



Wolfson Department of Chemical Engineering Seminar

Wednesday, May 21st, 2025 at 13:30

Room 5

Development of a controlled wastewater-remediation single reactor, utilizing both photocatalysis and biotreatment

Yuejun Yu

PhD final seminar

Advisor: Prof. Yaron Paz; Co-advisor: Prof. Sima Yaron

Department of Chemical Engineering, Technion-Israel Institute for Technology

Wastewater typically contains a complex mixture of organic and inorganic pollutants derived from industrial, agricultural, and domestic sources. Due to this compositional complexity, conventional single-method treatment systems often prove inadequate for complete purification. Biological treatment and photocatalytic treatment, as two techniques that are frequently used in contaminated water purification, suffer from their own drawbacks in practical wastewater treatment.

To address these challenges, we designed an integrated AOP-biological reactor that synergistically combines both approaches. The photocatalytic component in the reactor was enhanced with rare earth oxides (REOs) to improve the selective degradation of non-polar toxic compounds, while small bioreactor platform (SBP) capsules were employed to protect and maintain a stable bacterial culture.

This hybrid reactor was combined with turbidity and bio-toxicity sensors. These sensors monitor the situation of the wastewater and enable automatic control of both the energy load of the photocatalytic part and the retention time in the combined-reactor. This enables to operate the reactor in the most economical way, assuming a known cost function. By leveraging the complementary strengths of photocatalytic oxidation and biological degradation, the reactor not only enhances purification efficiency but also reduces operational costs under challenging conditions.

Refreshments will be served at 13:15.