

AY2018-19 UROP PROJECTS

School of Materials Science & Engineering



PROJECT OFFERED BY ASST PROF. YU JING

The 'salting out' effect of trivalent ions on polyelectrolytes in solution

Project Objectives:

- ▶ Strong polyelectrolytes have charged groups along the polymer backbone, and are typically soluble in water. When environment condition changes, *e.g.*, pH, ionic strength, temperature, counterion/salt, the polyelectrolyte solution may form precipitates or gels. In this project, the student will mainly explore how trivalent ions, (La^{3+} , Y^{3+}) can affect the critical salt concentration C_s^* (when precipitation occurs) and second critical salt concentration C_s^{**} (when polymer re-dissolution) on poly(styrene sulfonate) (PSS). Hence, the phase behaviour of PSS of different molecular weight on different salt concentration will be studied.

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The 'salting out' effect of trivalent ions on polyelectrolytes in solution


Project Description:

- ▶ Background Introduction – The phase behavior of polyelectrolytes in solution is of great importance to many applications, such as in cosmetic products, detergents, and food related applications. Many polyelectrolytes are stable in solution with various concentrations of monovalent salt. But studies found polyelectrolytes showing different phase behavior when high valent salt presents. Precipitation will occur at critical salt concentration, C_s^* , and re-dissolution will happen at a second critical salt concentration C_s^{**} .
- ▶ Project contents – By adding different trivalent salts (La^{3+} , Y^{3+}) into PSS solutions, student should observe the salting-out and re-dissolution of PSS and the C_s^* , C_s^{**} , respectively. UV spectrophotometer and optical microscope will be used to identify when precipitation and re-dissolution occur. The work will give a better understanding how high valency salts affect PSS phase behaviour and diagrammed phase behaviour of PSS.
- ▶ Key words: polyelectrolytes, salting-out, multivalency, solubility.

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Major Tasks:

- ▶ To conduct literature review and analyze the pros/cons of existing study/products.
 - ▶ To establish good lab practice.
 - ▶ To master operations of UV spectrophotometer.
 - ▶ To learn/understand "salting-out" effects, ionic strength, and phase behaviour of polyelectrolytes with salts.
 - ▶ To work as a team member with other lab researchers.
 - ▶ To analyze obtained data and draw meaningful conclusions.
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PROJECT OFFERED BY ASSOC PROF. NG KEE WOEI

Fabricating of Fingerprint Sample Cassettes

Project Objectives:

- ▶ *Design a cassette style holder for fingerprint tapes for transporting fingerprint samples from crime scene to lab.*
 - ▶ *Selection of the optimal fabrication methodology.*
 - ▶ *Fabricate a prototype using external vendor and test the feasibility of the model*
 - ▶ *Develop a mass production workflow.*
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PROJECT OFFERED BY ASSOC PROF. NG KEE WOEI

Fabricating of Fingerprint Sample Cassettes


Project Description:

- ▶ *Forensics heavily relies on preserving clues collected at crime scenes. Fingerprints are one of the most critical samples which are extracted from crime scenes. In order to preserve fingerprint samples, a device which can hold lifting tapes to transport fingerprint samples from the field to the laboratory is a pertinent need. The cassette needs to provide an isolated, waterproof and dustproof environment which can preserve the physical and chemical components of the fingerprint as well as be conducive for repeated use by forensics officers.*
- ▶ *Keywords: Product design, Solidworks, Fabrication, Fingerprint Analysis, Forensics*

PROJECT OFFERED BY ASSOC PROF. NG KEE WOEI

Fabricating of Fingerprint Sample Cassettes


Major Tasks:

- ▶ *Come up with design ideas to achieve the functional goals of the cassettes*
 - ▶ *Draw out 3-D models of the cassettes on Solidworks, Autocad or other 3-D modelling tools.*
 - ▶ *Select optimal fabrication methodology and build prototypes.*
 - ▶ *Source an external vendor(s) for the fabrication and handle the flow administratively and technically.*
 - ▶ *Test cassette durability, usability and functionality.*
 - ▶ *Review the product giving insights to its pros and cons and future improvements.*
 - ▶ *Suggest a suitable cost of the final product.*
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PROJECT OFFERED BY ASSOC PROF. NG KEE WOEI

Biometrics of sweat via mass spectrometry (Software Development)

Project Objectives:

- ▶ Develop a data analysis software with a user friendly interface.
 - ▶ Incorporate an algorithm in the back end for processing mass spectra files through an in-house data processing workflow.
 - ▶ Generate a report with key information regarding the mass spectral summary.
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PROJECT OFFERED BY ASSOC PROF. NG KEE WOEI

Biometrics of sweat via mass spectrometry (Software Development)

Project Description:

- ▶ *MALDI-ToF mass spectrometry can generate high resolution mass spectra of a wide range of molecules. The signal generated, however, is highly dependent on an array of sample preparation techniques, such that quantitative analysis is not directly possible. The aim of this study is therefore to develop an algorithm which can treat large amounts of data (mass spectra) and derive statistical differences between complex mixtures based on the signal/noise ratio. The ultimate goal is to incorporate the algorithm into a software with simple user interface for use by non-technical end users.*
- ▶ *Key words: DATA Analysis, Software Development, Mass Spectrometry, Fingerprint, Programming*

PROJECT OFFERED BY ASSOC PROF. NG KEE WOEI

Biometrics of sweat via mass spectrometry (Software Development)

Major Tasks:

- ▶ *Handle large amounts of data in the MS Excel framework to determine statistical significance and trends.*
- ▶ *Develop a software which automates the statistical analysis by incorporating the algorithm developed in the back end.*
- ▶ *Design a user friendly interface for non-technical persons to utilize the software.*
- ▶ *Work with a post-doc and project officer to come with smart logic for the back end processing.*
- ▶ *Learn new software development tools (if needed) using commonly available resources.*
- ▶ *To perform analysis on existing datasets to test drive the developed software.*