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,
Wednesday May 9th at 1:30pm

Ariela Tarnapolsky

M.Sc. Student (Advisor: Prof. Slava Freger), Chemical Engineering, Technion

Understanding QCM-D response to deposition and attachment of bacteria and particles on surfaces

Quartz crystal microbalance with dissipation monitoring (QCM-D) is a powerful tool for studying adhesion, yet its use for analyzing deposition and attachment of abiotic microparticles and living cells on surfaces from solutions has been hampered by the difficulties of interpreting the response and loading regimes. In this study, we systematically investigate QCM-D response to deposition of abiotic microparticles as well as *Pseudomonas fluorescence* bacteria by modulating different characteristics of particles and substrate, including surface chemistries and mechanical properties, particle size, and solution composition. Using the electromechanical analogy, we constructed a physical model for the interaction of particles with QCM-D in the form of an equivalent circuit, in which inertial, elastic and dissipative loads are represented by appropriately connected elements, whose mechanical impedance can be related to actual physical characteristics of the particle and surface. In this way we could observe and understand the entire spectrum of possible responses and transition from inertial to elastic loading for model abiotic polystyrene and silica particles and pinpoint the effects of different physical parameters. The only uncertainty of the model was associated with the contact mechanics relation, however, this could be resolved by adjusting the contact radius as an independent parameter. Ultimately, we found that the model offers a reasonable quantitative prediction of the observed response and its frequency dependence for different abiotic particles and substrates as well as for bacterial cells. This model can be used to interpret and analyze QCM-D results and help turn it to a quantitative tool for studying deposition and attachment of micro-colloids and living cells to surfaces.

Yasmine Shibli

Ph.D. Student, mid-seminar (Advisor: Prof. Hossam Haick), Chemical Engineering, Technion

VOCs as a tool for the assessment of embryos in IVF

The quality of embryos in IVF (in vitro fertilization) influences success rate and accompanied medical, psychological and financial consequences. Due to many limitations in the current assessment methods; morphology and morphokinetic monitoring, much research has focused on the ECM (embryo culture medium). VOCs (volatile organic compounds contributed by cellular processes, might provide a much greater understanding of the embryo at a molecular level for their ability to contribute information non-invasively, simultaneously and in an on-line manner enabling continuous monitoring of the embryo. Moreover, VOCs facilitate exploring potential chemical communication between adjacent embryos. We have investigated VOC patterns in embryos/ECM through the developmental potential and genetic status of the embryo. Two complementary methods have been used to characterize samples. The first method uses gas chromatography mass spectroscopy (GC-MS) to identify and quantify the VOCs. The second method deploys cross-reactive nanoarrays combined with pattern recognition methods providing collective VOC patterns rather than identifying specific VOCs. Nanoarrays are inexpensive and has a more realistic potential for fast cost-effective and high-throughput GC diagnostics. Our preliminary results indicate that measurable VOCs emanate from the embryos and their medium. Variance in the combination and concentration of VOCs in relation to the number of embryos per culture have been detected as well as alterations in VOC patterns as a function of culturing time. The research provides the ability for determining embryo quality and its genetic status using VOCs and ultimately increasing the success rate.

Refreshments will be served at 1:15pm