Title: Experimental and Mathematical studies for Environmental Remediation and liquid-liquid systems

Abstract of the talk:

The cynosure of my research aims at exploring this fathom issue mathematically and experimentally in a three dimensional approach for analysis and monitoring of pollutants, exploring engineering techniques for effective treatment of effluents, recovering energy and resource from effluent.

An eco-friendly technology has been adopted for the removal of hexavalent chromium using novel lignocellulosic biosorbents. The biosorbent subjected in the raw form and under physical modification for toxic heavy metal sequestration, Cr(VI). Batch biosorption, desorption and dynamic modeling was performed for the commercial application of this process. The parameter under study of both batch and continuous were optimized using advanced optimization technique like the genetic algorithm. The biosorbent and the process adopted can be used for the commercial application for the real time effluent treatment holding hexavalent chromium.

Mathematical relationship between the source composition and receptor concentration can results source contribution estimates at the receptor (downwind) locations provided the uncertainties during the emission inventory (source profile data) and receptor concentration analysis. The number of factors through factor analysis (FA) and its contributions at receptor (downwind) locations has been determined through receptor model analysis such as chemical mass balance (CMB), positive matrix factorization (PMF), Unmix, principal component analysis etc. We have observed in the combined analysis of FA, CMB, PMF and Unmix the strength of each model and refined the accuracy of source contribution estimation. Optimization of source contribution estimation through MATLAB 'fmincon' and 'genetic algorithm' methods in the CMB model results have been analyzed in predicting the concentrations at a receptor. Coupled receptor (CMB) dispersion (Area source) model analysis for refining the emission rate of pollutants from a large area source can find accurate source contribution at downwind locations.

My research explores advance concept called 'Microfluidic' for effective detection and monitoring of pollutants in industrial discharges. Microfluidics devices can detect very small quantities of a substance in a fluid stream. Experimental investigations and ANN optimization techniques of flow characteristics of fluid that passes through the channel has been carried out and published in few journals.