ChE Graduate Seminar Series

Departmental Seminars Presented by Ph.D. Students

Development of a low-cost, high-throughput native polyacrylamide gel electrophoresis (N-PAGE) protocol for lipoprotein sub-fractionation using Quality by Design approach.

Mili Pathak (Advisor: Prof. Anurag S. Rathore)

25th September 2014, Thursday, 0400-0425 pm (15+10 mins), ChE Seminar hall

Ratio of low density to high density lipoprotein concentration is critical for normal functioning of human body. Deviation in this ratio has been linked to various diseases, many of which are fatal if not diagnosed at early stages. For example, cardiovascular diseases (CVD) have been linked to the level of low density lipoprotein (LDL). Henceforth, detection of the lipoprotein subtractions is crucial for health of an individual. To date, methods like ultracentrifugation, nuclear magnetic resonance (NMR), high performance liquid chromatography (HPLC) and gradient gel electrophoresis (GGE) have been used for separation and identification of lipoprotein types and subtypes. However, these methods are expensive, time consuming and require specialized equipment and expertise. This paper aims to propose a low-cost, high-throughput native polyacrylamide gel electrophoresis (N-PAGE) based protocol for analysis of lipoproteins. Quality by Design (QbD) based approach has been utilized. The initial screening of parameters was followed by a fractional factorial design to optimize the protocol. The lipoprotein subtractions obtained by the optimized protocol were compared with the commercially available and commonly used Lipoprint® Lipoprotein Subfractions Testing System from Quantimetrix. The proposed method gave comparable results to those obtained with the commercial system. The proposed method is capable of analysis of up to forty different samples in two hours at a cost of approximately 2$/sample. This is an order of magnitude better than the present cost of 265$/sample when using the commercial system. We think that the proposed method would be of particular interest to the developing and under-developed economies of the world, where this cost differential would be deemed quite significant and would make testing affordable to the majority of the population.

Osmotically Driven Membrane Processes for Power Genration, Desalination and Waste Water Tratement: Model Development and Experimentation

Dinesh Attarde (Advisor: Prof. S. K. Gupta)

25th September 2014, Thursday, 0425-0450 pm (15+10 mins), ChE Seminar hall

With the continuously increasing population and simultaneous depletion of fossil fuels, water and energy have become two of the most essential sources on the earth. Shortfall (or price rise) in both water and energy supplies have plagued various communities around the world. Nowadays, osmotically (osmotic pressure) driven membrane processes have attracted growing attention in several applications such as energy generation, desalination and wastewater treatment. However, new membrane development and appropriate design of membrane module are still major challenges for the commercial application of these processes.

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Transport Mechanism and Irreversible Thermodynamic based models have been developed for spiral wound and hollow fiber membrane modules to find the optimal operating conditions and module configurations in the present work. A combination of two constrained optimization techniques (Univariate and three point fibonacci methods) is used with experimental data points to predict the unknown parameters of models. To confirm the validity of models, a series of experiments using cellulosed triacetate (CTA) and thin film composite (TFC) polyamide spiral wound membrane modules have been conducted and compared with model predictions. The model predictions are found to be in good agreement with the experimental results. The predicted maximum power density is 1.8 W/m^2 for CTA membrane module and 1.1 W/m^2 for TFC membrane module. Moreover, an extraction efficiency of PRO using spiral wound module is also analysed.

Peptide Manufacture using Functionalized Ionic Liquids

Tanmoy Patra (Advisor: Dr. Sreedevi Upadhyayula)

25th September 2014, Thursday, 0450-0515 pm (15+10 mins), ChE Seminar hall

Functionalized ionic liquids were synthesized and different functionalities were properly tuned to use as a support in small chain peptide synthesis reaction sequence. Functionalized ionic liquid in both liquid phase and solid phase were used for blocking the N-terminal of one amino acid. The blocked amino acid was then reacted with another C-terminal blocked amino acid in presence of a dehydrating agent. Similarly, the process was repeated in reverse order, i.e. C-terminal of amino acid was blocked and reacted with another N-terminal blocked amino acid. The resultant dipeptides as well as larger peptides were easily separated from the ionic liquids with a high overall yield. A comparative study on both solid and liquid phase ionic liquid upon overall yield of dipeptides in both type of process was performed. DFT studies using Gaussian09 program confirmed the reported ionic liquids give a directionality towards the peptide chain leading to better kinetics and improved yield than already reported processes using other supports like resins. Overall a new methodology with higher yield, more control and least separation problems for synthesizing smaller peptides using functionalized ionic liquids was obtained.

0515 pm High Tea

CC
All ChE Faculty
Department N. B.
PhD Students (near biometric device)
Mr. Krishna (for audio/video help)
ChE office: refreshment arrangements