

Abstracts of the 2nd Symposium of Asian Analytical Chemistry Network (AACN) on "Education of Undergraduate Analytical Chemistry" Aug. 25, 2011. Jinling Conference Center, Nanjing China, Organized by Prof. Huangxian Ju (Nanjing University, China), Prof. Ting-Kueh Soon (Institut Kimia Malaysia, Malaysia), Prof Hitoshi Watarai (Osaka University, Japan)

## Keynote Lecture

### MICROSCALE EXPERIMENTS FOR ATTRACTIVE CHEMISTRY CLASS

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Over the past two decades, there has been a worldwide initiative in developing microscale chemistry (MC). Implementation of MC in laboratory teaching can result in a variety of advantages such as saving cost of chemicals and time for preparation, elimination of the risk of fire or explosion danger, reduction of waste and creation of the sense of green chemistry. There are many other significant bonuses: the learning experience of students can be enriched, students' interest in chemistry could be stimulated. However, MC is not just miniaturizing conventional equipment or reducing amount of reagents used, more importantly, there should be some innovation and creativity to make the MC experiments more attractive than the ordinary scale ones. We have been working to develop attractive MC experiments. These experiments cover various basic topics. One example is a series of electrochemical experiments with a 12-wellplate [1]. Various electrolytic and galvanic cells can be assembled easily on the plate in a short time. Experiments on Faraday's law and Nernst equation can be carried out also on a plate. Another example is a series of experiments on ion exchanger [2]. Through these experiments, students can learn the principles of ion exchange, some properties of complex ions and application to analysis of some metal ions. All the experiments can be carried out in a short time.

**KEYWORDS:** Microscale chemistry • Electrochemical cells • Ion exchange • Column chromatography

**ACKNOWLEDGEMENTS:** Our research has been supported by series of Grants-in-Aid for Scientific Research (17011005, 19500716 and 21500863).

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# **THE BASIC ANALYTICAL CHEMISTRY– A COMPREHENSIVE TEXTBOOK IN ANALYTICAL CHEMISTRY AND A DIRECTIVE IN TEACHING OF MODERN ANALYTICAL CHEMISTRY IN UNIVERSITY UNDERGRADUATE COURSE**

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The textbook “Basic Analytical Chemistry” <sup>[1,2]</sup> translated from Japanese language to Vietnamese language was published and donated to Vietnamese universities and institutes. From the foundations of analytical science to state-of-the art techniques, the book is comprehensive textbook covering both general analytical chemistry and instrumental analysis. The first 5 chapters are devoted for acid-base, complex-formation, ion-exchange, extraction, redox equilibrium and corresponding volumetric titration analyses. The 2 following chapters are for the electrochemical, chromatographic, electrophoresis analyses. Chapters 8<sup>th</sup> - 11 are given for broad range of analyses based on interaction between light and matter such as molecular and atomic spectrophotometry as well as X-Ray structural analyses. In chapter 12, the ERS and NMR methods based on the magnetic properties of substances are summarized. Chapter 13 is MS powerful qualitative and quantitative analyses. In chapter 14, microscopes ranging from optical, electronic to modern probe microscopes and special ones like confocal laser scanning microscope, x-ray microscope and electron probe X-ray microanalyser are described. In Chapter 15, thermoanalyses, small-feature analysis and chemical sensors are discussed. Protein and nucleic acid labeling – a crucial work in biochemical analyses is given in Chapter 16; in addition, a new approach in application of nanoparticles in chemical and biochemical analyses are also presented. Finally, how to perform the data analyses and quality control of obtained data is given in the last chapter. The textbook is easy understandable, logical and clearly written, and may be used for most undergraduate analytical chemistry courses offered today. Carefully chosen examples show how analytical problems can effectively be solved; besides the new perspective and new applications of the methods are presented. Reading the book one can find the most reasonable analytical method for his analytical target. The textbook is fully appreciated by Vietnamese chemists and became the important directive in teaching of modern analytical chemistry in undergraduate course in Vietnam universities and colleges.

## **ACKNOWLEDGEMENTS**

The author would like express sincerest thanks to Prof. Makoto Takagi of Fukuoka Women’s University, Prof. Watarai of Osaka University, for their donation and hearty support; Mr. Kato and the publisher Kagakudojin for the effort during publishing process. I am grateful to Dr. Takechi of Osaka University; professors and lecturers of University of Science - Vietnam National University of HoChiMinh City, and University of Pharmacy of HoChiMinh City who shared the credit for the success of the book-donation project.

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## PROJECT-BASED TEACHING IN CHROMATOGRAPHY-A CASE STUDY

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Effectiveness of project-based teaching in chromatography over other modes of teaching was tested on a group of Students at NCE in Analytical Chemistry, University of Sindh, Pakistan. Students were given overview of basic theory of separation followed by assignment to present videos related to chromatography and discuss them in class. Once they establish the idea how liquid chromatography works, students were assigned to work on project entitled “determination of caffeine in various tea samples available in local market”. Students were assisted in collecting samples and selection of suitable method for determination of caffeine using liquid chromatography and implying reported method for assay. They learned to workout optimizing separation, plotting calibration graph, quantification and report writing. The same course was taught by class-room technique next year. Students were evaluated for understanding of the subject, development of attitude towards analytical problem solving, skills in data interpretation, and scores in final exams. It was observed that project-based teaching is more effective than class-room teaching. However, managing cost of project-based teaching was much higher than class-room teaching. Also, Instructor and student have to put more time.

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## TEACHING ANALYTICAL CHEMISTRY AT PEKING UNIVERSITY

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“Analytical chemistry is what analytical chemists do”.<sup>1</sup> Often considered to be the NAVIGATOR, the task of the educators is to show the students how analytical chemists do to develop an analytical method. Analytical chemists try to answer the four basic questions about a material sample:<sup>2</sup> What? Where? How much? And what arrangement, structure or form? The basic principles for developing analytical methods have been there for more than a century. How to make it “fresh” to the students is a big challenge. At Peking University, we tried to introduce the basic principles to the students with examples from the most notable events and happenings in the late 20<sup>th</sup> century and 21<sup>st</sup> century, such as the human genome project started in late 1980s, the food pathogen this year, identifying earthquake and tsunami victims in the past decade. We also used our own research work to illustrate the ways to improve the sensitivity and selectivity of an analytical method. After marching through the necessary steps in the development of an analytical method, including sample collection and preparation, system calibration and measuring the sample concentration, calculating and evaluating the results, one or two complete analytical examples were usually introduced to illustrate how to develop an analytical method using all they have learned in this course.<sup>3</sup> As the university became international, an English course on analytical chemistry was lectured since 2005 to provide course for international students and to help those students who want to start reading literature and research in their early college years.

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## LEARNING ACTIVITIES INTRODUCED TO PHARMACEUTICAL ANALYSIS CURRICULUM

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### **Abstract**

Pharmaceutical analysis is a sub-discipline from analytical chemistry with emphasis in drug assay. It is one of the core subjects in the pharmacy discipline.

### **Objective**

To develop and evaluate the impact of learning activities introduced to pharmaceutical analysis students.

### **Design**

Consistent with the university's development of outcome-based education, the present pharmaceutical analysis curriculum was re-examine to meet the present education demand. Important programme and course outcomes were identified. Innovative learning activities were introduced to meet the course objectives. New assessment tools were designed to evaluate the effectiveness of the tools and feedback were gathered to improve the learning activities.

### **Conclusion**

The learning activities have impacted positively on the students learning and view on the importance of pharmaceutical analysis.

**Keywords:** Learning activities, evaluation, pharmaceutical analysis

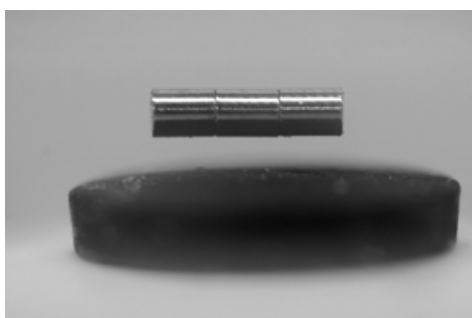


## INTEGRATED CHEMISTRY LABORATORY WORKS FOR UNDERGRADUATE

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Chemistry is the center of science. More than five thousand students from 30 departments take the chemistry and laboratory courses at NTU each academic year. To enhance students' learning interests and laboratory skills we develop a series of Integrated Chemistry Experiments and Integrated Teaching Resources in these ten years. In the newly developed Integrated Chemistry Experiments, students practice to synthesize and characterize the modern materials such as gold nano-particles [1],  $\text{YBa}_2\text{Cu}_3\text{O}_7$  high-temperature superconductor [2], and conducting polymer. As the Integrated Teaching Resources, we develop a series of laboratory manuals in bilingual, supplements of laboratory with photos demonstration, PowerPoint for teaching, laboratory skills demonstration videos, ChemLab Online Website, and [ntuchemistrylab](http://ntuchemistrylab) on YouTube. These multimedia and e-learning teaching resources are suitable for undergraduate chemistry laboratory instructions and we have adopted to our chemical education programs already. Most of the teaching resources are opened to the public that can be accessed conveniently and freely.



The Meissner effect of Y-123 superconductor synthesized by students

**ACKNOWLEDGMENTS:** Thanks for the efforts from teaching staff of Chemistry Department, NTU. The financial supports from Deans of College of Science and Academic Affairs, NTU, as well as the Ministry of Education, Taiwan, R.O.C. are gratefully acknowledged.

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**UNDERGRADUATE ANALYTICAL CHEMISTRY AND TAUGHT MSc in  
ANALYTICAL CHEMISTRY & INSTRUMENTAL ANALYSIS AT  
UNIVERSITY OF MALAYA**

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The Department of Chemistry at the University of Malaya in Kuala Lumpur offers two undergraduate degree programmes in Chemistry and one taught MSc course in Analytical Chemistry and Instrumental Analysis. The analytical chemistry courses which are offered are compulsory for the students who intend to major in chemistry. In the taught MSc course, the programme is offered on a modular basis where the students have to take the compulsory modules comprising chromatography techniques, atomic spectroscopy, sample treatment and preparation and data analysis and trace environmental analysis. This paper will put forward the basis for the teaching of selected topics in analytical chemistry at the undergraduate and MSc programme at the University of Malaya as it relates to industry in Malaysia.

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