Themengebiete für Studien- & Abschlussarbeiten

Doktoranden des MAB
Allgemeines


Interessenten mit konkreten Themenwünschen können sich direkt bei den jeweiligen Doktoranden melden oder allgemein bei David Grijalva (david.grijalva@kit.edu).
Angela Valentic

Changes in dispersity, structure and phase behaviour of virus-like particles (VLPs) in the presence of nucleic acids

Motivation: Virus-like particles as carrier system for gene therapy

Tasks: Analytical development + method development

Disassembly and effect of host cell nucleic acids

Reassembly in the presence of nucleic acids

VLP loaded with RNA

Analytics:
- qPCR
- cGE
- SLS, DLS
- RP-/SEC- UHPLC
- Spectroscopic methods

Experimental:
- Process development + characterization of process parameters by common and nucleic acid specific analytical tools
- VLP production by cultivation in E.coli and purification by e.g. precipitation, chromatography methods and UF/DF

PhD project started 09/2019
Purification of biopharmaceuticals by protein crystallization is an attractive alternative to costly chromatography. Up to now, proper conditions for crystallization of proteins on a technical scale can only be identified empirically and therefore knowledge on phase behaviour and rheology of complex protein solutions is required for crystallization process development.

Current projects:
- Creation of HTS for selective crystallization
- Development of HTS analytics for specific protein quantification
- Development of automated image recognition software

Methods:
- Tecan – LHS
- Formulatrix – protein crystallography screen builder
- Light scattering
- Spectroscopic methods
- Multivariate data analysis

Spectroscopy
- \( c_{\text{protein}} \)
- \( c_{\text{contaminant}} \)

On-line analytics

Phase behaviour
- Nucleation rate
- \( c_{\text{protein}} \)
- \( x_{\text{crystal}} \)

Prediction
- \( \omega_{CO} \)
- \( G' \)
- \( G'' \)
David Grijalva – 3D Bioprinting

**Background:**
Automated, reproducible manufacturing and analysis of complex structures with biomaterials containing viable cells

**Experimental:**
- Evaluation of biomaterials for 3D printing applications
- Characterisation cell metabolic activities

**Analytics:**
- Rheometry
- Flow cytometry
- Microscopy
- UV/Vis spectroscopy
**Protein Stability in Freeze-Thaw Operations**

**Background**

Freezing and thawing are necessary process units during the production of biopharmaceuticals.

During the freezing process, freeze concentration might occur. This may lead to:

- Protein aggregation
- Surface denaturation
- pH denaturation
- Cold denaturation
- ...

It is the aim of my thesis to evaluate the protein stability during freezing/thawing.

**Material & Methods**

**Experiments**

- µL- and mL cryodevices
- Robotic liquid handling station

**Analytics**

- SLS, DLS
- Melting temperature
- FT-IR
- ...

**CFD simulations**
Synthesis of Hybrid Nanoparticles via Aerosol Thiol-ene Photopolymerization

Legend:
- Gold Nanoparticle
- 3-functional thiol
- Photoinitiator
- 3-functional ene
- Cancer tumor

Applications:
- Cancer Screening and treatment
- Drug delivery
- Encapsulation into hydrogels for enzymatic reactions

Process:
- Spray Solution
- Aerosol Droplets
- Polymer Nanoparticles
- Bioconjugated Nanoparticles

Imaging and Diagnostics

Phototherm lal therapy
Nils Hillebrandt

Entwicklung eines hochdurchsatzfähigen Hochfrequenz-Rheometers zur Analyse der viskoelastischen Eigenschaften hochkonzentrierter Proteinlösungen [1]

Ziel

- Korrelation viskoelastischer Eigenschaften mit der Lösungsstabilität von Proteinlösungen [2]

Aufgaben

- Evaluierung und konzeptionelle Optimierung von Messaufbau/Konstruktion
- Design und Implementierung der Automatisierungs- und Temperierungseinheit

Techniken/Arbeitsbereiche

- Ansteuerung von piezokeramischen Aktoren und Sensoren
- Schwingungsanalyse
- Programmierung mit MATLAB
- Ansteuerung der peripheren Bauteile (Pumpen, Peltier-Element, Temperatur-Controller)

[1] Kooperation mit dem Institut für Automation und angewandte Informatik (IAI), Ansprechpartner: Prof. Dr. Christian Pylatiuk

Nils Hillebrandt

Advancing ultra- and diafiltration

Online-Monitoring

High-Throughput

Modeling

In collaboration with

Source: https://gosilico.com/

Source:

Source:
Development and establishment of bioinks made of specially developed elastic proteins for 3D printing of high-performance materials

Theoretical background
Elastic materials are mostly petroleum-based and not biodegradable. The goal of my work is the use of biotechnologically produced, elastin-like proteins (ELP) to produce highly elastic, 3D-printed hydrogels. Therefore, it is necessary to develop an understanding of the factors influencing the later mechanical properties of the resulting hydrogels.
Background:
Automated, reproducible manufacturing and analysis of complex structures with biomaterials containing viable cells

Experimental:
- Printing optimisation of biomaterials
- Development of standardised analytical methods

Analytics and tools:
- Rheometry
- Microscopy
- Image processing
- Matlab