of PGM-BLG mixture were also highly affected. Surface adsorption properties of the proteins by bicinchoninic acid (BCA) assay revealed that both mucins adsorbed onto the hydrophobic substrates in a large amount to form either highly compact layers or multilayers, whereas BLG appeared to adsorb to a much less extent. Even in the absence of tribostress, the adsorbed masses of the mixed protein solutions reduced significantly, and BLG appeared to dominate the surface adsorption event, presumably due to the reduced concentration of mucins as well as the Vroman effect. Nevertheless, BSM apparently dominated the tribological interface, which highlights the excellent lubricating capabilities of BSM, while PGM’s intrinsically weaker lubricity remained largely unchangede ven in the interaction with BLG. The pH dependent lubricating properties of BLG-BSM mixed solutions appeared to be determined by competitive adsorption of the two proteins onto the substrates, which suggests that they do not form as strong aggregates as BLG-saliva, especially under tribological stress. The combined spectroscopic and lubricating properties of BLG and
mucins provided advanced understanding on the molecular level interaction between two macromolecules, representing food proteins and bodily fluids.

A new strategy for synthesizing AgInS2 quantum dots emitting brightly in near-infrared window for in vivo imaging

A new strategy for fabricating water-dispersible AgInS2 quantum dots (QDs) with bright near-infrared (NIR) emission is demonstrated. A type of multidentate polymer (MDP) was synthesized and utilized as a compact capping ligand for the AgInS2 QDs. Using silver nitrate, indium acetate and sulfur-hydrazine hydrate complex as the precursors, MDP-capping AgInS2 QDs were synthesized in aqueous solution at room temperature. Characterization indicates that the MDP-capping AgInS2 QDs are highly photoluminescent in NIR window and possess good photostability. Also, the QDs are stable in different media and have low cytotoxicity. Nude mice photoluminescence imaging shows that the MDP-capping AgInS2 QDs can be well applied to in vivo imaging. These readily prepared NIR fluorescent nanocrystals have huge potential for biomedical applications.
Bioactive protein-based nanofibers interact with intestinal biological components resulting in transepithelial permeation of a therapeutic protein

Proteins originating from natural sources may constitute a novel type of material for use in drug delivery. However, thorough understanding of the behavior and effects of such a material when processed into a matrix together with a drug is crucial prior to further development into a drug product. In the present study the potential of using bioactive electrospun fish sarcoplasmic proteins (FSP) as a carrier matrix for small therapeutic proteins was demonstrated in relation to the interactions with biological components of the intestinal tract. The inherent structural and chemical properties of FSP as a biomaterial facilitated interactions with cells and enzymes found in the gastrointestinal tract and displayed excellent biocompatibility. More specifically, insulin was efficiently encapsulated into FSP fibers maintaining its conformation, and subsequent controlled release was obtained in simulated intestinal fluid. The encapsulation of insulin into FSP fibers provided protection against chymotrypsin degradation, and resulted in an increase in insulin transport to around 12% without compromising the cellular viability. This increased transport was driven by interactions upon contact between the nanofibers and the Caco-2 cell monolayer leading to the opening of the tight junction proteins. Overall, electrospun FSP
may constitute a novel material for oral delivery of biopharmaceuticals.

**General information**

State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science, Research Group for Food Production Engineering, University of Copenhagen
Contributors: Boutrup Stephansen, K., García-Díaz, M., Jessen, F., Chronakis, I. S., Nielsen, H.
Number of pages: 9
Pages: 58-66
Publication date: 2015
Peer-reviewed: Yes

**Publication information**

Journal: International Journal of Pharmaceutics
Volume: 495
Issue number: 1
ISSN (Print): 0378-5173
Ratings:
- BFI (2018): BFI-level 2
- Web of Science (2018): Indexed yes
- BFI (2017): BFI-level 1
- Scopus rating (2017): CiteScore 4.06 SJR 1.172 SNIP 1.27
- Web of Science (2017): Impact factor 3.862
- Web of Science (2017): Indexed yes
- BFI (2016): BFI-level 1
- Scopus rating (2016): CiteScore 4.24 SJR 1.323 SNIP 1.386
- Web of Science (2016): Impact factor 3.649
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 1
- Scopus rating (2015): CiteScore 4.2 SJR 1.298 SNIP 1.45
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 1
- Scopus rating (2014): CiteScore 4.13 SJR 1.347 SNIP 1.551
- Web of Science (2014): Impact factor 3.65
- Web of Science (2014): Indexed yes
- BFI (2013): BFI-level 1
- Scopus rating (2013): CiteScore 4.17 SJR 1.377 SNIP 1.605
- Web of Science (2013): Impact factor 3.785
- ISI indexed (2013): ISI indexed yes
- Web of Science (2013): Indexed yes
- BFI (2012): BFI-level 1
- Scopus rating (2012): CiteScore 4.1 SJR 1.552 SNIP 1.637
- Web of Science (2012): Impact factor 3.458
- ISI indexed (2012): ISI indexed yes
- BFI (2011): BFI-level 1
- Scopus rating (2011): CiteScore 4.01 SJR 1.493 SNIP 1.619
- Web of Science (2011): Impact factor 3.35
- ISI indexed (2011): ISI indexed yes
- BFI (2010): BFI-level 1
- Scopus rating (2010): SJR 1.574 SNIP 1.608
- Web of Science (2010): Indexed yes
- BFI (2009): BFI-level 1
- Scopus rating (2009): SJR 1.399 SNIP 1.53
- BFI (2008): BFI-level 1
Design and characterization of self-assembled fish sarcoplasmic protein-alginate nanocomplexes

Macrostructures based on natural polymers are subject to large attention, as the application range is wide within the food and pharmaceutical industries. In this study we present nanocomplexes (NCXs) made from electrostatic self-assembly between negatively charged alginate and positively charged fish sarcoplasmic proteins (FSP), prepared by bulk mixing. A concentration screening revealed that there was a range of alginate and FSP concentrations where stable NCXs with similar properties were formed, rather than two exact concentrations. The size of the NCXs was 293 +/- 3 nm, and the zeta potential was -42 +/- 0.3 mV. The NCXs were stable in water, gastric buffer, intestinal buffer and HEPES buffered glycose, and at all pH values from 2 to 9 except pH 3, where they aggregated. When proteolytic enzymes were present in the buffer, the NCXs were degraded. Only at high concentrations the NCXs caused a decreased viability in HeLa and U2OS cell lines. The simple processing procedure and the high stability of the NCXs, makes them excellent candidates for use in the food and pharmaceutical industry. (C) 2015 Elsevier B.V. All rights reserved.

General information
State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science, Research Group for Food Production Engineering, Technical University of Denmark, University of Copenhagen, University of Münster
Contributors: Boutrup Stephansen, K., Mattebjerg, M. A., Wattjes, J., Milisavljevic, A., Jessen, F., Qvortrup, K., Goycoolea, F. M., Chronakis, I. S.
Number of pages: 7
Pages: 146-152
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: International Journal of Biological Macromolecules
Volume: 76
ISSN (Print): 0141-8130
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 4.11 SJR 0.917 SNIP 1.307
Web of Science (2017): Impact factor 3.909
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.84 SJR 0.882 SNIP 1.294
Web of Science (2016): Impact factor 3.671
Web of Science (2016): Indexed yes
Development and characterization of nano-micro structures as carrier for bioactive compounds

New biopolymers are in high demand due to their excellent biocompatibility, biodegradability, and natural origin. In this PhD project, water soluble fish sarcoplasmic proteins (FSPs) from the North Atlantic cod (Gadus morhua) have been studied as a potential new biopolymer for development of nano-micro structures. Two kinds of nano-micro structures have been explored: electrospun fibers (Paper I, Paper II, and Paper III) and self-assembled nanocomplexes (NCXs) (Paper
Effects of electrospun chitosan wrapping for dry-aging of beef, as studied by microbiological, physicochemical and low-field nuclear magnetic resonance analysis

The effects of using electrospun chitosan fibres as a wrapping material for dry-aging beef was studied and compared to traditional dry-aging and wet-aging of beef for up to 21 days. The chitosan treatment showed improved results in terms of yield, reduction of microbial counts, yeasts and moulds, and lighter appearance compared to traditional dry-aging. Weight and trimming losses were minimal in the wet-aging beef. However, significant growth of lactic acid bacteria was observed in this group. Transverse relaxation times indicated a lower degree of muscle denaturation during ageing in the chitosan dry-aging beef compared to the traditional dry-aging meat. A principal component analysis furthermore observed in this group. Transverse relaxation times indicated a lower degree of muscle denaturation during ageing in the chitosan dry-aging beef compared to the traditional dry-aging meat. A principal component analysis furthermore observed in this group. Transverse relaxation times indicated a lower degree of muscle denaturation during ageing in the chitosan dry-aging beef compared to the traditional dry-aging meat. A principal component analysis furthermore observed in this group. Transverse relaxation times indicated a lower degree of muscle denaturation during ageing in the chitosan dry-aging beef compared to the traditional dry-aging meat. A principal component analysis furthermore observed in this group. Transverse relaxation times indicated a lower degree of muscle denaturation during ageing in the chitosan dry-aging beef compared to the traditional dry-aging meat. A principal component analysis furthermore observed in this group. Transverse relaxation times indicated a lower degree of muscle denaturation during ageing in the chitosan dry-aging beef compared to the traditional dry-aging meat. A principal component analysis furthermore observed in this group. Transverse relaxation times indicated a lower degree of muscle denaturation during ageing in the chitosan dry-aging beef compared to the traditional dry-aging meat. A principal component analysis furthermore observed in this group. Transverse relaxation times indicated a lower degree of muscle denaturation during ageing in the chitosan dry-aging beef compared to the traditional dry-aging meat. A principal component analysis furthermore observed in this group. Transverse relaxation times indicated a lower degree of muscle denaturation during ageing in the chitosan dry-aging beef compared to the traditional dry-aging meat. A principal component analysis furthermore observed in this group. Transverse relaxation times indicated a lower degree of muscle denaturation during ageing in the chitosan dry-aging beef compared to the traditional dry-aging meat. A principal component analysis furthermore observed in this group. 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Transverse relaxation times indicated a lower degree of muscle denaturation during ageing in the chitosan dry-aging beef compared to the traditional dry-aging meat. A principal component analysis furthermore observed in this group. Transverse relaxation times indicated a lower degree of muscle denaturation during ageing in the chitosan dry-aging beef compared to the traditional dry-aging meat. A principal component analysis furthermore observed in this group. Transverse relaxation times indicated a lower degree of muscle denaturation during ageing in the chitosan dry-aging beef compared to the traditional dry-aging meat. A principal component analysis furthermore observed in this group. Transverse relaxation times indicated a lower degree of muscle denaturation during ageing in the chitosan dry-aging beef compared to the traditional dry-aging meat. A principal component analysis furthermore observed in this group. 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Electrospun dye-doped fiber networks: lasing emission from randomly distributed cavities
Dye-doped polymer fiber networks fabricated with electrospinning exhibit comb-like laser emission. We identify randomly distributed ring resonators being responsible for lasing emission by making use of spatially resolved spectroscopy. Numerical simulations confirm this result quantitatively.

Electrospun NiO, ZnO and composite NiO–ZnO nanofibers/photocatalytic degradation of dairy effluent
Among the food wastes, the dairy effluent (DE) is considered to be the most polluting one because of the large volume of wastewater generated and its high organic load. Photocatalytic degradation of DE and organic dye methylene blue (MB) was studied using Zinc oxide nanofibers (ZnO NFs), Nickel oxide nanofibers (NiO NFs) and composite Zinc oxide–Nickel oxide nanofibers (ZnO–NiO NFs). These nanomembranes were characterized in SEM, TEM, XRD and UV studies. The pristine nanofiber membranes were smooth and continuous, with an average diameter of about 400nm, and held their nanofibrous morphology even after calcination of 600°C and more than 3h of photocatalytic degradation of DE and MB dye. The ZnO NFs and NiO NFs were effective materials for degradation of DE and MB dye. NiO NFs and ZnO NFs showed a maximum degradation of 70% and 75% in DE and 50% and 60% in MB dye respectively, after 3h. The significant enhancement of degradation in the composite ZnO–NiO NFs is attributed to the photoactivity of material under visible light irradiation. The composite ZnO–NiO NFs eliminated 40% of DE and 65% of MB dye, after 1h and maximum degradation of 80% DE after 3h and 100% MB dye after 90min. Overall, this study also shows that the nanofibrous morphology strongly enhances the surface activity of the ZnO–NiO photocatalyst when utilized to degrade DE and MB dye.
at room temperature.

**General information**
State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science, Chonbuk National University
Contributors: Kanjwal, M. A., Chronakis, I. S., Barakat, N. A.
Number of pages: 8
Pages: 12229-12236
Publication date: 2015
Peer-reviewed: Yes

**Publication information**
Journal: Ceramics International
Volume: 41
Issue number: 9
ISSN (Print): 0272-8842
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.85 SJR 0.784 SNIP 1.167
Web of Science (2017): Impact factor 3.057
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.88 SJR 0.844 SNIP 1.376
Web of Science (2016): Impact factor 2.986
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.64 SJR 0.823 SNIP 1.281
Web of Science (2015): Impact factor 2.758
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.76 SJR 0.856 SNIP 1.645
Web of Science (2014): Impact factor 2.605
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.28 SJR 0.799 SNIP 1.552
Web of Science (2013): Impact factor 2.086
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.08 SJR 0.81 SNIP 1.736
Web of Science (2012): Impact factor 1.789
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.1 SJR 0.918 SNIP 1.733
Web of Science (2011): Impact factor 1.751
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.855 SNIP 1.292
Web of Science (2010): Impact factor 1.472
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.932 SNIP 1.468
Forming of Polymeric Tubular Micro-components.

This chapter is intended to provide an overview of three nontraditional shaping technologies for the forming of polymeric micro-tubes, which are hot embossing, blow molding, and cross rolling, as well as realization of a process chain and the integration of a modular machine-based manufacturing platform for the production of functional polymeric tubular micro-components. The chapter gives background on the current market and process development trends, followed by description of materials, process configuration, tool design and machine development for each processing technology as well as strategy for integration of the technologies and equipment into a common platform. Finally, potential applications of the technologies and facilities developed are highlighted.

General information
State: Published
Organisations: Department of Management Engineering, National Food Institute, Research Group for Nano-Bio Science, University of Strathclyde, Institute for Product Development, Sysmelec S.A, Fraunhofer-Gesellschaft, Technical University of Cologne
Contributors: Qin, Y., Zhao, J., Anyasodor, G., Schütt Hansen, K., Calderon, I., Konrad, K., Hartl, C., Arentoft, M., Chronakis, I. S.
Pages: 179–200
Publication date: 2015

Host publication information
Title of host publication: Micromanufacturing Engineering and Technology
Publisher: Elsevier
Editor: Qin, Y.
ISBN (Print): 978-0-323-31149-6
Keywords: Forming machines, Forming tools, Micro-shaping, Polymeric tubes, Tubular micro-components
DOIs: 10.1016/B978-0-323-31149-6.00008-6
Research output: Research - peer-review ✱ Book chapter – Annual report year: 2015

Highly functionalized nano-microstructures for Bioengineering

General information
State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science
Contributors: Mendes, A. C. L., Chronakis, I. S.
Number of pages: 1
Publication date: 2015

Host publication information
Title of host publication: Book of Abstracts. DTU's Sustain Conference 2015
Hybrid nanofibers of TiO₂-silicone and TiO₂-Ag-silicone for high water flux photocatalytic degradation of dairy effluent

General information
State: Published
Contributors: Kanjwal, M. A., Alm, M., Thomsen, P., Barakat, N. A., Chronakis, I. S.
Number of pages: 1
Publication date: 2015

Host publication information
Title of host publication: Book of Abstracts. DTU's Sustain Conference 2015
Place of publication: Lyngby
Publisher: Technical University of Denmark (DTU)
Article number: W-10
Electronic versions: W10_DTU_Sustain_2015.pdf

Integrated Micro/Nanofibrous PLGA-Collagen Scaffold: an Optimized Method for Plastic Compression of Collagen into PLGA Microfibers

General information
State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science, Uppsala University, Karolinska Institutet
Contributors: Ajalloueian, F., Hilborn, J., Fossum, M., Chronakis, I. S.
Pages: 347-347
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: Tissue Engineering. Part A
Volume: 21
Issue number: Supplement 1
ISSN (Print): 1937-3341
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 3.66 SJR 1.159 SNIP 1.034
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.43 SJR 1.24 SNIP 0.988
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 4.03 SJR 1.536 SNIP 1.099
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 4.45 SJR 1.624 SNIP 1.273
BFI (2013): BFI-level 1
Integrated micro/nanofibrous PLGA-Collagen scaffolds for bladder tissue regeneration

General information
State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science, Uppsala University, Karolinska Institutet
Contributors: Ajalloueian, F., Hilborn, J., Fossum, M., Chronakis, I. S.
Number of pages: 1
Publication date: 2015

Host publication information
Title of host publication: Book of Abstracts. DTU's Sustain Conference 2015
Place of publication: Lyngby
Publisher: Technical University of Denmark (DTU)
Article number: Q-13
Electronic versions: Q13_DTU_Sustain_2015.pdf

Bibliographical note
Poster presentation
Research output: Research - peer-review » Conference abstract in journal – Annual report year: 2015

Interactions between electrospun fibers and the surrounding biological environment; cells and small molecules

General information
State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science, Research Group for Food Production Engineering, University of Copenhagen
Contributors: Stephansen, K., García-Díaz, M., Jessen, F., Nielsen, H. M., Chronakis, I. S.
Number of pages: 1
Publication date: 2015

Host publication information
Title of host publication: Book of Abstracts. DTU's Sustain Conference 2015
Place of publication: Lyngby
Publisher: Technical University of Denmark (DTU)
Article number: I-8
Electronic versions: I8_DTU_Sustain_2015.pdf

Bibliographical note
Poster presentation
Research output: Research - peer-review » Conference abstract in proceedings – Annual report year: 2015

Micro- and nano-structures such as micro- and nano-fibers and micro- and nano-particles based on polymers (synthetic and natural) can be processed by electrospinning. Electrospun micro- and nano-structures are an exciting class of novel materials due to several unique characteristics, including their micro- and nano-meter diameter, the extremely high surface area per unit mass, the very small pore size, and their tunable surface properties. To this may be added their cost-
effectiveness. Significant progress has been made in this field in the past few years, and the resultant micro- and nano-
structures may serve as a highly versatile platform for a broad range of applications in areas such as medicine, pharmacy,
sensors, catalysis, filter, composites, ceramics, packaging, electronics, and photonics. Some latest developments in the
processing and applications of micro- and nano-structured polymers by electrospinning are presented.

**General information**

State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science
Contributors: Chronakis, I. S.
Pages: 513–548
Publication date: 2015

**Host publication information**

Title of host publication: Micromanufacturing Engineering and Technology
Publisher: Elsevier
Editor: Qin, Y.
ISBN (Print): 978-0-323-31149-6
Keywords: Applications, Electrospinning, Micro- and nano-fibers, Micro- and nano-structures, Polymers
DOIs:
10.1016/B978-0-323-31149-6.00022-0
Research output: Research - peer-review; Book chapter – Annual report year: 2015

**Nanomechanics of electrospun phospholipid fiber**

Electrospun asolectin phospholipid fibers were prepared using isooctane as a solvent and had an average diameter of 6.1
+/- 2.7 μm. Their mechanical properties were evaluated by nanoindentation using Atomic Force Microscopy, and their
elastic modulus was found to be approximately 17.2 +/- 1MPa. At a cycle of piezo expansion-retraction (loading-
unloading) of a silicon tip on a fiber, relatively high adhesion was observed during unloading. It is proposed that this was
primarily due to molecular rearrangements at the utmost layers of the fiber caused by the indentation of the hydrophilic tip.
The phospholipid fibers were shown to be stable in ambient conditions, preserving the modulus of elasticity up to 24 h. (c)
2015 AIP Publishing LLC.

**General information**

State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, National Food Institute,
Research Group for Nano-Bio Science
Contributors: Mendes, A. C. L., Nikogeorgos, N., Lee, S., Chronakis, I. S.
Number of pages: 4
Publication date: 2015
Peer-reviewed: Yes

**Publication information**

Volume: 106
Issue number: 22
Article number: 223108
ISSN (Print): 0003-6951
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 3.25 SJR 1.382 SNIP 1.167
Web of Science (2017): Impact factor 3.495
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.67 SJR 1.673 SNIP 1.249
Web of Science (2016): Impact factor 3.411
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.47 SJR 1.499 SNIP 1.226
Web of Science (2015): Impact factor 3.142
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.25 SJR 1.861 SNIP 1.492
Web of Science (2014): Impact factor 3.302
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 3.77 SJR 2.146 SNIP 1.633
Web of Science (2013): Impact factor 3.515
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 3.76 SJR 2.57 SNIP 1.739
Web of Science (2012): Impact factor 3.794
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 4.04 SJR 2.814 SNIP 1.917
Web of Science (2011): Impact factor 3.844
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.92 SNIP 1.775
Web of Science (2010): Impact factor 3.841
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 2.826 SNIP 1.834
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 2.894 SNIP 1.82
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 3.012 SNIP 1.916
Web of Science (2007): Indexed yes
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 3.755 SNIP 2.353
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 3.992 SNIP 2.367
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 3.897 SNIP 2.275
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 4.018 SNIP 2.414
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 4.281 SNIP 2.22
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 4.178 SNIP 2.017
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 4.173 SNIP 2.066

Original language: English
Electronic versions:
2015_APL_1_.pdf
DOIs:
10.1063/1.4922283

Bibliographical note
Copyright 2015, American Institute of Physics. This article may be downloaded for personal use only. Any other use requires prior permission of the author and the American Institute of Physics. The following article appeared in (Applied Physics Letters 106 (2015) 223108) and may be found at http://scitation.aip.org/content/aip/journal/apl/106/22/10.1063/1.4922283.
**Oxidative stability of electrospun nanofibers loaded with fish oil**

**General information**
State: Published
Organisations: National Food Institute, Research Group for Bioactives – Analysis and Application, Research Group for Nano-Bio Science, University of Granada
Contributors: García Moreno, P. J., Boutrup Stephansen, K., Guadix, A., Guadix, E. M., Chronakis, I. S., Jacobsen, C.
Number of pages: 1
Pages: 30-30
Publication date: 2015

**Host publication information**
Title of host publication: Fats, oils and lipids: New challenges in technology, quality control and health : Book of abstracts
Place of publication: Florence, Italy

**Abstract_Euro_Fed_Lipid_2015.pdf**
Source: PublicationPreSubmission
Source-ID: 121138123
Research output: Research - peer-review › Conference abstract in proceedings – Annual report year: 2016

**Phospholipid electrospun nanofibers: effect of solvents and co-axial processing on morphology and fiber diameter**

Asolectin phospholipid nano-microfibers were prepared using electrospinning processing. The asolectin fibers were studied by scanning electron microscopy, and the fiber morphology was found to be strongly dependent on the phospholipid concentration and the solvents used. The solvents studied were chloroform : dimethylformamide (CHCl3 : DMF, 3 : 2 v/v), isooctane, cyclohexane and limonene, producing phospholipid fibers with average diameters in the range of 2.57 +/- 0.59 μm, similar to 3-8 μm, similar to 4-5 μm and 14.3 +/- 2.7 μm, respectively. The diameter of asolectin electrospun fibers does not follow the theoretically predicted value of similar to 0.35 μm because of the intermolecular aggregation between the reverse micelles formed in the highly concentrated asolectin solutions. However, when co-axial solvent electrospinning was applied, where the outer needle contains a pure solvent and the inner needle contains the asolectin solution in CHCl3: DMF, a substantial reduction in the average fiber diameter was observed. In particular, the average diameter of the fibers when DMF (a solvent with a high dielectric constant) was used as a sheath solvent was reduced by a factor of about 7 and was at the nano-size range, as theoretically predicted. The dielectric constant of the solvents had a strong influence on the jet split properties and affected the morphology of the electrospun asolectin fibers.

**General information**
State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science, University of Copenhagen
Contributors: Jørgensen, L., Qvortrup, K., Chronakis, I. S.
Number of pages: 9
Pages: 53644-53652
Publication date: 2015
Peer-reviewed: Yes

**Publication information**
Journal: R S C Advances
Volume: 5
Issue number: 66
ISSN (Print): 2046-2069
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 3.01 SJR 0.863 SNIP 0.736
Web of Science (2017): Impact factor 2.936
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.06 SJR 0.889 SNIP 0.757
Photocatalytic degradation of dairy effluent using AgTiO₂ nanostructures/polyurethane nanofiber membrane

Dairy effluent (DE) is environmentally toxic and needs special attention. Photocatalytic degradation of DE was studied using novel polyurethane (PU)-based membranes. Typically, silver-titanium dioxide nanofibers (AgTiO₂ NFs) and silver-titanium dioxide nanoparticles (AgTiO₂ NPs) were individually incorporated in PU electrospun nanofibers to overcome the mandatory sophisticated separation of the nanocatalysts, which can create a secondary pollution, after the treatment process. These nanomembranes were characterized in SEM, TEM, XRD and UV studies. The polymeric electrospun nanofibers were smooth and continuous, with an average diameter of about 550nm, and held their nanofibrous morphology even after more than 2h of photocatalytic degradation of DE, due to the good stability of PU in the aqueous solutions, which indicates good imprisoning of the functional photocatalysts. The PU-AgTiO₂ NPs and PU-AgTiO₂ NFs showed a maximum degradation of 75% and 95%, respectively after 2h. The significant enhancement of degradation in the PU-Ag-TiO₂ NPs and PU-Ag-TiO₂ NFs is attributed to the photoactivity of Ag-TiO₂ material under visible light irradiation.

General information
State: Published
Organisations: National Food Institute, Division of Industrial Food Research, Minia University
Contributors: Kanjwal, M. A., Barakat, N. A., Chronakis, I. S.
Number of pages: 7
Pages: 9615-9621
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: Ceramics International
Volume: 41
Issue number: 8
ISSN (Print): 0272-8842
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Production of omega-3 nanodelivery systems by emulsion electrospinning

General information
State: Published
Organisations: National Food Institute, Research Group for Bioactives – Analysis and Application, Research Group for Nano-Bio Science
Contributors: García Moreno, P. J., van der Kruijs, J., Boutrup Stephansen, K., Chronakis, I. S., Jacobsen, C.
Number of pages: 1
Pages: 22-22
Publication date: 2015

Host publication information
Title of host publication: Electrospinning: principles, practice and possibilities 2015: Programme and abstract book
Place of publication: London, Uk
Source: PublicationPreSubmission
Source-ID: 121138006
Research output: Research - peer-review > Conference abstract in proceedings – Annual report year: 2016

Spectroscopic studies of the interactions between β-lactoglobulin and bovine submaxillary mucin
The structural changes occurring during the interaction between β-lactoglobulin (BLG), the major whey protein, and bovine submaxillary mucin (BSM), a major salivary protein, were studied using high and low field Nuclear Magnetic Resonance (NMR), Dynamic Light Scattering (DLS), and Circular Dichroism (CD) spectroscopy. The zeta potentials of the proteins were also measured to provide information on the role of electrostatic forces in the interaction. The ratio between BLG and BSM was 1:1, and pH was adjusted to 3.0, 5.0 and 7.4 at room temperature. These spectroscopic results suggested that the interaction between BSM and BLG led to a compact aggregation. DLS results of the mixture showed a size distribution which is intermediate between that of BLG (215 nm) and BSM (200 nm). While no particular changes in the secondary structure were observed in either BSM or BLG, a weak tertiary structure, observed in BLG only, was further weakened upon interaction with BSM. High field NMR results for the BSM-BLG mixture indicated that spectral differences were mostly observed for solvent exposed groups, especially the mucin glycan chains, while hydrophobic core residues were less affected. The interaction between the two proteins can thus be concluded to be mostly of hydrophilic origin. Moreover, low field NMR measurements showed a decrease in transverse relaxation times in the mixture compared to the pure BLG and buffer solutions. This is possibly connected to fewer hydrophilic binding sites available in the BLG–BSM mixtures for water–protein interaction after aggregation of the two proteins.

General information
State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science, Department of Chemistry, Organic Chemistry, Department of Mechanical Engineering, Materials and Surface Engineering
Contributors: Celebioglu, H. Y., Guðjónsdóttir, M., Meier, S., Duus, J. Ø., Lee, S., Chronakis, I. S.
Number of pages: 8
Pages: 203-210
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: Food Hydrocolloids
Volume: 50
ISSN (Print): 0268-005X
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 5.25 SJR 1.991 SNIP 1.892
Web of Science (2017): Impact factor 5.089
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Bioactive electrospun fish sarcoplasmic proteins as a drug delivery system

Nano-microfibers were made from cod (Gadus morhua) sarcoplasmic proteins (FSP) (M_w < 200 kDa) using the electrospinning technique. The FSP fibers were studied by scanning electron microscopy, and the fiber morphology was...
found to be strongly dependent on FSP concentration. Interestingly, the FSP fibers were insoluble in water. However, when exposed to proteolytic enzymes, the fibers were degraded. The degradation products of the FSP fibers proved to be inhibitors of the diabetes-related enzyme DPP-IV. The FSP fibers may have biomedical applications, among others as a delivery system. To demonstrate this, a dipeptide (Ala-Trp) was encapsulated into the FSP fibers, and the release properties were investigated in gastric buffer and in intestinal buffer. The release profile showed an initial burst release, where 30% of the compound was released within the first minute, after which an additional 40% was released (still exponential) within the next 30 min (gastric buffer) or 15 min (intestinal buffer). The remaining 30% was not released in the timespan of the experiment.

General information
State: Published
Organisations: National Food Institute, Division of Industrial Food Research
Contributors: Stephansen, K., Chronakis, I. S., Jessen, F.
Pages: 158–165
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Colloids and Surfaces B: Biointerfaces
Volume: 122
ISSN (Print): 0927-7765
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 4.24 SJR 1.071 SNIP 1.101
Web of Science (2017): Impact factor 3.997
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.42 SJR 1.079 SNIP 1.322
Web of Science (2016): Impact factor 3.887
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 4.26 SJR 1.085 SNIP 1.241
Web of Science (2015): Impact factor 3.902
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 4.53 SJR 1.21 SNIP 1.56
Web of Science (2014): Impact factor 4.152
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 4.64 SJR 1.267 SNIP 1.587
Web of Science (2013): Impact factor 4.287
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 3.74 SJR 1.242 SNIP 1.342
Web of Science (2012): Impact factor 3.554
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 3.49 SJR 1.051 SNIP 1.27
Web of Science (2011): Impact factor 3.456
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.972 SNIP 1.161
Web of Science (2010): Impact factor 2.78
Electrospun fish protein fibers as a biopolymer-based carrier – implications for oral protein delivery

Purpose: Protein-based electrospun fibers have emerged as novel nanostructured materials for tissue engineering and drug delivery due to their unique structural characteristics, biocompatibility and biodegradability. The aim of this study was to explore the use of electrospun fibers based on fish sarcoplasmic proteins as an oral delivery platform for biopharmaceuticals, using insulin as a model protein. Methods: Fish sarcoplasmic proteins (FSP) were isolated from fresh cod and electrospun into nanomicrofibers using insulin as a model payload. The morphology of FSP fibers was characterized using scanning electron microscopy (SEM), and the conformational stability of insulin was confirmed by circular dichroism (CD). The in vitro release and enzymatic degradation of encapsulated insulin was measured in different buffers and quantified using RP-HPLC. The permeability of released insulin across differentiated Caco-2 cell monolayers was followed by RP-HPLC and ELISA, and the transepithelial electrical resistance (TEER) was measured before and after the experiment. Cell viability was assessed by the MTS/PMS assay. Results: Insulin was encapsulated in the electrospun FSP fibers with high efficiency, high loading and without any effect on fiber morphology. Release of insulin in vitro was 75% after 3 h in simulated intestinal fluid. The secondary structure of insulin was preserved after release, and insulin functionality was confirmed by ELISA. Insulin permeability across Caco-2 cell monolayers was significantly enhanced when administered encapsulated in FSP fibers. The TEER was decreased after 4 h incubation, and no negative effect on cell viability was observed at any time. Conclusion: In this work we present electrospun FSP fibers as a novel oral drug delivery system for biopharmaceuticals. The electrospinning process did not affect the functionality of the encapsulated insulin and it provided controlled release kinetics. The epithelial permeability enhancing effect and biocompatibility of the FSP fibers provide evidence for further investigating protein-based electrospun nanofibers for delivery of proteins and peptides.

General information
State: Published
Organisations: National Food Institute, Division of Industrial Food Research, University of Copenhagen
Contributors: Boutrup Stephansen, K., García-Díaz, M., Jessen, F., Chronakis, I. S., Nielsen, H. M.
Number of pages: 1
Publication date: 2014

Host publication information
Title of host publication: Abstract Book - DTU Sustain Conference 2014
Place of publication: Kgs. Lyngby
Publisher: Technical University of Denmark (DTU)
Research output: Research - peer-review | Conference abstract in proceedings – Annual report year: 2014
Gold nanoparticles–gelatin hybrid fibers with bright photoluminescence

In the present work, a type of hybrid fibers—gold nanoparticles (GNPs)–gelatin fibers were designed. Spinning solutions for the sub-micron fibers were prepared by adding gelatin, ethylene diamine tetraacetic acid (EDTA) and chloroauric acid in water successively. The EDTA reduced the chloroauric acid and gave rise to in situ synthesis of GNPs in the spinning solutions. The GNPs–gelatin fibers were fabricated by electrospinning the spinning solutions. The GNPs were encapsulated in the fibers, which endowed the fibers photoluminescence (PL) characteristics. A variety of experiments were performed to characterize the structure and properties of the GNPs–gelatin fibers. This work provides new perspectives for the fabrication of functional nanocomposite fibers.

General information

State: Published
Organisations: National Food Institute, Division of Industrial Food Research, Shanghai Jiao Tong University, Jiangnan University
Contributors: Liu, S., Tan, L., Li, X., Fu, J., Chronakis, I. S., Ge, M.
Pages: 1-4
Publication date: 2014
Peer-reviewed: Yes

Publication information

Journal: Materials Letters
Volume: 135
ISSN (Print): 0167-577X
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.68 SJR 0.782 SNIP 0.887
Web of Science (2017): Impact factor 2.687
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.51 SJR 0.754 SNIP 0.939
Web of Science (2016): Impact factor 2.572
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.5 SJR 0.767 SNIP 0.993
Web of Science (2015): Impact factor 2.437
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.64 SJR 0.877 SNIP 1.28
Web of Science (2014): Impact factor 2.489
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.41 SJR 0.824 SNIP 1.221
Web of Science (2013): Impact factor 2.269
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.41 SJR 0.917 SNIP 1.383
Web of Science (2012): Impact factor 2.224
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.54 SJR 1.014 SNIP 1.546
Web of Science (2011): Impact factor 2.307
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.056 SNIP 1.276
Hyperbranched polyether hybrid nanospheres with CdSe quantum dots incorporated for selective detection of nitric oxide

In this work, hybrid nanosphere vehicles consisting of cadmium selenide quantum dots (CdSe QDs) were synthesized for nitric oxide (NO) donating and real-time detecting. The nanospheres with QDs being encapsulation have spherical outline with dimension of ~127 nm. The fluorescence properties of the mHP conjugated QDs are sensitivity and high selectivity for NO against oxidation products from NO. The QDs-mHP-NO nanospheres provide perspectives for designing a new class of biocompatible NO donating and imaging systems.

General information
State: Published
Organisations: National Food Institute, Division of Industrial Food Research, Jiangnan University
Contributors: Liu, S., Jin, L., Chronakis, I. S., Li, X., Ge, M.
Pages: 104-106
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Materials Letters
Volume: 123
ISSN (Print): 0167-577X
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.68 SJR 0.782 SNIP 0.887
Web of Science (2017): Impact factor 2.687
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.51 SJR 0.754 SNIP 0.939
Web of Science (2016): Impact factor 2.572
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.5 SJR 0.767 SNIP 0.993
Web of Science (2015): Impact factor 2.437
Web of Science (2015): Indexed yes
Lubrication of soft and hard interfaces with thermo-responsive F127 hydrogel

In this study, we have investigated the lubricating properties of an aqueous fluid prepared with polyoxamer triblock copolymer in water, namely “F127-20” (F127 at the concentration of 20% wt./vol.). In coherence with its well-known thermo-responsive rheological properties, lubricating properties of F127-20 also displayed varying lubricating properties, both in the lubricating mechanism and efficacy, as a function of temperature, speed and tribopairs. F127-20 was most effective in lubricating a soft interface (PDMSePDMS) based on its gel-forming properties in 22.5-60 °C and feasible formation of hydrodynamic lubricating films at all speeds. More importantly, enhanced shear thinning of F127-20 and an optimum pressure opposed from PDMSePDMS tribological contact led to a substantial reduction in viscosity of the lubricant and smooth gliding of the interface while maintaining fluidic lubricating films. At temperatures lower or higher than temperature range 22.5-60 °C, F127-20 behaved as a liquid, and boundary lubrication became the dominant lubrication mechanism. © 2014 Elsevier Ltd. All rights reserved.
A nicotine imprinted polymer was synthesized by reversible addition-fragmentation chain transfer (RAFT) polymerization using methacrylic acid (MAA) as a functional monomer. The resulting molecularly imprinted polymers were monodispersed beads with an average diameter of 1.55 mm. The molecular selectivity of the imprinted polymer beads was evaluated by studying the uptake of nicotine and its structural analogs by the polymer beads. Equilibrium binding results indicate that the amount of nicotine bound to the imprinted polymer beads is significantly higher than that bound to the nonimprinted polymer in both acetonitrile and in a mixture of acetonitrile and water. The RAFT reagent present on the surface of the polymer beads allowed straightforward grafting of hydrophilic polymer brushes on the particle surface. In addition to the demonstrated molecular selectivity and the straightforward surface modification of the imprinted polymer beads, we also show that the dithioester end groups on the surface of the polymer beads can be converted into new thiol groups without sacrificing the specific molecular recognition. Through the new terminal thiol groups, a fluorescent dye was conveniently conjugated to the imprinted polymer beads via Michael addition reaction. The living characteristic of RAFT and the versatile thiol groups that can be derived from the RAFT reagent provide many new possibilities for realizing multifunctionalities for molecularly imprinted polymers.
Nano-microdelivery systems for oral delivery of an active ingredient
A composition for oral delivery of one or more active ingredients in the form of a lipid nano-micro-delivery system comprising a lipid nano-micro-structure comprising at least one lipid and at least one active ingredient, said at least one active ingredient being immobilized in said lipid nano-micro-structure; and at least one enzyme.

General information
State: Published
Organisations: National Food Institute, Division of Industrial Food Research
Contributors: Chronakis, I. S., Jørgensen, L.
Publication date: 2014

Publication information
IPC: EP20130162947
Patent number: WO2014166994
Date: 16/04/2014
Priority date: 09/04/2013
Priority number: EP20130162947
Original language: English
Research output: Research › Patent – Annual report year: 2014

Nano-microdelivery systems for oromucosal delivery of an active ingredient
A composition for oromucosal delivery of at least one active ingredient, more particularly a lipid nano-microdelivery system comprising a nicotine component and/or a flavour component, wherein the nicotine component may be delivered to the oral cavity via absorption through the mucosal membranes thereof and/or wherein the flavour component may be delivered to the oral mucosa by controlled release.

General information
State: Published
Quantum dots-hyperbranched polyether hybrid nanospheres towards delivery and real-time detection of nitric oxide
In this work, novel hybrid nanosphere vehicles were synthesized for nitric oxide (NO) donating and real-time detection. The hybrid nanosphere vehicles consist of cadmium selenide quantum dots (CdSe QDs) as NO fluorescent probes, and the modified hyperbranched polyether (mHP)-based diazeniumdiolates as NO donors, respectively. The nanospheres have spherical outline with dimension of ~ 127 nm. The data of systematic characterization demonstrated that the mHP-based hybrid nanosphere vehicles (QDs-mHP-NO) can release and real-time detect NO with the low limit of 25 nM, based on fluorescence quenching mechanism. The low cell-toxicity of QDs-mHP-NO nanospheres was verified by means of MTT assay on L929 cells viability. The QDs-mHP-NO nanospheres provide perspectives for designing a new class of biocompatible NO donating and imaging systems.
Random-Cavity Lasing from Electrospun Polymer Fiber Networks

General information
State: Published
Organisations: Department of Micro- and Nanotechnology, Optofluidics, National Food Institute, Division of Industrial Food Research, Karlsruhe Institute of Technology
Contributors: Krämmer, S., Vannahme, C., Smith, C., Grossmann, T., Jenne, M., Schierle, S., Jørgensen, L., Chronakis, I. S., Kristensen, A., Kalt, H.
Number of pages: 5
Pages: 8096-8100
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Advanced Materials
Volume: 26
Issue number: 48
ISSN (Print): 0935-9648
Ratings:
BFI (2018): BFI-level 3
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 21.1
Web of Science (2017): Impact factor 2.227
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 17.79
Web of Science (2016): Impact factor 1.333
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 18.5
Web of Science (2015): Impact factor 1.789
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 16.79
Web of Science (2014): Impact factor 1.703
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 15.78
Web of Science (2013): Impact factor 1.371
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 14.41
Web of Science (2012): Impact factor 1.316
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 12.28
Web of Science (2011): Impact factor 1.796
Relationship between Beta-Lactoglobulin and Bovine Submaxillary Mucin: Structure and Tribology Studies

For food oral processing, any specific component in the food products and its structural changes in varying environment can give crucial influence on the sensory acceptance of the products. The objective of this research was to investigate the inter-action between beta-Lactoglobulin (BLG), the major whey protein, and bovine submaxillary mucin (BSM), a (model) major salivary component, when mixed (1:1) at different pHs (pH 3.0, 5.0 and 7.4) in order to broaden our understanding of food oral processing on the molecular level. High and low field Nuclear Magnetic Resonance (NMR), Dynamic Light Scattering (DLS) and Circular Dichroism (CD) techniques were employed to study the structural changes. A Mini-Traction Machine (MTM) was then employed to investigate the friction and lubrication properties of the proteins at a compliant interface, as a mimic of oral processing of dairy products.

General information
State: Published
Organisations: National Food Institute, Division of Industrial Food Research, Department of Chemistry, Organic Chemistry, Department of Mechanical Engineering, Materials and Surface Engineering
Contributors: Celebioglu, H. Y., Guðjónsdóttir, M., Chronakis, I. S., Duus, J. Ø., Lee, S.
Number of pages: 1
Publication date: 2014
Peer-reviewed: No
Event: Poster session presented at 12th International Conference on the Applications of Magnetic Resonance in Food Science, Cesena, Italy.
Electronic versions:
Relationship_between_Beta_Lactoglobulin.pdf
Source: PublicationPreSubmission
Source-ID: 99521969
Research output: Research - peer-review ⇒ Journal article – Annual report year: 2014

The viscoelastic properties of the cervical mucus plug

ObjectiveTo characterize the viscoelastic properties of cervical mucus plugs (CMPs) shed during labor at term.
DesignExperimental research. SettingDepartment of Obstetrics and Gynecology, Aarhus University Hospital, Denmark. Population/SampleSpontaneously shed CMPs from 18 healthy women in active labor. MethodsViscoelastic properties of CMPs were investigated with a dynamic oscillatory rheometer using frequency and stress sweep experiments within the linear viscoelastic region. Main outcome measures The rheological variables obtained were as follows: elastic modulus (G), viscous modulus (G) and tan delta (G/G). Random-effects regression was used for statistical analysis. ResultsAll CMPs showed solid-like viscoelastic behavior. This was substantiated by the elastic modulus which was three to four times greater than the viscous modulus and by tan delta, which was

General information
State: Published
Organisations: National Food Institute, Division of Industrial Food Research, Aarhus University Hospital
Contributors: Bastholm, S. K., Becher, N., Stubbe, P. R., Chronakis, I. S., Uldbjerg, N.
Electrospun polyvinyl-alcohol nanofibers as oral fast-dissolving delivery system of caffeine and riboflavin

Fast-dissolving drug delivery systems were prepared by electrospinning using polyvinyl alcohol (PVA) as the filament-forming polymer and drug carrier. Caffeine and riboflavin were used as the model drugs. Scanning electron microscopy (SEM), Fourier-transform infrared (FTIR) and X-ray diffraction were applied to investigate the physicochemical properties of electrospun nanofibers. The SEM images showed that nanofibers prepared from electrospinning PVA/drug aqueous solutions possessed an ultrafine morphology with an average diameter in the range of 260-370 nm. Pharmacotechnical tests showed that PVA/caffeine and PVA/riboflavin nanofibrous mats had almost the same dissolution time (about 1.5 s) and wetting time (about 4.5 s). The release measurements indicated that drugs can be released in a burst manner (caffeine to an extent of 100% and riboflavin to an extent of 40% within 60 s) from the PVA nanofibrous matrices.
In this study, the influence of the temperature on the photodegradation process using Ag-doped TiO2 nanostructures was investigated. Two morphologies were used; nanoparticles and nanofibers. The nanofibers were synthesized by electrospinning of a sol–gel consisting of titanium isopropoxide, silver nitrate and poly(vinyl acetate). The silver nitrate amount was changed to produce nanofibers having different silver contents. Typically, sol–gels containing 0.5, 1.0, 1.5, 2.0 and 2.5 wt% silver nitrate were utilized. Calcination of the electrospun mats at 700 °C led to produce well morphology Ag-doped TiO2 nanofibers for all formulations. The nanoparticles were prepared from the same sol–gels, however, instead of spinning the gels were dried, ground and sintered at 700 °C. Photodegradation under UV irradiation for the rhodamine B at 5, 15, 25, 45 and 55 °C were performed. For the nanoparticles, increasing the temperature has positive impact as the best degradation was obtained at 55 °C. In contrast to the known influence of the temperature on the chemical reactions, in case of the nanofibrous morphology, the temperature has negative impact as the experimental work indicated that the optimum temperature is 25 °C. The observed strange effect of the temperature in case of the nanofibrous morphology indicates instant degradation of the dye molecules in the active zones surrounding the nanofibers. Therefore, the increase of temperature results in increase the kinetic energy of the dye molecules so the molecules escape from the active thin film surrounding the photocatalyst. Overall, this study shows that the nanofibrous morphology strongly enhances the surface activity of the photocatalyst which generates negative influence of the temperature.
Influence of temperature on the photodegradation process using Ag-doped TiO2 nanostructures: Negative impact with the nanofibers

In this study, the influence of the temperature on the photodegradation process using Ag-doped TiO2 nanostructures was investigated. Two morphologies were used; nanoparticles and nanofibers. The nanofibers were synthesized by electrospinning of a sol–gel consisting of titanium isopropoxide, silver nitrate and poly(vinyl acetate). The silver nitrate amount was changed to produce nanofibers having different silver contents. Typically, sol–gels containing 0.5, 1.0, 1.5, 2.0 and 2.5 wt% silver nitrate were utilized. Calcination of the electrospun mats at 700 °C led to produce well morphology Ag-doped TiO2 nanofibers for all formulations. The nanoparticles were prepared from the same sol–gels, however, instead of spinning the gels were dried, grinded and sintered at 700 °C. Photodegradation under UV irradiation for the rhodamine B at 5, 15, 25, 45 and 55 °C were performed. For the nanoparticles, increasing the temperature has positive impact as the best degradation was obtained at 55 °C. In contrast to the known influence of the temperature on the chemical reactions, in case of the nanofibrous morphology, the temperature has negative impact as the experimental work indicated that the optimum temperature is 25 °C. The observed strange effect of the temperature in case of the nanofibrous morphology indicates instant degradation of the dye molecules in the active zones surrounding the nanofibers. Therefore, the increase of temperature results in increase the kinetic energy of the dye molecules so the molecules escape from the active thin film surrounding the photocatalyst. Overall, this study shows that the nanofibrous morphology strongly enhances the surface activity of the photocatalyst which generates negative influence of the temperature.
Stabilization of oil-in-water emulsions by enzyme catalyzed oxidative gelation of sugar beet pectin

Enzyme catalyzed oxidative cross-linking of feruloyl groups can promote gelation of sugar beet pectin (SBP). It is uncertain how the enzyme kinetics of this cross-linking reaction are affected in emulsion systems and whether the gelation affects emulsion stability. In this study, SBP (2.5% w/v) was mixed into an oil-in-water emulsion system (4.4% w/w oil, 0.22% w/w whey protein, pH 4.5). Two separate, identically composed, emulsion systems were prepared by different methods of preparation. The emulsions prepared separately and subsequently mixed with SBP (referred as Mix A) produced significantly larger average particle sizes than the emulsions in which the SBP was homogenized into the emulsion system during emulsion preparation (referred as Mix B). Mix B type emulsions were stable. Enzyme catalyzed oxidative gelation of SBP helped stabilize the emulsions in Mix A. The kinetics of the enzyme catalyzed oxidative gelation of SBP helped stabilize the emulsions in Mix A. The kinetics of the enzyme catalyzed oxidative gelation of SBP was evaluated by small angle oscillatory measurements for horseradish peroxidase (HRP) (EC 1.11.1.7) and laccase (EC 1.10.3.2) catalysis, respectively. HRP catalyzed gelation rates, determined from the slopes of the increase of elastic modulus (G0) with time, were higher (P < 0.05) than the corresponding laccase catalyzed rates, but the final G0 values were higher for laccase catalyzed gels, regardless of the presence of emulsions or type of emulsion preparation (Mix A or Mix B). For both enzymes, rates of gelation in Mix A were higher (P < 0.05) than in Mix B, and higher stress was needed to break the gels in Mix A than in Mix B at similar enzyme dosage levels. These differences may be related to a lower availability of the feruloyl groups for cross-linking when the SBP was homogenized into the emulsion system during preparation.
The viscoelastic properties of the cervical mucus plug
The objective of this study was to characterize the viscoelastic properties of cervical mucus plugs (CMPs) shed during labor at term. Spontaneously shed cervical mucus plugs from healthy women in active labor, were tested. The viscoelastic properties of cervical mucus plugs were investigated with using frequency and stress sweep experiments within the linear viscoelastic region. Random-effects regression was used for statistical analysis. The CMPs are solid-like viscoelastic structures and the elastic modulus dominated the viscous modulus at all frequencies. These rheological characteristics are probably essential for the CMP’s ability to form and sustain a plug in the cervical canal during pregnancy, thereby reducing the risk of ascending infections.

General information
State: Published

DOI: 10.1016/j.foodhyd.2012.04.004
Research output: Research - peer-review › Journal article – Annual report year: 2013
Enzyme catalyzed oxidative gelation of sugar beet pectin: Kinetics and rheology
Sugar beet pectin (SBP) is a marginally utilized co-processing product from sugar production from sugar beets. In this study, the kinetics of oxidative gelation of SBP, taking place via enzyme catalyzed cross-linking of ferulic acid moieties (FA), was studied using small angle oscillatory measurements. The rates of gelation, catalyzed by horseradish peroxidase (HRP) (EC 1.11.1.7) and laccase (EC 1.10.3.2), respectively, were determined by measuring the slope of the increase of the elastic modulus (G') with time at various enzyme dosages (0.125–2.0 U mL−1). When evaluated at equal enzyme activity dosage levels, the two enzymes produced different gelation kinetics and the resulting gels had different rheological properties: HRP (with addition of H2O2) catalyzed a fast rate of gelation compared to laccase (no H2O2 addition), but laccase catalysis produced stronger gels (higher G'). The main effects and interactions between different factors on the gelation rates and gel properties were examined in response surface designs in which enzyme dosage (0.125–2.0 U mL−1 for HRP; 0.125–10 U mL−1 for laccase), substrate concentration (1.0–4.0%), temperature (25–55 °C), pH (3.5–5.5), and H2O2 (0.1–1.0 mM) (for HRP only) were varied. Gelation rates increased with temperature, substrate concentration, and enzyme dosage; for laccase catalyzed SBP gelation the gel strengths correlated positively with increased gelation rate, whereas no such correlation could be established for HRP catalyzed gelation and at the elevated gelation rates (>100 Pa min−1) gels produced using laccase were stronger (higher G') than HRP catalyzed gels at similar rates of gelation. Chemical analysis confirmed the formation of ferulic acid dehydrodimers (dIFAs) by both enzymes supporting that the gelation was a result of oxidative cross-linking of FAs.
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 5.25 SJR 1.991 SNIP 1.892
Web of Science (2017): Impact factor 5.089
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.1 SJR 2.03 SNIP 2.045
Web of Science (2016): Impact factor 4.747
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.53 SJR 1.802 SNIP 1.924
Web of Science (2015): Impact factor 3.858
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 5.21 SJR 2.232 SNIP 2.554
Web of Science (2014): Impact factor 4.09
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 4.81 SJR 2.098 SNIP 2.256
Web of Science (2013): Impact factor 4.28
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 3.69 SJR 1.837 SNIP 2.06
Web of Science (2012): Impact factor 3.494
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 3.57 SJR 1.618 SNIP 1.911
Web of Science (2011): Impact factor 3.473
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.759 SNIP 1.519
Web of Science (2010): Impact factor 2.659
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.762 SNIP 1.786
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.484 SNIP 1.651
Scopus rating (2007): SJR 1.574 SNIP 1.716
Scopus rating (2006): SJR 1.272 SNIP 1.624
Scopus rating (2005): SJR 1.019 SNIP 1.39
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.068 SNIP 1.397
Scopus rating (2003): SJR 1.01 SNIP 1.497
Scopus rating (2002): SJR 1.051 SNIP 1.243
Scopus rating (2001): SJR 0.7 SNIP 0.901
Scopus rating (2000): SJR 0.801 SNIP 1.259
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 0.822 SNIP 1.146
Original language: English
Keywords: Rheology, Laccase, Horseradish peroxidase, Sugar beet pectin, Gelation
Influence of mucolytic compounds on rehydrated porcine gastric mucin

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, National Food Institute, Division of Industrial Food Research
Contributors: Pakkanen, K. I., Olander Petersen, H., Chronakis, I. S., Lee, S.
Publication date: 2012
Peer-reviewed: Yes
Event: Poster session presented at Workshop: Hydration of Biomolecules and BioInterfaces, Malmö, Sweden.
Research output: Research - peer-review; Poster – Annual report year: 2012

Influence of template/functional monomer/cross-linking monomer ratio on particle size and binding properties of molecularly imprinted nanoparticles

A series of molecularly imprinted polymer nanoparticles have been synthesized employing various template/functional monomer/crosslinking monomer ratio and characterized in detail to elucidate the correlation between the synthetic conditions used and the properties (e.g., particle size and template binding properties) of the obtained nanoparticles. In brief, the presence of propranolol (template) in the polymerization mixture turned out to be a critical factor on determination of the size as well as the binding properties of the imprinted nanoparticles. The functional monomer/crosslinking monomer ratio significantly affects the binding capability of the imprinted nanoparticles, but its influence on the size of the nanoparticles was found to be rather limited. The results obtained provide valuable clues for designing molecularly imprinted nanoparticle preparation in future studies, where fine tuning of particle size and binding properties are required to fit practical applications. © 2011 Wiley Periodicals, Inc. J Appl Polym Sci, 2012

General information
State: Published
Organisations: Division of Industrial Food Research, National Food Institute, Lund University, National Institute for Materials Science
Contributors: Yoshimatsu, K., Yamazaki, T., Chronakis, I. S., Ye, L.
Pages: 1249-1255
Publication date: 2012
Peer-reviewed: Yes

Publication information
Journal: Journal of Applied Polymer Science
Volume: 124
Issue number: 2
ISSN (Print): 0021-8995
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.87 SJR 0.543 SNIP 0.742
Web of Science (2017): Impact factor 1.901
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.73 SJR 0.588 SNIP 0.792
Web of Science (2016): Impact factor 1.86
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.74 SJR 0.587 SNIP 0.846
Web of Science (2015): Impact factor 1.866
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.76 SJR 0.664 SNIP 0.972
Web of Science (2014): Impact factor 1.768
Preparing photochromic nanofibers and animal cells using a photochromic compound of 1′,3′,3′-trimethyl-6-nitrospiro (2H-1-benzopyran-2,2′-indoline)

In this work, the photochromic compound 1′,3′,3′-trimethyl-6-nitrospiro (2H-1-benzopyran-2,2′-indoline) (NOSP) was synthesized by a two step process. The photochromic properties of NOSP were investigated by ultraviolet-visible (UV-Vis) spectrophotometry. The results showed that NOSP was very sensitive to UV irradiation with absorption peaks at about 336nm and 567nm. Our hypothesis was that both photochromic nanofibers and photochromic living animal cells could be obtained by combining them with NOSP. To test the hypothesis, photochromic nanofibers were fabricated by electrospinning from various mixed solutions of NOSP and polymers (including a synthetic polymer of poly(methyl...
methacrylate) and a natural polymer of gelatin); NOSP/ethanol solution was dissolved in culture medium to stain pig iliac endothelial cells (PIEC) and endow them with photochromic capability. Polymer nanofibers from electrospinning were characterized by water contact angle measurements, ultraviolet–visible (UV–Vis) spectrophotometry and fluorescence microscopy. Morphology of photochromic PIEC was observed by fluorescence microscopy after being irradiated. It was shown that nanofibers from electrospun polymers and NOSP-treated PIEC had photochromic properties. The bio-toxicity of the photochromic compound was also evaluated and it was shown that ~50% of PIEC remained viable for at least 20min. The photochromic compound NOSP could be a potentially powerful tool for development of multi-functional nanofibers and biological applications.
Preparing poly (caprolactone) micro-particles through solvent-induced phase separation

Poly (caprolactone) (PCL) particles with the size distribution from 1 to 100 μm were prepared through solvent-induced phase separation, in which polyvinyl-alcohol (PVA) was used as the matrix-forming polymer to stabilize PCL particles. The cloud point data of PCL-acetone-water was determined by the titration method. PCL-acetone and PVA-water solutions, PCL-PVA gel, and PCL particles suspension were recorded by a digital camera. The morphology of PCL-PVA suspension and PCL particles were observed by optical microscopy and scanning electron microscopy, respectively. The size distribution of PCL particles was investigated by a particle size analyzer. Results from differential scanning calorimeter indicated that the main interaction between PCL and PVA were mediated through hydrogen bonding.

General information
State: Published
Organisations: Division of Industrial Food Research, National Food Institute
Contributors: Li, X., Kanjwal, M. A., Stephansen, K., Chronakis, I. S.
Pages: 189-191
Publication date: 2012
Peer-reviewed: Yes

Publication information
Journal: Materials Letters
Volume: 75
ISSN (Print): 0167-577X
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.68 SJR 0.782 SNIP 0.887
Web of Science (2017): Impact factor 2.687
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.51 SJR 0.754 SNIP 0.939
Web of Science (2016): Impact factor 2.572
Web of Science (2016): Indexed yes
In this study, a new hierarchical nanostructure that consists of zinc oxide (ZnO) was produced by the electrospinning process followed by a hydrothermal technique. First, electrospinning of a colloidal solution that consisted of zinc nanoparticles, zinc acetate dihydrate and poly(vinyl alcohol) was performed to produce polymeric nanofibers embedding solid nanoparticles. Calcination of the obtained electrospun nanofiber mats in air at 500 °C for 90 minutes produced pure ZnO nanofibers with rough surfaces. The rough surface strongly enhanced outgrowing of ZnO nanobranches when a specific hydrothermal technique was used. Methylene blue dihydrate was used to check the photocatalytic ability of the
produced nanostructures. The results indicated that the hierarchical nanostructure had a better performance than the other form.

**General information**

State: Published
Organisations: Division of Industrial Food Research, National Food Institute, University of Texas-Pan American, Chonbuk National University
Pages: 3695-3702
Publication date: 2012
Peer-reviewed: Yes

**Publication information**

Journal: Applied Surface Science
Volume: 258
Issue number: 8
ISSN (Print): 0169-4332
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 4.22 SJR 1.093 SNIP 1.328
Web of Science (2017): Impact factor 4.439
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.37 SJR 0.958 SNIP 1.221
Web of Science (2016): Impact factor 3.387
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 3.13 SJR 0.89 SNIP 1.268
Web of Science (2015): Impact factor 3.15
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.96 SJR 0.948 SNIP 1.453
Web of Science (2014): Impact factor 2.711
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.78 SJR 0.96 SNIP 1.475
Web of Science (2013): Impact factor 2.538
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.26 SJR 0.913 SNIP 1.362
Web of Science (2012): Impact factor 2.112
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.27 SJR 0.908 SNIP 1.386
Web of Science (2011): Impact factor 2.103
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.922 SNIP 1.126
Web of Science (2010): Impact factor 1.795
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.84 SNIP 1.024
Biologically Active Polycaprolactone/Titanium Hybrid Electrospun Nanofibers for Hard Tissue Engineering

In this study, a novel strategy to improve the bioactivity of polycaprolactone nanofibers is proposed. Incorporation of pure titanium nanoparticles into polycaprolactone nanofibers strongly enhances the precipitation of bone-like apatite materials when the doped nanofibers are soaked in a simulated body fluid. The introduced nanofibers have been prepared by electrospinning of a colloid composed of a polycaprolactone solution and titanium nanopowder. A mixed solvent composed of N,N dimethyl formammide and methyl chloride has been utilized to dissolve the polycaprolactone. The physiochemical characterizations have affirmed the embedding of the titanium nanoparticles in the polycaprolactone nanofibers. Moreover the results have revealed that the bioactivity of the polycaprolactone is directly proportional to the content of the titanium nanoparticles. Overall, the high porosity of the electrospin nanofiber mats and the successful incorporation of the titanium nanoparticles make the prepared polycaprolactone nanofiber mat a proper candidate for the hard-tissue engineering applications.
Co3O4–ZnO hierarchical nanostructures by electrospinning and hydrothermal methods
A new hierarchical nanostructure that consists of cobalt oxide (Co3O4) and zinc oxide (ZnO) was produced by the electrospinning process followed by a hydrothermal technique. First, electrospinning of a colloidal solution that consisted of zinc nanoparticles, cobalt acetate tetrahydrate and poly(vinyl alcohol) was performed to produce polymeric nanofibers embedding solid nanoparticles. Calcination of the obtained electrospun nanofiber mats in air at 600°C for 1h, produced Co3O4 nanofibers with rough surfaces containing ZnO nanoparticles (i.e., ZnO-doped Co3O4 nanofibers). The rough surfaced nanofibers, containing ZnO nanoparticles (ZnNPs), were then exploited as seeds to produce ZnO nanobranches using a specific hydrothermal technique. Scanning electron microscopy (SEM), and transmission electron microscopy (TEM) were employed to characterize the as-spun nanofibers and the calcined product. X-ray powder diffractometry (XRD) analysis was used to study the chemical composition and the crystallographic structure.
Co$_3$O$_4$, ZnO, Co$_3$O$_4$-ZnO Nanofibers and Their Properties

General information
State: Published
Organisations: National Food Institute, Division of Industrial Food Research, University of Texas-Pan American, Chonbuk National University
Fabrication of Mineralized Collagen from Bovine Waste Materials by Hydrothermal Method as Promised Biomaterials

In the present study, we aimed to produce mineralized-collagen by hydrothermal process. A simple method not depending on additional foreign chemicals has been employed to isolate the mineralized-collagen fibers from bovine waste. The process of extraction involves the use of hydrothermal method from available bovine bones. The structural and morphological properties of the collagen fibers were characterized by using scanning electron microscopy and transmission electron microscopy. These results indicated well received collagen fibers, having a diameter less than 1 m and with established mineral content in the individual fibers. The X-ray diffraction showed the crystalline feature of the obtained nano-compounds. The thermo gravimetric analysis was used to differentiate between the collagen and mineral parts of obtained product. Overall, the results generously indicated production of well received collagen fibers from bovine bones.

General information
State: Published
Organisations: Division of Industrial Food Research, National Food Institute, University of Texas-Pan American, Eindhoven University of Technology, Chonbuk National University
Pages: 194-197
Publication date: 2011
Peer-reviewed: Yes

Publication information
Journal: Journal of Biomaterials and Tissue Engineering
Volume: 1
Issue number: 2
ISSN (Print): 2157-9083
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SJR 0.248 SNIP 0.362
Web of Science (2017): Impact factor 0.781
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.37 SJR 0.377 SNIP 0.469
Web of Science (2016): Impact factor 1.383
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.51 SJR 0.458 SNIP 0.6
Web of Science (2015): Impact factor 1.287
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.05 SJR 0.446 SNIP 0.835
Web of Science (2014): Impact factor 2.066
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.1 SJR 0.255 SNIP 0.39
Influences of Silver-Doping on the Crystal Structure, Morphology and Photocatalytic Activity of TiO2 Nanofibers

Doping of titanium dioxide nanofibers by silver nanoparticles revealed distinct improvement in the photocatalytic activity; however other influences have not been investigated. In this work, effect of silver-doping on the crystal structure, the nanofibrous morphology as well as the photocatalytic activity of titanium oxide nanofibers has been studied. Silver-doped TiO2 nanofibers having different silver contents were prepared by calcination of electrospun nanofiber mats consisting of silver nitrate, titanium isopropoxide and poly(vinyl acetate) at 600°C. The results affirmed formation of silver-doped TiO2 nanofibers composed of anatase and rutile when the silver nitrate content in the original electrospun solution was more than 3 wt%. The rutile phase content was directly proportional with the AgNO3 concentration in the electrospun solution. Negative impact of the silver-doping on the nanofibrous morphology was observed as increase the silver content caused to decrease the aspect ratio, i.e. producing nanorods rather nanofibers. However, silver-doping leads to modify the surface roughness. Study of the photocatalytic degradation of methylene blue dye clarified that in-crease the silver content strongly enhances the dye oxidation process.

General information
State: Published
Organisations: Division of Industrial Food Research, National Food Institute, Chonbuk National University, King Saud University
Contributors: Barakat, N. A. M., Kanjwal, M. A., Al-Deyab, S. S., Chronakis, I. S.
Pages: 1188-1193
Publication date: 2011
Peer-reviewed: Yes

Publication information
Journal: Materials Sciences and Applications
Issue number: 2
ISSN (Print): 2153-117X
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
BFI (2016): BFI-level 1
BFI (2015): BFI-level 1
BFI (2014): BFI-level 1
BFI (2013): BFI-level 1
ISI indexed (2013): ISI indexed no
ISI indexed (2012): ISI indexed no
ISI indexed (2011): ISI indexed no
Original language: English
Keywords: Electrospinning, Crystal Structure, Nanostructured Ceramics, Inorganic Materials, Titanium Oxide Nanofibers
DOI:
10.4236/msa.2011.29160
URLs:
Source: orbit
Source-ID: 286337
Research output: Research - peer-review › Journal article – Annual report year: 2011
Nano-microfibers by Electrospinning Technology: Processing, Properties and Applications

General information
State: Published
Organisations: Swerea AB
Contributors: Chronakis, I. S.
Pages: 264-286
Publication date: 2010

Host publication information
Title of host publication: Advances in Solid Hybrid Materials and Membranes
Editor: Xu, T.
ISBN (Print): 978-81-7895-461-5
Source: orbit
Source-ID: 263587
Research output: Research - peer-review › Book chapter – Annual report year: 2010

Nano-micromaterials processing, analysis, inspection and materials knowledge based management

General information
State: Published
Organisations: Swerea AB
Contributors: Chronakis, I. S., Mekras, N., Fuentes, G., Stifter, D., Hofer, C., Qin, Y.
Pages: 963-971
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: International Journal of Advanced Manufacturing Technology
Volume: 47
ISSN (Print): 0268-3768
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.8 SJR 0.994 SNIP 1.697
Web of Science (2017): Impact factor 2.601
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.3 SJR 1.046 SNIP 1.608
Web of Science (2016): Impact factor 2.209
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.8 SJR 0.889 SNIP 1.325
Web of Science (2015): Impact factor 1.568
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.03 SJR 1.082 SNIP 1.841
Web of Science (2014): Impact factor 1.458
Nanostructured Conductive Polymers by Electrospinning

**General information**
State: Published
Organisations: Swerea AB
Contributors: Chronakis, I. S.
Pages: 163-207
Publication date: 2010

**Host publication information**
Title of host publication: Nanostructured Conductive Polymers
Publisher: Wiley-VCH
Editor: Eftekhari, A.
ISBN (Print): 10: 0-470-74585-1
Metal-polymer Composite Nanofibres by Electrospinning

General information
State: Published
Organisations: Unknown
Contributors: Verma, S., Tahir, A., Fredholm, A., Chronakis, I. S.
Pages: 25-29
Publication date: 2009
Peer-reviewed: Yes

Publication information
Journal: Journal of Nanostructured Polymers and Nanocomposites
Volume: 5
Issue number: 2
ISSN (Print): 1790-4439
Ratings:
Scopus rating (2017): SJR 0.102 SNIP 0
Scopus rating (2016): CiteScore 0.13 SJR 0.113 SNIP 0.241
Scopus rating (2015): CiteScore 0.26 SJR 0.141 SNIP 0.098
Scopus rating (2014): CiteScore 0.29 SJR 0.141 SNIP 0.124
Scopus rating (2013): CiteScore 0.3 SJR 0.178 SNIP 0.272
ISI indexed (2013): ISI indexed no
Scopus rating (2012): CiteScore 0.4 SJR 0.156 SNIP 0.2
ISI indexed (2012): ISI indexed no
Scopus rating (2011): CiteScore 0.3 SJR 0.165 SNIP 0.225
ISI indexed (2011): ISI indexed no
Scopus rating (2010): SJR 0.246 SNIP 0.116
Scopus rating (2009): SJR 0.322 SNIP 0.293
Scopus rating (2008): SJR 0.146 SNIP 0.253
Scopus rating (2007): SJR 0.193 SNIP 0.742
Scopus rating (2006): SJR 0.104 SNIP 0.215
Original language: English
Source: orbit
Source-ID: 262207
Research output: Research - peer-review › Journal article – Annual report year: 2009

Nano-fiber scaffold electrodes based on PEDOT for cell stimulation

General information
State: Published
Organisations: Linköping University, Karolinska Institutet, Swerea AB
Pages: 451-456
Publication date: 2009
Peer-reviewed: Yes

Publication information
Journal: Sensors and Actuators B: Chemical
Volume: 142
Issue number: 2
ISSN (Print): 0925-4005
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 5.67 SJR 1.406 SNIP 1.453
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<td>2000</td>
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<td>1999</td>
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<td>SJR 0.916</td>
<td>Indexed yes</td>
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A simple method for preparation of molecularly imprinted nanofiber materials with signal transduction ability

A simple electrospinning method is developed to introduce signal transduction ability into molecularly imprinted nanofibers.
Selective molecular adsorption using electrospun nanofiber membranes

Molecularly imprinted nanoparticles were encapsulated into polymer nanofibers with a simple electrospinning method. The composite nanofibers form non-woven mats that can be used as affinity membrane to greatly simplify solid phase extraction of drug residues in analytical samples. Upward 100% of propranolol-imprinted nanoparticles can be easily encapsulated into poly(ethylene terephthalate) nanofibers, ensuring the composite materials to have a high specific binding capacity. As confirmed by radioligand binding analysis, the specific binding sites in the composite materials remain easily accessible and are chiral-selective. Using the new composite nanofiber mats as solid phase extraction materials, trace amount of propranolol (1 ng mL\(^{-1}\)) in tap water can be easily detected after a simple sample preparation. As validated in this study, there is no problem of template leakage from the composite nanofibers. Without the solid phase extraction, the existence of propranolol residues in water cannot be confirmed with even tandem HPLC-MS/MS analysis.

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Electrospun aliphatic polycarbonates as tailored tissue scaffold materials

Two different aliphatic polycarbonates were synthesised from CO2 and the respective epoxides. Poly(propyl carbonate) (PPC) was prepared by heterogeneous catalysis with zinc glutarate. Poly(cyclohexyl carbonate) (PCHC) was prepared via living copolymerisation homogeneously catalysed by a 3-amino-2-cyanoimidatoicrylate zinc acetate complex and subjected to electrospinning. The obtained nanofibres had a well-defined morphology free of beads along the fibres and with slightly porous structures on their surface. Subsequently, low-power deep UV irradiations, previously applied for photochemical surface modifications of two-dimensional and three-dimensional scaffolds from biostable polymers, were performed. Here, an effect on surface and bulk properties of PPC nanofibres was observed. Surface modifications of both polymers affected plasma protein adsorption. Photochemical bulk modifications observed for the first time on PPC nanofibres are indicating the possibility of spatial control of biodegradation rates, hence allow for control of the progression of host/implant interactions in vivo. In particular PPC was used for cell culture of L929 fibroblasts and primary rat hepatocytes. Even delicate primary cells showed good adhesion to the scaffolds and high viability.

General information

State: Published
Organisations: Forschungs Zentrum Karlsruhe GmbH, Swedish Institute for Fiber and Polymer Research
Contributors: Welle, A., Kröger, M., Döring, M., Niederer, K., Pindel, E., Chronakis, I. S.
Pages: 2211-2219
Publication date: 2007
Peer-reviewed: Yes

Publication information

Journal: Biomaterials
Volume: 28
Issue number: 13
ISSN (Print): 0142-9612
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 9.21 SJR 3.111 SNIP 1.897
Web of Science (2017): Impact factor 8.806
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 8.89 SJR 2.9 SNIP 1.885
Web of Science (2016): Impact factor 8.402
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 9.35 SJR 3.404 SNIP 2.013
BFI (2014): BFI-level 2
Encapsulation and exfoliation of inorganic lamellar fillers into polycaprolactone by electrospinning

The present paper reports, for the first time, the successful fabrication of layered double hydroxide (Mg-Al LDH)-reinforced polycaprolactone (PCL) nanofibers by electrospinning. Either the LDH in carbonate form or an LDH organically modified with 12-hydroxystearic acid (LDH-HA) were incorporated into PCL and electrospun using a voltage of 20 KV. The LDH-HA was prepared by an ionic exchange reaction from pristine LDH and encapsulated into PCL from acetone solution’s at 15 wt %. The morphological analysis showed pure PCL fibers with an average diameter of 600 +/- 50 nm, and this dimension was maintained in the fibers With LDH, with the inorganic component residing outside the fibers and not exfoliated. At variance, the fibers with the LDH-HA showed a significantly lower average diameter in the range of 350 50
nm, indicating the improved electrospinnability of PCL. Moreover, the inorganic lamellae were exfoliated, as shown by X-rays and residing inside the nanofibers as demonstrated by energy dispersive X-ray spectroscopy analysis. The structural parameters, such as degradation temperature and crystallinity, were investigated for all the samples and correlated with the electrospinning process.

**General information**

State: Published
Organisations: University of Salerno, Swedish Institute for Fiber and Polymer Research
Contributors: Romeo, V., Gorrasi, G.; Vittoria, V., Chronakis, I. S.
Pages: 3147-3152
Publication date: 2007
Peer-reviewed: Yes

**Publication information**

Journal: Biomacromolecules
Volume: 8
Issue number: 10
ISSN (Print): 1525-7797
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 5.89 SJR 1.95 SNIP 1.339
Web of Science (2017): Impact factor 5.738
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.74 SJR 1.98 SNIP 1.323
Web of Science (2016): Impact factor 5.246
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 6.05 SJR 2.105 SNIP 1.434
Web of Science (2015): Impact factor 5.583
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 6.38 SJR 2.207 SNIP 1.642
Web of Science (2014): Impact factor 5.75
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 6.07 SJR 2.09 SNIP 1.593
Web of Science (2013): Impact factor 5.788
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 5.72 SJR 2.316 SNIP 1.661
Web of Science (2012): Impact factor 5.371
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 5.74 SJR 2.222 SNIP 1.759
Web of Science (2011): Impact factor 5.479
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 2.347 SNIP 1.652
Web of Science (2010): Impact factor 5.327
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Conductive polypyrrole nanofibers via electrospinning: Electrical and morphological properties

Conductive polypyrrole nanofibers with diameters in the range of about 70-300 nm were obtained using electrospinning processes. The conductive nanofibers had well-defined morphology and physical stability. Two methods were employed. Electrospun nanofibers were prepared from a solution mixture of polypyrrole (PPy), and poly(ethylene oxide) (PEO) acted as a carrier in order to improve PPy processability. Both the electrical conductivity and the average diameter of PPy nanofibers can be controlled with the ratio of PPy/PEO content. In addition, pure (without carrier) polypyrrole nanofibers were also able to be formed by electrospinning organic solvent soluble polypyrrole, [(PPy3)(+)(DEHS)(-)](x), prepared using the functional doping agent di(2-ethylhexyl) sulfosuccinate sodium salt (NaDEHS) [Jang KS, Lee H, Moon B. Synth Met 2004; 143:289-94. 124]. Electrospun blends of sulfonic acid (SO3H)-bearing water soluble polypyrrole, [PPy(SO3H)-DEHS], with PEO acting as a carrier, are also reported. The factors that facilitate the formation of electrical conduction paths through the electrospun nanofiber segments are discussed. (c) 2006 Elsevier Ltd. All rights reserved.

General information
State: Published
Organisations: Swedish Institute for Fiber and Polymer Research
Contributors: Chronakis, I. S., Grapenson, S., Jakob, A.
Pages: 1597-1603
Publication date: 2006
Peer-reviewed: Yes

Publication information
Journal: Polymer
Volume: 47
Issue number: 5
ISSN (Print): 0032-3861
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 3.59 SJR 1.097 SNIP 1.163
Web of Science (2017): Impact factor 3.483
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.77 SJR 1.207 SNIP 1.253
Web of Science (2016): Impact factor 3.684
Encapsulation and Selective Recognition of Molecularly Imprinted Theophylline and 17beta-Estradiol Nanoparticles within Electrospun Polymer Nanofibers

General information
State: Published
Organisations: Lund University, Swedish Institute for Fiber and Polymer Research
Contributors: Chronakis, I. S., Jakob, A., Hagström, B., Ye, L.
Pages: 8960-8965
Publication date: 2006
Peer-reviewed: Yes

Publication information
Journal: Langmuir
Volume: 22
ISSN (Print): 0743-7463
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4 SJR 1.479 SNIP 1.148
Web of Science (2017): Impact factor 3.789
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.99 SJR 1.559 SNIP 1.178
Web of Science (2016): Impact factor 3.833
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.33 SJR 1.65 SNIP 1.281
Web of Science (2015): Impact factor 3.993
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 4.59 SJR 1.81 SNIP 1.371
Web of Science (2014): Impact factor 4.457
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 4.55 SJR 1.896 SNIP 1.343
Web of Science (2013): Impact factor 4.384
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 4.37 SJR 2.179 SNIP 1.369
Web of Science (2012): Impact factor 4.187
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 4.42 SJR 2.051 SNIP 1.349
Web of Science (2011): Impact factor 4.186
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.158 SNIP 1.393
Web of Science (2010): Impact factor 4.269
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 2.164 SNIP 1.344
Generation of Molecular Recognition Sites in Electrospun Polymer Nanofibers via Molecular Imprinting

General information
State: Published
Organisations: Lund University, Swedish Institute for Fiber and Polymer Research
Contributors: Chronakis, I. S., Milosevic, B., A., F., Ye, L.
Pages: 357-361
Publication date: 2006
Peer-reviewed: Yes

Publication information
Journal: Macromolecules
Volume: 39
ISSN (Print): 0024-9297
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 5.86 SJR 2.419 SNIP 1.513
Web of Science (2017): Impact factor 5.914
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.76 SJR 2.564 SNIP 1.483
Web of Science (2016): Impact factor 5.835
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 5.82 SJR 2.357 SNIP 1.599
Web of Science (2015): Impact factor 5.554
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 5.83 SJR 2.524 SNIP 1.695
Web of Science (2014): Impact factor 5.8
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 6.09 SJR 2.578 SNIP 1.736
Web of Science (2013): Impact factor 5.927
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 5.35 SJR 2.78 SNIP 1.568
Web of Science (2012): Impact factor 5.521
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 5.15 SJR 2.556 SNIP 1.571
Web of Science (2011): Impact factor 5.167
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.516 SNIP 1.496
Web of Science (2010): Impact factor 4.838
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 2.971 SNIP 1.512
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 2.834 SNIP 1.522
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 3.1 SNIP 1.6
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 3.004 SNIP 1.72
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 2.623 SNIP 1.645
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 2.619 SNIP 1.693
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 2.565 SNIP 1.634
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 2.561 SNIP 1.7
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 2.863 SNIP 1.73
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 2.793 SNIP 2.012
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 2.75 SNIP 1.961
Original language: English
Source: orbit
Source-ID: 262203
Research output: Research - peer-review ; Journal article – Annual report year: 2006

Manufacturing of Polymer Micro and Nanostructures

General information
State: Published
Biodegradable films of partly branched Poly(L-lactide)-co-poly(epsilon-caprolactone) copolymer: Modulation of phase morphology, plasticization properties and thermal depolymerization

We report on the modulation of phase morphology, plasticization properties, and thermal stability of films of partly branched poly(L-lactide)-co-poly(epsilon-caprolactone) copolymer (PLLA-co-PCL) with additions of low molecular weight compounds, namely, triethyl citrate ester, diethyl phthalate, diepoxy polyether (poly(propylene glycol) diglycidyl ether), and with epoxidized soybean oil (ESO). The PLLA-co-PCL/polyether films showed significant stability against thermal depolymerization, high film flexibility, and good plasticizing properties, probably due to cross-linking and chain branching formation between diepoxy groups with both the end carboxyl and hydroxyl groups of the PLLA copolymer (initially present or generated during the degradation process) to produce primary ester and ether bonds, respectively. Diethyl phthalate and triethyl citrate ester were found to be efficient plasticizers for PLLA copolymer in terms of glass transition and mechanical properties, but the more water-soluble plasticizer triethyl citrate induced a dramatic loss in the molecular weight of the copolymer. Although ESO cannot play the role of a plasticizer, it substantially stabilizes and retards thermal depolymerization of the PLLA copolymer matrix, possibly because of a reaction between epoxy groups with the end carboxyl and hydroxyl groups of the PLLA copolymer. The presence of ESO in PLLA-co-PCL/ESO/triethyl citrate blends enhanced the compatibility and miscibility of the plasticizer with the PLLA copolymer matrix, considerably improved the mechanical properties (elongation at break), and substantially stabilized the copolymer against thermal depolymerization. It seems likely that the epoxy groups interact not only with the end hydroxyl and carboxyl group of the copolymer but as well with the hydroxyl group of triethyl citrate plasticizer to produce a new ether bond (C-O-C) as the crosslinking unit. On the other hand, for PLLA-co-PCL/ESO/polyether blends, (80/10/10) epoxidized oil distorts the compactness of the blend by diminishing the proposed entanglements between carboxyl, hydroxyl, and diepoxy groups of polyether and reduces the high elongation properties otherwise observed in the PLLA-co-PCL/polyether films. The multicomponent approach toward modulating poly(L-lactide)-co-poly(epsilon-caprolactone) copolymer films using epoxy compounds and plasticizers and the insight into the nature of various PLLA matrixes presented here offer advantages to a broad engineering of PLLA copolymer films having desirable physical properties and multiphase behavior for efficient uses in future technical applications.

General information
State: Published
Organisations: Swedish Institute for Fiber and Polymer Research
Contributors: Borström, J., Boss, A., Chronakis, I. S.
Pages: 1124-1134
Publication date: 2004
Peer-reviewed: Yes

Publication information
Journal: Biomacromolecules
Volume: 5
Issue number: 3
ISSN (Print): 1525-7797
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 5.89 SJR 1.95 SNIP 1.339
Web of Science (2017): Impact factor 5.738
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.74 SJR 1.98 SNIP 1.323
Web of Science (2016): Impact factor 5.246
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 6.05 SJR 2.105 SNIP 1.434
Web of Science (2015): Impact factor 5.583
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 6.38 SJR 2.207 SNIP 1.642
Web of Science (2014): Impact factor 5.75
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Complex formation in aqueous medium of partially hydrolysed oat cereal proteins with sodium stearoyl-2 lactylate (SSL) lipid surfactant and implications for bile acids activity

Sodium stearoyl-2 lactylate (SSL) lipid surfactant molecules specifically bind partially hydrolysed oat proteins in aqueous medium and significantly enhance the dispersion stability of oat cereal preparations. The proposed complexation is composition dependent and a greater understanding of the role of both oat proteins and lipid surfactant in the effect was gained with data from high performance liquid chromatography (HPLC-UV), viscometry and differential scanning micro calorimetry. The effect of the lipid surfactant on the degree of association is primarily governed by the conformational activity of oat protein molecules related to the extent of protein hydrolysed state, as well as protein unfolded and subsequent aggregated structures. SSL does not dissociate oat proteins into subunits or destroy important hydrophobic contacts already stabilising the protein molecules. Although the exact mode of association is unknown, the present study demonstrates that such interactions occur in a specific manner and suggest selectivity of oat proteins for individual fatty acids. The effect of various amounts of bile acids on SSL-oat protein interaction was also investigated, as a first attempt to investigate the role of lipid surfactant molecules in the known cholesterol-lowering action of oat cereal ingredients and to elucidate favourable conditions by which oat cereal can elicit hypocholesterolemic effects. (C) 2004 Elsevier B.V. All rights
Scopus rating (2007): SJR 0.873 SNIP 1.065
Scopus rating (2006): SJR 0.75 SNIP 0.868
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.737 SNIP 0.943
Scopus rating (2004): SJR 0.623 SNIP 0.834
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.714 SNIP 0.998
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.832 SNIP 0.986
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.692 SNIP 0.849
Scopus rating (2000): SJR 0.356 SNIP 0.714
Scopus rating (1999): SJR 0.432 SNIP 0.741
Original language: English
DOIs: 10.1016/j.colsurfb.2004.03.011
Source: orbit
Source-ID: 262213
Research output: Research - peer-review › Journal article – Annual report year: 2004

Hydrophilic monolayer formation of adsorbed cationic starch and cationic hydroxyethyl cellulose derivates on polyester surfaces

General information
State: Published
Organisations: Swedish Institute for Fiber and Polymer Research
Contributors: Roos, P., Westling, Å., Chronakis, I. S.
Pages: 2247-2256
Publication date: 2004
Peer-reviewed: Yes

Publication information
Journal: Bioscience, Biotechnology and Biochemistry
Volume: 68
Issue number: 11
Original language: English
Source: orbit
Source-ID: 262334
Research output: Research - peer-review › Journal article – Annual report year: 2004

Solid-state characteristics and re-dispersible properties of powders formed by spray-drying and freeze-drying cereal dispersions of varying (1→3, 1→4) beta-glucan content

General information
State: Published
Organisations: Cereal Base Ceba AB, Swedish Institute for Fiber and Polymer Research
Contributors: Chronakis, I. S., Triantafyllou, A. Ö., Oste, R.
Pages: 183-193
Publication date: 2004
Peer-reviewed: Yes

Publication information
Journal: Journal of Cereal Science
Volume: 40
ISSN (Print): 0733-5210
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 2.95 SJR 1.121 SNIP 1.632
Polymer nanofibers assembled by electrospinning
Isotropic-nematic phase equilibrium and phase separation of kappa-carrageenan in aqueous salt solution: experimental and theoretical approaches

The behavior of chiral-nematic and isotropic phases of helical kappa-carrageenan in aqueous solution of sodium iodide was compared with that of the anisotropic biphasic phase that contains both these phases. On the basis of birefringence, rheology, chemical analysis, average molecular weight, and polydispersity index measurements, we derived a number of characteristic differences as well as similarities between these phases, over a range of polysaccharide concentrations obtained by the dilution of each phase. For example, we assessed the critical concentration of an isotropic-anisotropic transition (C-i), the temperature of the anisotropic-isotropic phase shift during thermal heating-cooling cycles, and the viscosity changes due to the phase shift and due to the diminishing of the helical conformation. We also demonstrated how the different phases and their dilutions behave under the effect of shear and frequency of oscillation and how the viscoelastic properties vary in each phase and discussed the isotropic and anisotropic liquid crystal controlling behavior mechanisms. From a theoretical point of view, we propose to combine the wormlike chain model for semiflexible polyelectrolytes interacting via both hard-core and electrostatic repulsion to assess the concentration of isotropic-nematic transition, to assess the coexistence concentration range, and to determine the effects of charge by applying the effective diameter and a twisting effect.
Thermoreversible Gels of Hydrophobically Modified Hydroxyethyl Cellulose Cross-Linked by Amylose

General information
State: Published
Organisations: Lund University
Contributors: Chronakis, I. S., Egermayer, M., Piculell, L.
Pages: 4113-4122
Publication date: 2002
Peer-reviewed: Yes

Publication information
Journal: Macromolecules
Volume: 35
ISSN (Print): 0024-9297
Ratings:
BFI (2018): BFI-level 2
Gelation of Edible Blue-Green Algae Protein Isolate (Spirulina platensis strain pacifica)

General information
State: Published
Organisations: Lund University
Contributors: Chronakis, I. S.
Pages: 888-898
Publication date: 2001
Peer-reviewed: Yes

Publication information
Journal: Journal of Agricultural and Food Chemistry
Volume: 49
Issue number: 2
ISSN (Print): 0021-8561
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 3.64 SJR 1.269 SNIP 1.343
Web of Science (2017): Impact factor 3.412
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.45 SJR 1.305 SNIP 1.343
Web of Science (2016): Impact factor 3.154
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 3.23 SJR 1.224 SNIP 1.245
Web of Science (2015): Impact factor 2.857
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.25 SJR 1.267 SNIP 1.413
Web of Science (2014): Impact factor 2.912
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 3.44 SJR 1.43 SNIP 1.47
Web of Science (2013): Impact factor 3.107
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 3.2 SJR 1.408 SNIP 1.464
Web of Science (2012): Impact factor 2.906
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Polyelectrolyte-ionic surfactant interactions in aqueous solutions: effects of polymer molecular weight, surfactant architecture, and added cyclodextrin, probed by dynamic mechanical fluorescence and NMR spectroscopy

General information
State: Published
Organisations: Unknown
Contributors: Alexandridis, P., Chronakis, I. S., Ahn, S., Tsianou, M.
Publication date: 2001

Host publication information
Title of host publication: Abstract of Papers of the American Chemical Society
Volume: 221, U322
Source: orbit
Source-ID: 263686
Research output: Research - peer-review › Article in proceedings – Annual report year: 2001

Rheological Properties of Oppositely Charged Polyelectrolyte - Surfactant Mixtures: Effect of Polymer Molecular Weight and Surfactant Architecture

General information
State: Published
Biosolar Proteins from Aquatic Algae

General information
State: Published
Organisations: Lund University
Contributors: Chronakis, I. S.
Pages: 39-72
Publication date: 2000

Host publication information
Title of host publication: Novel Macromolecules in Food Systems
Place of publication: Amsterdam
Publisher: Elsevier Applied Science Publishers
Editors: Doxastakis, G., Kiosseoglou, V.
ISBN (Print): 0-444-82932-6
Source: orbit
Source-ID: 263669
Research output: Research - peer-review; Journal article – Annual report year: 2001

Ternary Phase diagram of surfactant Triton X - 100 / Poly (Acrylic Acis) / Water system

General information
State: Published
Organisations: Lund University
Contributors: Galatanu, A. N., Chronakis, I. S., Anghel, D. F., Khan, A.
Pages: 4922-4928
Publication date: 2000
Peer-reviewed: Yes

Publication information
Journal: Langmuir
Volume: 16
Issue number: 11
ISSN (Print): 0743-7463
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4 SJR 1.479 SNIP 1.148
Web of Science (2017): Impact factor 3.789
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.99 SJR 1.559 SNIP 1.178
Web of Science (2016): Impact factor 3.833
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.33 SJR 1.65 SNIP 1.281
Web of Science (2015): Impact factor 3.993
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 4.59 SJR 1.81 SNIP 1.371
Web of Science (2014): Impact factor 4.457
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 4.55 SJR 1.896 SNIP 1.343
Web of Science (2013): Impact factor 4.384
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 4.37 SJR 2.179 SNIP 1.369
Web of Science (2012): Impact factor 4.187
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 4.42 SJR 2.051 SNIP 1.349
Web of Science (2011): Impact factor 4.186
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.158 SNIP 1.393
Web of Science (2010): Impact factor 4.269
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 2.164 SNIP 1.344
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 2.389 SNIP 1.324
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 2.473 SNIP 1.42
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 2.392 SNIP 1.433
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 2.19 SNIP 1.452
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.979 SNIP 1.457
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 2.013 SNIP 1.394
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.971 SNIP 1.471
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 2.038 SNIP 1.359
The behaviour of protein preparations from blue-green algae (Spirulina platensis strain Pacifica) at the air/water interface

The surface tension of a protein sample isolated from the blue-green algae (cyanobacteria) Spirulina platensis strain Pacifica was studied using the Wilhelmy plate method. The isolated material was characterised by determining the protein and lipid content, SDS-PAGE electrophoresis, isoelectric focusing, and visible spectroscopy. The protein is capable of reducing the interfacial tension at the aqueous/air interface already at relatively lower bulk concentrations compared to common food proteins. The surface tension of the protein preparation seems to be quite independent of pH, which indicates that electrostatic interactions are of minor importance for the interfacial behaviour. We have also separated out fractions with different interfacial properties by centrifugation. When the protein was spread at the air/aqueous interface, the pressure area isotherm somewhat resembles those recorded for lipids, with a higher collapse pressure than usually observed for proteins. The interfacial behaviour of extracted lipids confirms that remaining traces of lipids in protein powder have only a minor influence on the surface activity of Spirulina protein. The surface-active components are likely to be protein and/or protein-pigment complexes rather than individual protein molecules. (C) 2000 Elsevier Science B.V. All rights reserved.
Viscoelastic properties of kappa- and iota-carrageenan in aqueous NaI from the liquid-like to the solid-like behaviour

General information
State: Published
Organisations: INRA Institut National de La Recherche Agronomique, Lund University
Contributors: Chronakis, I. S., Doublier, J., Piculell, L.
Pages: 1-14
Publication date: 2000
Peer-reviewed: Yes

Publication information
Journal: International Journal of Biological Macromolecules
Volume: 28
Issue number: 1
ISSN (Print): 0141-8130
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 4.11 SJR 0.917 SNIP 1.307
Web of Science (2017): Impact factor 3.909
Web of Science (2017): Indexed yes
Conformation and association of kappa-carrageenan with Locust Bean Gum in mixture of ions - Rheology and Cryo-TEM studies
Marine Algae Proteins: a study on the extraction, thermal denaturation and functionality of Spirulina

General information
State: Published
Organisations: Lund University
Contributors: Chronakis, I. S., Sanchez, A.
Pages: 154-166
Publication date: 1998

Host publication information
Title of host publication: Gums and Stabilisers for the Food Industry 9
Place of publication: Cambridge
Publisher: Royal Society of Chemistry
Editor: Williams, P.
Source: orbit
Source-ID: 263687
Research output: Research - peer-review › Article in proceedings – Annual report year: 1998

Measurement of heat transfer coefficient in a thawing tunnel

General information
State: Published
Organisations: Technical University of Crete, Catholic University of Portugal, Lund University
Contributors: Gekas, V., Chronakis, I. S., Escada, G., Sjöholm, I.
Pages: 271-278
Publication date: 1998
Peer-reviewed: Yes

Publication information
Journal: Journal of Food Process Engineering
Volume: 21
Issue number: 4
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.25 SJR 0.465 SNIP 0.739
Web of Science (2017): Impact factor 1.955
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.15 SJR 0.477 SNIP 0.69
Web of Science (2016): Impact factor 1.37
On the molecular characteristics, compositional properties and structural functional mechanisms of Maltodextrins: A Review

General information
State: Published
Organisations: Lund University
Contributors: Chronakis, I. S.
Pages: 599-637
Specific Methods for the Analysis of Identity and Purity of Functional Food Polysaccharides

General information
State: Published
Organisations: Research Center for Food and Development, Lund University
Contributors: Goycoolea, F., Chronakis, I. S.
Pages: 99-140
Publication date: 1998

Host publication information
Title of host publication: Developments in Food Science Series, 39. 'Instrumental Methods in Food and Beverage Analysis'
Place of publication: Amsterdam
Publisher: Elsevier Applied Science Publishers
Editors: Wetzel, D., Charalambous, G.
ISBN (Print): 0-444-82018-3
Source: orbit
Source-ID: 263670
Research output: Research - peer-review › Book chapter – Annual report year: 1998

Organisation and association of kappa-carrageenan helices under different salt conditions

General information
State: Published
Organisations: North East Wales Institute of Higher Education, Umeå University, Lund University
Contributors: Piculell, L., Borgström, J., Chronakis, I. S., Quist, P., Viebke, C.
Pages: 141-153
Publication date: 1997
Peer-reviewed: Yes

Publication information
Journal: International Journal of Biological Macromolecules
Volume: 21
Issue number: (1-2)
ISSN (Print): 0141-8130
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 4.11 SJR 0.917 SNIP 1.307
Web of Science (2017): Impact factor 3.909
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.84 SJR 0.882 SNIP 1.294
Web of Science (2016): Impact factor 3.671
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 3.38 SJR 0.808 SNIP 1.303
Web of Science (2015): Indexed yes
Partially denatured trypsinized-sunflower and soya protein isolates properties

General information
State: Published
Organisations: Lund University
Contributors: Chronakis, I. S., Sanchez, A.
Pages: 269-274
Publication date: 1997

Host publication information
Title of host publication: Plant Proteins from European Crops: Food and Non Food Applications
Place of publication: Versailles
Structural-Functional and Water-Holding studies of Biopolymers in Low Fat content Spreads

General information
State: Published
Organisations: Cranfield University
Contributors: Chronakis, I. S.
Pages: 36-44
Publication date: 1997
Peer-reviewed: Yes

Publication information
Journal: Food Science and Technology (LEB)
Volume: 30
Issue number: 1
Original language: English
Source: orbit
Source-ID: 262508
Research output: Research - peer-review › Article in proceedings – Annual report year: 1997

Structural Properties of Gelatin - Pectin Gels. Effect of Ethylene Glycol

General information
State: Published
Organisations: University of York, Cranfield University
Contributors: Chronakis, I. S., Kasapis, S., Abeysekera, R.
Pages: 271-279
Publication date: 1997
Peer-reviewed: Yes

Publication information
Journal: Food Hydrokolloids
Volume: 11
Issue number: 3
Original language: English
Source: orbit
Source-ID: 262509
Research output: Research - peer-review › Journal article – Annual report year: 1997

Gelation and Phase Separation in Maltodextrin - Caseinate systems

General information
State: Published
Organisations: Cranfield University
Contributors: Manoj, P., Kasapis, S., Chronakis, I. S.
Pages: 407-420
Publication date: 1996
Peer-reviewed: Yes

Publication information
Journal: Food Hydrocolloids
Volume: 10
Issue number: 4
ISSN (Print): 0268-005X
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
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Source: English

Source-ID: 262562

Research output: Research - peer-review
Rheology of kappa-carrageenan in mixtures of sodium & cesium iodide: Two types of gels

Recent studies on dilute solutions (Borgstrom et al. (1996), Int. J. Biol. Macromol. 18, 223) have shown that kappa-carrageenan helices associate into superhelical rigid rods in mixed 0.1 M aqueous solutions of NaI and CsI above a critical mole fraction (x(Cs)=0.4) of Cs. This work concerns the temperature-dependent rheology of more concentrated systems in mixed and pure solutions of the same salts. Gels with low moduli were even found in NaI alone, although this salt is known to impede the gelation of kappa-carrageenan, but only above 0.9% (w/w) of carrageenan. These gels were reminiscent of iota-carrageenan gels in two respects: the (low) magnitude of the shear storage modulus (G'), and the absence of hysteresis in the sol-gel transition. On the other hand, both the threshold concentration for gelation and the ratio between the loss and storage moduli were substantially higher for the kappa-carrageenan gels in NaI. In mixed solutions of CsI and NaI, two types of kappa-carrageenan gels could be distinguished, depending on the cesium content. The transition occurred at x(Cs) = 0.4, as in the previous studies on dilute solutions. Below x(Cs)=0.4, the gels were similar to those in NaI alone. Above x(Cs)=0.4, the gels were similar to 'conventional' kappa-carrageenan gels, formed in salts such as KCl: a pronounced thermal hysteresis appeared in the sol-gel transition, the gels showed tendencies for syneresis, and G' increased dramatically with increasing cesium content. (C) 1997 Elsevier Science Ltd.

General information
State: Published
Organisations: Lund University
Contributors: Chronakis, I. S., Piculell, L., Borgström, J.
Pages: 215-225
Publication date: 1996
Peer-reviewed: Yes

Publication information
Journal: Carbohydrate Polymers
Volume: 31
Issue number: 4
ISSN (Print): 0144-8617
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 5.58 SJR 1.428 SNIP 1.733
Web of Science (2017): Impact factor 5.158
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 5.15 SJR 1.419 SNIP 1.75
Scientific and Technological aspects of Polymer incompatibility in mixed Biopolymer systems
Small deformation rheological properties of single and mixed Maltodextrin-Milk protein systems

Small deformation dynamic oscillation was used to investigate the structural behaviour of conformationally dissimilar maltodextrin and milk protein macro-molecules in a mixture, with the view of identifying the state of phase separation and the pattern of solvent distribution between the two constituent phases. The enthalpic nature of the maltodextrin network produced a sigmoidal transition in the development of storage modulus ($G'$) during cooling and substantial thermal hysteresis upon heating of the gel. By contrast, the entropically-driven build up of structure in milk protein samples yielded linear and overlapping cooling and heating scans of $G'$ with networks reverting into solutions at relatively low temperatures. These differences in the viscoelastic functions of the two polymers in combination with theoretical analysis (isostress-isostain models, Kerner equation) have documented the reinforcing effect of strong and spherical maltodextrin inclusions on the weaker and continuous milk protein phase. However, at concentrations of maltodextrin beyond the phase inversion point, the binary assembly comprises a strong and continuous maltodextrin network surrounding the weaker milk protein inclusions. Finally, the sharp change in the pattern of water partition between the two polymeric components, as a result of phase inversion in the system, was rationalised on the basis of kinetically-influenced co-gels comprising phase separated networks which are trapped away from the state of thermodynamic equilibrium. Copyright (C) 1996 Published by Elsevier Science Ltd.
Applications of Biopolymers - Theory and Practice

General information
State: Published
Organisations: Cranfield University
Contributors: Chronakis, I. S., Kasapis, S.
Pages: 75-110
Publication date: 1995

Host publication information
Title of host publication: Food Flavors: Generation, Analysis and Process Influence
Place of publication: Amsterdam
A Recent Advance in the Application of Blending Laws in Mixed Biopolymer Systems

General information
State: Published
Organisations: Cranfield University
Contributors: Chronakis, I. S., Kasapis, S.
Pages: 99-118
Publication date: 1995
Peer-reviewed: Yes

Publication information
Journal: International Journal of Polymer Analysis and Characterization
Volume: 1
ISSN (Print): 1023-666X
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.57 SJR 0.444 SNIP 0.83
Web of Science (2017): Impact factor 1.333
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.12 SJR 0.542 SNIP 1.143
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.77 SJR 0.476 SNIP 0.867
Web of Science (2015): Impact factor 1.515
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.26 SJR 0.395 SNIP 0.596
Web of Science (2014): Impact factor 1.264
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.62 SJR 0.478 SNIP 0.746
Web of Science (2013): Impact factor 1.487
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.32 SJR 0.364 SNIP 0.763
Web of Science (2012): Impact factor 1.233
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.31 SJR 0.477 SNIP 0.85
Web of Science (2011): Impact factor 1.412
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.31 SNIP 0.636
Web of Science (2010): Impact factor 0.814
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.264 SNIP 0.582
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.323 SNIP 0.624
Scopus rating (2007): SJR 0.221 SNIP 0.319
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.283 SNIP 0.525
Scopus rating (2005): SJR 0.352 SNIP 0.657
Scopus rating (2004): SJR 0.366 SNIP 0.451
A Rheological Study of the Application of Carbohydrate-Protein Incompatibility to the Development of Low Fat Commercial Spreads

The small and large deformation properties of commercial low fat spreads and traditional full fat products have been investigated in order to develop a background understanding of the changes in viscoelastic properties and the structural organisation occurring as a result of addition of biopolymers to the aqueous phase of low fat dispersions. Parameters have been derived from compression analysis, dynamic oscillation (frequency, strain and temperature sweeps) and creep compliance testing.

It seems that the direct replacement of fat with a biopolymer-structured aqueous phase does not imitate the plastic rheology of butter and margarine. Thus, the ratio of plastic to maximum stress (σ_p/σ_m) of butter and margarine is substantially higher (0.96 - 1.0) than the ratio of inflectional to maximum stress (σ_i/σ_m) of commercial low fat spreads with a strong, gel-like character (up to 0.83). Additionally, some commercial embodiments with reduced amounts of structural components have stress-strain profiles resembling those of viscous solutions instead of a plastic product. Dynamic oscillatory measurements have characterised the mechanical properties of water-continuous low fat spreads. Dispersions reproduced the mechanical profile of three-dimensional biopolymer gels with a high elastic component (tan δ approximate to 0.04) and a substantial linear response to increasing amplitude of oscillation (up to 10% deformation). Products comprising hydrolysed starch as one of the functional ingredients show long melting profiles upon heating, which contrast strongly with the 'melt in the mouth' properties of butter. In accordance with the above, butter requires lower initial strain to exhibit negligible recovery of shape after the removal of stress, than do commercial low fat spreads with a pronounced elastic element, during a creep compliance experiment. Copyright (C) 1996 Elsevier Science Ltd.

General information
State: Published
Organisations: Cranfield University
Contributors: Chronakis, I. S., Kasapis, S.
Pages: 367-373
Publication date: 1995
Peer-reviewed: Yes

Publication information
Journal: Carbohydrate Polymers
Volume: 28
Issue number: 4
ISSN (Print): 0144-8617
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 5.58 SJR 1.428 SNIP 1.733
Web of Science (2017): Impact factor 5.158
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 5.15 SJR 1.419 SNIP 1.75
Web of Science (2016): Impact factor 4.811
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 4.86 SJR 1.44 SNIP 1.819
Web of Science (2015): Impact factor 4.219
Web of Science (2015): Indexed yes
Characterisation of a Commercial Soy Isolate by Physical Techniques

General information
State: Published
Organisations: Aristotle University of Thessaloniki, Cranfield University
Contributors: Chronakis, I. S., Kasapis, S., Richardson, R., Doxastakis, G.
Pages: 371-389
Publication date: 1995
Peer-reviewed: Yes

Publication information
Journal: Journal of Textural Studies
Preparation and Analysis of Water Continuous Very Low Fat Spreads

General information
State: Published
Organisations: Cranfield University
Contributors: Chronakis, I. S., Kasapis, S.
Pages: 488-494
Publication date: 1995
Peer-reviewed: Yes

Publication information
Journal: Food Science & Technology
Volume: 28
Issue number: 5
ISSN (Print): 1475-3324
Ratings:
Web of Science (2018): Indexed yes
Scopus rating (2017): CiteScore 0.09 SJR 0.132
Web of Science (2017): Indexed yes
Scopus rating (2016): CiteScore 0.06 SJR 0.11
Scopus rating (2015): CiteScore 0.06 SJR 0.109 SNIP 0
Scopus rating (2014): CiteScore 0.09 SJR 0.11 SNIP 0.269
Scopus rating (2013): CiteScore 0.09 SJR 0.119 SNIP 0.209
ISI indexed (2013): ISI indexed no
Scopus rating (2012): CiteScore 0.04 SJR 0.105 SNIP 0.042
ISI indexed (2012): ISI indexed no
Scopus rating (2011): CiteScore 0.06 SJR 0.12 SNIP 0.069
ISI indexed (2011): ISI indexed no
Scopus rating (2010): SJR 0.122 SNIP 0.072
Scopus rating (2009): SJR 0.121 SNIP 0.025
Scopus rating (2008): SJR 0.12 SNIP 0.127
Scopus rating (2007): SJR 0.112 SNIP 0.007
Scopus rating (2006): SJR 0.111 SNIP 0.214
Scopus rating (2005): SJR 0.123 SNIP 0.028
Original language: English
Source: orbit
Source-ID: 262575
Research output: Research - peer-review › Journal article – Annual report year: 1995

Structural Properties of single and mixed Milk / Soya Protein Systems

General information
State: Published
Organisations: Cranfield University
Contributors: Chronakis, I. S., Kasapis, S.
Pages: 459-478
Publication date: 1993
Peer-reviewed: Yes

Publication information
Journal: Food Hydrocolloids
Volume: 7
Issue number: 6
ISSN (Print): 0268-005X
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 5.25 SJR 1.991 SNIP 1.892
Web of Science (2017): Impact factor 5.089
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.1 SJR 2.03 SNIP 2.045
Web of Science (2016): Impact factor 4.747
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.53 SJR 1.802 SNIP 1.924
Web of Science (2015): Impact factor 3.858
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 5.21 SJR 2.232 SNIP 2.554
Web of Science (2014): Impact factor 4.09
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 4.81 SJR 2.098 SNIP 2.256
Web of Science (2013): Impact factor 4.28
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 3.69 SJR 1.837 SNIP 2.06
Web of Science (2012): Impact factor 3.494
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 3.57 SJR 1.618 SNIP 1.911
Web of Science (2011): Impact factor 3.473
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.759 SNIP 1.519
Web of Science (2010): Impact factor 2.659
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.762 SNIP 1.786
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.484 SNIP 1.651
Scopus rating (2007): SJR 1.574 SNIP 1.716
Scopus rating (2006): SJR 1.272 SNIP 1.624
Scopus rating (2005): SJR 1.019 SNIP 1.39
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.068 SNIP 1.397
Scopus rating (2003): SJR 1.01 SNIP 1.497
Scopus rating (2002): SJR 1.051 SNIP 1.243
Scopus rating (2001): SJR 0.7 SNIP 0.901
Scopus rating (2000): SJR 0.801 SNIP 1.259
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 0.822 SNIP 1.146
Projects:

**PROBIO: PROBIO - Bioencapsulation of Bioingredients**
Chronakis, I. S., Project Manager, National Food Institute, Research Group for Nano-Bio Science
Mendes, A. C. L., Project Participant, National Food Institute, Research Group for Nano-Bio Science
Sevilla Moreno, J. A., Project Participant, National Food Institute, Research Group for Nano-Bio Science
Stubbe, P. R., Project Participant, National Food Institute, Research Group for Food Production Engineering
Bang-Berthelsen, I., Project Manager, National Food Institute
01/01/2018 → 01/01/2022
Keywords: Food, Health, Materials technology, encapsulation, Probiotika
Project: Research

**33525 : Experimental project in physics and nanotechnology: Cryo SEM Characterization of Food NMS Containing PUFA**
Mateiu, R. V., Main Supervisor, Center for Electron Nanoscopy, DTU Danchip
García Moreno, P. J., Supervisor, National Food Institute, Research Group for Bioactives – Analysis and Application
Jacobsen, C., Supervisor, National Food Institute, Research Group for Bioactives – Analysis and Application
Chronakis, I. S., Supervisor, National Food Institute, Research Group for Nano-Bio Science
Haaning, K., Project Participant, Duy Tan University
09/09/2016 → 01/12/2016
Collaborators: Duy Tan University
Project: Research

**Consistent Scale-up of the Freeze-drying Process**
de Carvalho, A. T. D. M. M. S., PhD Student, Department of Chemical and Biochemical Engineering
Gernaey, K. V., Main Supervisor, Department of Chemical and Biochemical Engineering
Clausen, A., Supervisor
Krühne, U., Supervisor, Department of Chemical and Biochemical Engineering
Madsen, M. M., Supervisor
Chronakis, I. S., Examiner
De Beer, T., Examiner
Davidsen, J., Examiner
Eksternt EU-finansieret
01/08/2015 → 31/10/2018
Award relations: Consistent Scale-up of the Freeze-drying Process
Project: PhD

**StrueSat - How structure affects satiety**
Stender, E. G. P., PhD Student
Svensson, B., Main Supervisor
Abou Hachem, M., Supervisor
Hägglund, P., Supervisor
Chronakis, I. S., Examiner
Barbirz, S., Examiner
Lo Leggio, L., Examiner
Forskningsrådssfinansiering
15/12/2014 → 18/04/2018
Award relations: StrueSat - How structure affects satiety
Project: PhD

**An improved physical understanding of the production of extruded fish feed will enable an optimized raw material utilization (ImProFeed)**
Dethlefsen, M. W., PhD Student, National Food Institute
Jørgensen, B. M., Main Supervisor, National Food Institute
Feyissa, A. H., Supervisor, National Food Institute
Nielsen, M. E., Supervisor, National Food Institute
Chronakis, I. S., Examiner, National Food Institute
Colovic, R., Examiner
Kristensen, J. B., Examiner
Industrial PhD
01/08/2014 → 05/12/2017
Award relations: An improved physical understanding of the production of extruded fish feed will enable an optimized raw material utilization (ImProFeed)
Project: PhD

Biosurface and biotribological properties of mucins and mucus gels
Madsen, J. B., PhD Student, Department of Mechanical Engineering
Lee, S., Main Supervisor, Department of Mechanical Engineering
Chronakis, I. S., Examiner
Kocherbitov, V., Examiner
Zappone, B., Examiner
Anden EU-finansiering
01/08/2011 → 30/09/2014
Award relations: Biosurface and biotribological properties of mucins and mucus gels
Project: PhD

Characterisation of the tribological and rheological properties between mucin/mucus and viscoelastic food systems
Celebioglu, H. Y., PhD Student, National Food Institute
Chronakis, I. S., Main Supervisor, National Food Institute
Lee, S., Supervisor
Lee, S., Supervisor
Mohammadifar, M. A., Examiner, National Food Institute
Mackie, A. R., Examiner
Sotres, J., Examiner
Stipendie fra udlandet
01/05/2013 → 30/08/2017
Award relations: Characterisation of the tribological and rheological properties between mucin/mucus and viscoelastic food systems
Project: PhD

Process development: Enzymatic upgrading of pectin from sugar beet pulp
Ahmadi Gavilghi, H., PhD Student, Department of Chemical and Biochemical Engineering
Mikkelsen, J. D., Main Supervisor, Department of Chemical and Biochemical Engineering
Meyer, A. S., Supervisor, Department of Chemical and Biochemical Engineering
Chronakis, I. S., Examiner
Bergenståhl, B., Examiner
Juul, A. G., Examiner
Stipendie fra udlandet
01/06/2009 → 04/09/2013
Award relations: Process development: Enzymatic upgrading of pectin from sugar beet pulp
Project: PhD

Development and characterization of nano-microstructures as carrier for bioactive compounds
Boutrup Stephansen, K., PhD Student, National Food Institute
Jessen, F., Main Supervisor, National Food Institute
Chronakis, I. S., Supervisor, National Food Institute
Sloth, J. J., Examiner, National Food Institute
Fojan, P., Examiner
Sarmento, B., Examiner
Forskningsrådsfinansiering
01/10/2011 → 02/09/2015
Award relations: Development and characterization of nano-microstructures as carrier for bioactive compounds
Project: PhD

Functional Biopolymer Nanostructures for Bioengineering Applications
Shekarforoush, E., PhD Student, National Food Institute
Chronakis, I. S., Main Supervisor, National Food Institute
Mendes, A. C. L., Supervisor, National Food Institute
ELECTRONANOMEGA: Development of omega-3 nanodelivery systems using electrospinning processing

Functional foods containing omega-3 lipids, which have approved health claims by EFSA, have resulted in one of the fastest-growing food product categories in Europe. However, to successfully develop foods enriched with omega-3 PUFA, lipid oxidation of these highly unsaturated fatty acids must be prevented in order to avoid both the loss of nutritional value and the formation of unpleasant off-flavors. Omega-3 PUFA can be added to foods as neat oils or as a “delivery system” such as microencapsulated oil powders and oil-in-water emulsions. Nevertheless, delivery of omega-3 lipids in the form of emulsions reduces the oxidative stability of omega-3 PUFA in some products. Furthermore, microencapsulates are less suitable for liquid or semi-liquid foods than emulsified omega-3 oils due to handling/mixing issues. Therefore, the development of alternative omega-3 PUFA delivery systems, which are easy to disperse and which will lead to improved oxidative stability of omega-3 enriched food products, is urgently required. One of the more promising delivery systems can be functional nanomicrostructures obtained by electrospinning technology, which is possible to up-scale. In light of the above, the aim of this research project is to develop advanced omega-3 delivery systems such as electrospun nano-microstructures. To this end, the specific objectives are: 1) Development of physically and oxidatively stable nano-microstructures with omega-3 PUFA and natural antioxidants using electrospinning processing. 2) Production of food enriched with the nano-microstructures having appropriate structural-functional properties and being oxidatively stable. The success of the research proposed will lead to an important advance in the protection of omega-3 PUFA against oxidation when incorporated into food. Thus, the knowledge generated by this study has the potential to being exploited by companies devoted to the production of functional foods containing omega-3 lipids.

FP7 Contract ID: 654818
24/08/2015 → 24/08/2017
Project: Research

Nanodelivery systems for urine bladder tissue engineering applications

Grant giver: The Danish Council for Independent Research | Technology and Production Sciences Instrument: DFF-Individuelt postdocstipendium med Sapere Aude 1
Ajalloueian, F., Project Applicant, Research Group for Nano-Bio Science, Technical University of Denmark
Chronakis, I. S., Project Manager, Research Group for Nano-Bio Science, Technical University of Denmark
Fossum, M., Project Participant, Karolinska Institutet, Stockholm, Sweden
Hilborn, J., Project Participant
01/03/2015 → 31/08/2017
Collaborators: Karolinska Institutet, Stockholm, Sweden
Project: Research

Functional Biopolymer Nanostructures for Bioengineering Applications

Shekarforoush, E., Project Participant, National Food Institute, Research Group for Nano-Bio Science
Chronakis, I. S., Main Supervisor, National Food Institute, Research Group for Nano-Bio Science
Mendes, A. C. L., Supervisor, National Food Institute, Research Group for Nano-Bio Science
01/02/2015 → 31/01/2018
Project: Research

FENAMI: Functional Electrospun Nanostructures and Microstructures for Food and Bioengineering Applications

The objectives of this project is to generate the scientific and technological basis to: (i) develop new nano-microcarrier systems for bioactive compounds using electrospun nano-microstructures for their immobilization, (ii) develop new nano-microdelivery systems utilizing enzyme functionality and molecular imprinted polymers for controlled delivery/release of bioactives, (iii) study the structural and functional properties of nano-microstructures (NMS) as novel components of food and bioengineered products, (iv) evaluate their bioavailability and degradation/digestion in-vitro and in-vivo. The overall aim is to create new functional systems that have a potential usage in foods/healthy foods, as nutritional supplements, as pharmaceutical products and for a range of other bioengineering applications. The project’s ambition is also to contribute to research training in research institutes and industrial companies as well as education of industrial employees. We expect that the obtained knowledge will strengthen the Danish industry’s potential to emerging nano-microtechnologies.
and technologies of bioactives.

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Qvortrup, K., Project Participant, University of Copenhagen

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Boutrup Stephansen, K., Project Participant, National Food Institute, Division of Industrial Food Research

Jørgensen, L., Project Participant, National Food Institute, Division of Industrial Food Research

Mendes, A. C. L., Project Participant, National Food Institute, Division of Industrial Food Research

Danish Research Council/Programme Commission for "Sundhed, Fødevarer og Velfærd": DKK14,866,637.00
01/05/2011 → 31/10/2015

Collaborators: Westphalian Wilhelm's University of Münster, Institute for Plant Biology and Biotechnology, University of Lund, Pure and Applied Biochemistry, University of Copenhagen, Fertin A/S

Award relations: Functional Electrospun Nanostructures and Microstructures for Food and Bioengineering Applications

Project: Research

**Fotoaktive nano-membraner til rensning af spildevand i mejerindustrien**

In Denmark, and in the richest countries in the world, the dairy industry is the largest, and the amount of wastewater produced is massive. Denmark is among the top 5 countries in the export of dairy products. Dairy industries produce wastewater during pasteurization and homogenization of milk, and during the production of dairy products (butter, cream, cheese, etc.). The wastewater makes the dairy industry one of the largest polluting industries, not only because of the volume of wastewater generated, but also by virtue of its wastewater character. On average 2.5 liters of wastewater is generated per liter of milk, but the amount can be as high as 10 liters of water per liter of milk. The purpose of this project is to develop innovative cost-effective membranes, consisting of a photocatalytic active material for use in the treatment process of wastewater from the dairy industry. These nano-membranes will only use a photactive semiconductor and a suitable light source for the purification process, and thus will not form other metabolites to the environment than CO2 and H2O.

Kanjwal, M. A., Project Manager, National Food Institute, Division of Industrial Food Research

Chronakis, I. S., Project Participant, National Food Institute, Division of Industrial Food Research

Barakat, N., Project Participant, Chonbuk National University

Yong, K. H., Project Participant, Chonbuk National University

Thomsen, P., Project Participant, Biomodics ApS

Det Frie Forskningsråd | Teknologi og produktion: DKK2,390,400.00
01/01/2014 → 31/12/2015

Collaborators: Biomodics ApS, Chonbuk National University

Project: Research

**Photo-catalytic nano-membranes for waste water treatment system in the dairy industry**

In Denmark and in most other countries, the dairy industry has grown in size and number of companies. Denmark is among the top 5 nations in the export of dairy products. Dairy Industries produce wastewater during pasteurization and homogenization of milk, and during the production of dairy products (butter, cream, cheese, etc.). The wastewater makes the dairy industry one of the most polluting industries, not only because of the volume of wastewater generated, but also by virtue of its wastewater character. On average 2.5 liters of wastewater is generated per liter of milk produced, but the amount can be as high as 10 liters of water per liter of milk. The purpose of this project is to develop innovative cost-effective membranes, consisting of a photocatalytic active material for use in the treatment process of wastewater from the dairy industry. These nano-membranes will only use a photactive semiconductor and a suitable light source for the purification process, and thus will not form other metabolites to the environment than CO2 and H2O.

Kanjwal, M. A., Project Manager, National Food Institute, Division of Industrial Food Research

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Yong, K. H., Project Participant, Chonbuk National University

Thomsen, P., Project Participant, Biomodics ApS

01/01/2014 → 31/12/2015

Collaborators: Biomodics ApS, Chonbuk National University

Project: Research

**Activities:**

**The electrospinning of xanthan gum: from solution to nanofiber formation**

Period: 18 Oct 2017 → 20 Oct 2017
Elhamalsadat Shekarforoush (Guest lecturer)
Adele Faralli (Guest lecturer)
Ana Carina Loureiro Mendes (Guest lecturer)
Ioannis S. Chronakis (Guest lecturer)

National Food Institute

Research Group for Nano-Bio Science
Degree of recognition: International
Documents:
ANNIC2017_Book_Of_Abstracts

**Related event**

**Applied NANOTECHNOLOGY and NANOSCIENCE International Conference**
18/10/2017 → 20/10/2017
Activity: Talks and presentations › Conference presentations

*Hybrid hydrogels by the co-assembly of chitosan with phospholipids*
Period: 3 Apr 2017 → 6 Apr 2017
Elhamalsadat Shekarforoush (Guest lecturer)
Ana Carina Loureiro Mendes (Guest lecturer)
Christoph Engwer (Other)
Francisco Goycoolea (Other)
Ioannis S. Chronakis (Guest lecturer)

National Food Institute

Research Group for Nano-Bio Science
Degree of recognition: International
Documents:
Elham Abstract-

**Related event**

**The Annual European Rheology Conference (AERC2017)**
03/04/2017 → 06/04/2017
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

*Hybrid hydrogels by the co-assembly of chitosan with phospholipids*
Period: 3 Apr 2017 → 6 Apr 2017
Elhamalsadat Shekarforoush (Other)
Ana Carina Loureiro Mendes (Other)
Christoph Engwer (Other)
Ioannis S. Chronakis (Other)

National Food Institute

Research Group for Nano-Bio Science
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Documents:
Elham Abstract-

**Related event**

**The Annual European Rheology Conference (AERC2017)**
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Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations