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
Wednesday, July 14th, 2021 at 13:30
Lecture Hall No. 6

Developing and study of an automatic on-line micro-biotoxicity sensing and control unit for wastewater treatment, based on a cell viability monitoring assay

Yuejun Yu

Department of Chemical Engineering, Technion-Israel Institute for Technology

MSc Seminar

Advisor: Prof. Yaron Paz

Wastewater from industrial, commercial or agricultural activities usually contains a lot of organic and inorganic contaminants, that might be harmful to human beings and to the environment. For this reason, it is important to treat wastewater to a level at which it has minimal impact on the environment. Among the many available technologies are biological treatment, Advanced Oxidation Processes (AOP), adsorption, membranal treatments and many more. Unfortunately, at present, one cannot outline a single technology that can decontaminate water regardless of the type of contaminants it has in an efficient manner. Each technique has its own drawbacks. A sequential AOP-Bio wastewater treatment could be the right way to purify sewage.

To materialize this approach, an automated system is proposed. Such a system should be able to make automatic decisions according to the characteristics of the input stream. For example, if the input stream contains high level of antibiotics it is preferable to have the AOP treatment first and only then the biological treatment. Similarly, one may think how to assure optimal operation of the bioreactor with minimal AOP pre-treatment. In order to develop such a system there is a need to develop a reliable sensor and to integrate it with the AOP reactor.

A toxicity sensor for non-biodegradable contaminants was developed to monitor the toxicity level (antibiotics concentration) in order to keep alive and active the working bacteria (in the bioreactor) and to achieve it in an efficient manner. A resazurin-based dye named PrestoBlue, which is metabolized by live cells into a second compound having a different color was used as the indicator. The rate of color change was measured, thus providing a way to indicate the toxicity. Three types of bacteria were studied as candidates for this sensor. Likewise, the proper sensing conditions were checked. Thus, it has been shown that the system can monitor antibiotics concentration in the wastewater. In parallel, the conversion of an antibiotic in a

photocatalytic reactor operating with 1-9 lamps were measured as a function of the number of lamps.

Based on this data, the sensing system was combined with the photocatalytic reactor thus enabling to automatically provide the minimal load on the photoreactor that yields an output steam having antibiotic concentration lower than some predesigned level. This approach can significantly reduce the operation cost of AOP and provide bacteria-friendly environment for further bio-treatment.

Refreshments will be served at 13:15