(2 credits)

001-2-5028

Lectures	Exercise	Laboratory	Field Trip
2			

Pre-requisite courses: Introduction to Microbiology for non Biology students or undergraduate background in microbiology is necessary (coordinate with the Dr. Herzberg).

The goal of the course is to deliver the students the significance of microbial biofilms in industrial facilities of water and wastewater treatment as well as in soil and groundwater, in which both destructive ("biofouling") and beneficial biofilms will be discussed. Case studies of different beneficial biofilm applications including bioremediation, biofiltrations, and biobarriers in soil and groundwater will be studied from both scientific and engineered approaches. Also, strategies to eradicate destructive biofilms will be studied. Case studies to be discussed in this part of the course will include analysis of the restriction of both heat and mass transfer in industrial facilities attributed to microbial biofilms and strategies in use for decreasing these adverse effects of biofouling.

Detailed Syllabus

- Introduction: where microbial biofilms are found and what is the significance of both destructive and beneficial biofilms.
- Physical and chemical heterogeneities in microbial biofilms and their effect on metabolic processes.
- Definitions and examples of extracellular polymeric substances (EPS). The role of EPS in biofilm physical, chemical, and physiological properties.
- Characterization of EPS and their effects on water and wastewater treatment processes.
- Biofilm models: standard diffusion-reaction model, mass transport in heterogenous biofilms.
- Biofilms and biofouling mechanisms in different membranes used for water and wastewater treatment facilities. Biofouling of heat-exchangers and heat-transfer phenomena.
- Eradication and cleaning methods of destructive biofilms: technical and environmental aspects.
- Water and wastewater treatment with biofilms reactors: activated sludge, fluidized bed, and fixed bed reactors. Design and modeling approach.
- Biofilms as biobarriers and biofilters in soil and groundwater.
- Review of destructive and non-destructive biofilm techniques: Laser Scanning Confocal Microscopy, molecular analysis of biofilm communities, flowcells, chemical analysis, ATR-FTIR, Raman microscopy, and more.

Lecturer**:** Moshe Herzberg

Recommended Reading: Provided during the course