הטכניון - מכון טכנולוגי לישראל

TECHNION - ISRAEL INSTITUTE OF TECHNOLOGY

הפקולטה להנדסה כימית
ע"ש וולפסון
The Wolfson Department of Chemical Engineering

Wolfson Department of Chemical Engineering Seminar

Lecture Hall 6, Wolfson Department of Chemical Engineering,

22nd June, 2016 at 13:30

Adi Azran-Gefen

Supervisor:Prof. Havazelet Bianco-Peled

Preparation of Hydrolysable Biocompatible Polymersomes for Drug Delivery

The desire to understand molecular self-assembly and to explore potential applications motivates the study of self-assembly principles, theories, properties and structures of the assemblies. Block copolymer chains aggregate into various morphologies according to different contributions to the free energy of the system. The most common morphologies are spherical and cylindrical micelles, and polymeric vesicles, termed polymersomes. Polymersomes are hollow spheres with sizes ranging from tens of nanometres to tens of micrometres, typically having a hydrophobic wall and hydrophilic internal and external coronas. Polymersomes have been studied vastly in the last decade and new types of drug delivery systems based on their unique properties have been reported. Yet, only few studies dealt with biocompatible and biodegradable polymersomes. A better understanding of the formation mechanisms of polymersomes and of the relation between nanostructure and properties are still required. Therefore, this work investigates the self-assembly of block copolymer aggregates with emphasis on polymersomes. In order to allow a rational design of polymersomes, insights into the formation and properties of biocompatible polymersome systems are needed. Therefore, the overall goal of this research is to establish a better understanding of biocompatible block copolymer systems with an emphasis on systems that lead to formation of polymersomesWe focused on formation of polymersomes from two types of biocompatible and biodegradable block copolymers, poly(ethylene oxide)-b-poly(ε-caprolactone) (PEO-b-PCL) and poly(ethylene oxide)-b-poly(lactic acid) (PEO-b-PLA). The study of the relation between aggregates morphology and preparation techniques includes variation of experimental parameters and evaluating their effect on the formed structures. The main tools that are used in the research are size and structure characterization using light and X-ray scattering techniques and electron microscopy. Four types of block copolymer aggregates have been produced and characterization of structure has been conducted.

Stas Levchenko

Supervisor:Assoc.Prof. Viatcheslav Freger

Development of novel multivalent ion-passing membranes

A tertiary nanofiltration (NF) treatment may remove excess NaCl from biologically treated wastewater to make it suitable for irrigation. However, commercial NF membranes have a very high retention of Ca and phosphate (PO_4^3), which results in severe scaling, low water recovery and depletion of water of nutrient ions. As a solution, we develop novel NF membranes with a different selectivity focusing on two types: (1) charge mosaic membranes (CMMs) containing small alternating positively and negatively charged microdomains, which may potentially achieve the best selectivity for the process, and (2) positively charged membrane employing Donnan exclusion mechanism. While CMMs prepared from mixed polymer-zeolite matrices did not reach the target characteristics due to unexpectedly low permeability of zeolite, the second type of NF memrbanes showed a reasonably rejection of NaCl with a much reduced rejection of phosphate. As a result, the membrane showed no phosphate scaling up to 80% water recovery, at which commercial NF was scaled severely. These results will be dicussed in the general context of principles and challenges of developing optimal NF membranes for waste water recycling for irrigation.

Refreshments served at 13:15