13ACC
2009
Shanghai
CHINA

13th Asian Chemical Congress
September 13-16, 2009
Shanghai, China

Program Book

Organized by

Chinese Chemical Society

Shanghai Institute of Organic Chemistry,CAS

Under the auspices of

Federation of Asian Chemical Societies

Microscale Chemistry Experiments Part A

ROOM: 3G

Tuesday, September 15, 2009

Section A (14:00-15:45)
Moderator: Datin Dr. Zuriati ZAKRIA, Supawan TANTAYANON, Ning-Huai ZHOU

Time	No.	Title and Speaker Information
14:00-15:45	S-ML-A01	**Small-lab Kit for Organic Chemistry** TANTAYANON Supawan *Chulalongkorn University, Bangkok, Tailand* Supawan.t@chula.ac.th ZAKRIA Zuriati *University Kebangsaan University, Malaysia* zuriz@ukm.my

15:45-16:00 Break

Section B (16:00-17:35)
Moderator: Datin Dr. Zuriati ZAKRIA, Supawan TANTAYANON, Ning-Huai ZHOU

Time	No.	Title and Speaker Information
16:00-17:35	S-ML-A02	**Hands-On Microscale Chemistry Workshop** ***---Some Typical Expts. by Using Micro Plastic Kit--- The Chinese Approach*** ZHENG Yijiang & ZHOU Ninghuai Chinese Microscale Chemistry Center, Hangzhou Normal University, China cmlc28@gmail.com

Microscale Chemistry Experiments Synposium (Part A) was partially supported by FACS

Microscale Chemistry Experiments Part B

UNESCO-China Workshop on Microscience Experiments

ROOM: 3G

Tuesday, September 16, 2009

Section A (14:00-15:45) **Moderator: Alexanda POKROVSKY, Ninghuai ZHOU**

Time	No.	Title and Speaker Information
14:00-14:20	S-ML-B01	***UNESCO* Global Microscience Experiments Project** POKROVSKY Alxanda UNESCO Basic Science Microscience Project a.pokrovsky@unesco.org
14:20-14:40	S-ML-B02	**The Study and Development of Microchemistry in China** ZHOU Ning Huai Chinese Microscale Chemistry, Hangzhou Normal University, China cmlc28@gmail.com
14:40-15:00	S-ML-B03	**Innovative Qualitative and Quantitative Instruments for Micro-scale School Chemistry Experiments** CHAN K.M. Hongkong Micro chem. Lab, Hongkong, China mclchan@biznetvigator.com
15:00-15:15	S-ML-B04	**Microscale Chemistry Innovations in Malaysia** MOHAMED Norita University Sains, Malaysia noritamohamed@yahoo.com
15:15~15:30	S-ML-B05	**THE MICRO-BURET FOR ACID-BASE TITRATION AND MOHR TITRATION** YAN Guopen Wuhan Instituite of Technology, Wuhan, China Guopyan2006@163.com
15:30-15:45	S-ML-B06	**Microscale Titration** CHEONG Wai Man Macao Pui Ching Middle School, Macau, China wm_cheong@hotmail.com

15:45~16:00 **Break**

Section B (16:00-17:30)		Moderator: Alexanda POKROVSKY, Ninghuai ZHOU
Time	**No.**	**Title and Speaker Information**
16:00~16:15	S-ML-B07	**A microscale experiment for the determination of enthalpy change and entropy change from temperature dependence of equilibrium constant** KHURMA, Jagjit R. Technology and Environment University of the South Pacific Suva, Fiji Islands Khurma.j@usp.ac.fj
16:15-16:30	S-ML-B08	**Microscale Experiments Based on a Low-cost Electronic Thermometer** SVILLA.Fortunato B. University of Santo Tomas, Manila, Philippins fbsevilla@mnl.ust.edu.ph
16:30-16:45	S-ML-B09	**Innovating on Microscale Instrument** XU Xiaoxue Chongqing Educational Research Academy, China Xu-500111@163.com
16;45-17:00	S-ML-B10	**Effective Chemical Education by Microscale Chemistry Experimets for High School and University** YOSHINO Teruo International Christian University, Japan yoshino@icu.ac.jp
17:00-17:15	S-ML-B11	**Practices on MCE in Secondary Schools** ZHU En Huipu High School, Linhai, Zhejiang 317000, China entea@126.com
17:15-17:30	S-ML-B12	**Demonstration of Microscale Chemistry Experiments in Taiwan** FANG Chin Hsiang Tajen University, Pingtund, Taiwan, China chfang1273@yahoo.com.tw
Poster	S-ML-B13	**THE GLASSWTARE FOR MICROSCALE CHEMISTRY** TAO Lan Hangzhou Normal University, Hangzhou, China
	S-ML-B14	**Two Microscale Chemistry Experiments in High School** WANG Hui Nanhui High School,201300 Shanghai, China

Microscale Chemistry Experiments Symposium (Part B) was partially supported by UNESCO.

S-ML-A01: Small –lab Kit for Organic Chemistry

Supawan Tantayanon
Department of Chemistry, Faculty of Science, Chulalongkorn University, Thailand.

Zuriati Zakaria
Department of Chemistry, Faculty of Science and Technology,
Universiti Kebangsaan Malaysia, Malaysia

September 15, 2009
Venue: The 13th Asian Chemical Congress, Shanghai, China

The experiments in this part will demonstrate more practical and safer organic laboratory using Small-Lab Kit, designed and tested by chemists in Thailand, which promotes the reduction of exposure by reducing the amounts of chemicals and solvents in each experiment. Additionally, the design of the aluminum heat dissipation block eliminates the use of any potentially flammable heating sources and provides other facilities, like melting point determination and several sizes of heating mantles in it. An added benefit of Small-Lab Kit is the inclusion of all basic laboratory accessories, for examples, apparatus assembling tools and water cooling system. Moreover, a vacuum filtration using a hand pump has been introduced which make it more practical to do organic experiments. Overall, the Small-Lab Kit can be used at any place even though there is no formal laboratory available. With such a useful set of equipment, all the basic organic experiments as well as a wide range of organic reactions can be carried out.

COURSE CONTENT

A half-day course consists of the followings:

- A brief introduction to small scale chemistry
- Introducing a Small-Lab Kit
- Experiments in organic small scale chemistry

  Basic organic laboratory – sublimation, distillation, m.p. & b.p. determination.

  Organic reaction experiments – hydrolysis, esterification, condensation

SPONSOR
This workshop is partially sponsored by Low-cost Instrumentation and Microscale Chemistry Network, Federation of Asian Chemical Societies.

S-ML-A02: Hands-On Microscale Chemistry Workshop

---Some Typical Expts. by Using Micro Plastic Kit--- ***The Chinese Approach***

Yijian ZHANG Ning-Huai ZHOU

Chinese Microscale Chemistry Center, College of Materials, Chemistry and Chemical Engineering, Hangzhou Normal University ,Hangzhou, 310036, China

The micro –plastic apparatus (kits) consists of multi-functional pipettes, 6-holes well plate and its lids with two connective tubes, 9-holes well plate, syringe, tip ,LED,electrode,wires with ctocodile clips and a stand . It is novel kits with some creative parts and with low cost but very effective in conducting microscale experiments in general chemistry for high school and university level. In this workshop, the attendees will have hand on experience for some typical experiments, using the kits.

The contents of the experiments are as follows:

1,The determination of indicator's pH range
2, Preparation of $Cu(NH_3)_4SO_4$
3, Micro-Titration
4. Electrolysis of Water and Explosion of Hydrogen and Oxygen
5. Voltaic Cell
6.. Electrolysis of KI Solution
7. Fuel Cell
8. Preparation and Properties of C_2H_2

Reference:

1, N.H.Zhou *Microscale Inorganic Chemistry* Sicience Press,2000,Beijing
2, N.H.Zhou *Microscale organic Chemistry* Sicience Press,1999,Beijing
3,J.Skinner, *Microscale Chemistry—Experiments in Miniature*, Royal Society of Chemistry, UK,1997
4,*Proceedings of 2nd International Symposium on Microscale Chemistry*,Hong Kong Baptist University,2001
5,Summary of The 3rd International Symposium on Microscale Chemistry, 2005, http://www.uia.mx/investigacion/cmqm/default.html
6, www.micrecol.de/wasser10mineral.html

***The correspond author's** email: cmlc-6@126.com or cmlc28@gmail.com
The workshop is partially supported by FACS & CCS

S-ML-B01: UNESCO GLOBAL MICROSCIENCE EXPERIMENTS PROJECT

Alexander Pokrovsky, Consultant,
Maria Liouliou, Assistant Programme Specialist, and Julia Hasler, Programme Specialist,

Natural Sciences Sector, Division of Basic and Engineering Sciences, UNESCO, Paris, France (j.hasler@unesco.org).

Within the framework of the International Basic Sciences Programme and the Intersectoral Platform for Science Education, UNESCO implements the Global Microscience Experiments Project in promotion of science education. To date, introductory training workshops in microscience have been organized in more then 80 countries.

The Global Microscience Experiments Project is a hands-on science education project that gives primary and secondary school pupils (in some countries university students as well) the opportunity to conduct practical scientific experiments in physics, chemistry and biology, using kits that come with a textbook. These kits are veritable mini-laboratories comprising components that fit into a small box. They are cost effective, environmentally friendly and safe, in so far as pupils never need to use more than a couple of drops of chemicals for each experiment. The kits are also affordable and far cheaper than conventional laboratory material. Each kit is compact, can be reused and is unbreakable. In addition, the small quantities of chemicals used make the methodology environmentally sound. The use of the microscience kits in hands-on experimentation will be demonstrated during this workshop.

The pedagogical importance of the methodology for capacity building in scientific thinking is high. Pupils learn to set up an experiment, to observe and record results, and then to draw conclusions. Teaching of scientific thinking can be achieved with this methodology in contexts where no laboratory facilities are available. The microscience approach not only helps to develop scientific thinking in students but also provides developed and developing countries alike with new teaching tools.

A full range of educational materials on microscience experiments (in English) is available on the webpage of the UNESCO Division of Basic and Engineering Sciences, Natural Sciences Sector, and is free for use by all internet users. All these teaching and learning materials have just been finalized in Russian, and some materials in chemistry exist in French, Spanish and Portuguese. All UNESCO's teaching and learning materials on Microscience Experiments can be duplicated by any country for free distribution through the educational community and can be very easily adapted to national curricula by local specialists. Consequently, they can be considered as universal models for easy adaptation for any educational needs. UNESCO is interested in partnering with other centres for promotion of microscale experimentation and dissemination of best practices and experiences.

Key Words: Global Microscience Project, microscale experimentation, microscience kits

Reference:

http://portal.unesco.org/science/en/ev.php-URL_ID=6811&URL_DO=DO_TOPIC&URL_SECTION=201.html

S-ML-B02: The Study and Development of Micro-Chemistry in China

Ning-huai ZHOU

Chinese Microscale Chemistry Center, Hangzhou Normal University
Wenyi Campus , Hangzhou China (310012)

We started the research and application of micro-chemistry (or microscale lab, abbr. ML) in1988.Now more than 1000 universities, colleges and high schools have adopted ML in their teaching. The Chinese Microscale Chemistry Center was established in1999. The duty of CMCC is to promote the development of ML in China and to exchange and cooperate with international academic units in this field.8 National Conferences on ML have been held (once/2~3years) and usually more than100 teachers from Taiwan, Hongkong. Macua and Mainland China attended every meeting. Over 1600 papers and 40 books or proceedings on ML have been published. They cover inorganic, organic, general, analytic, and polymer chemistry and high school's science experimentations

The study and manufacturing of micro-apparatus are the foundation for the application and promotion of micro-chemistry. The main challenge of microscale experiments, special micro-synthesis, is mechanical losses of reagent, such as adhesions of apparatus and losing in transferring. To solve this problem, we need to design the multi-functional micro-apparatus in a creative way.

Four kinds of low-cost micro-apparatus have been developed and put into application in China. We hereby list them as follows:

1. Glassware:
   A, one set for micro-synthesis (model HZ-1) including 36 parts with ground joints.
   B, one set for micro and semi-micro organic lab, including 60 parts
   C, micro-glassware for use in high schools (model HZ-2 and ML-1,…etc.)
2. Micro-plastic kit, which includes pipes, 9 well plate, 6 well plate (abbr.WP6), and lids with inlet and outlet tubes…etc.
3. Micro-equipment for the quantitative experiment, such as micro-buret with 0.001 ml., micro-scales and photometer,….etc.
4. Other micro-apparatus: A, micro ion exchange column
   B, Utensils use as experiment apparatus (in a creative way).

The above apparatus inclu parts that we have invented, such as micro distilling head, vacuum condenser, micro buret and lids with two tubes…etc. With these parts, we can assemble some new and interesting micro-apparatus. For an example, when seven lids covered with two WP6 and a syringe are connected by small rubber tubes, they can make the setting for micro preparation of Cl2, KClO3 and NaClO.

We believe that by gaining hands-on experience with these micro-apparatus, students improve their skills as well as promote their creative thinking and the idea of environmental protection.

Key words: micro-chemistry, ML, micro-apparatus, development in China

S-ML-B05: THE MICRO-BURET FOR ACID-BASE TITRATION AND MOHR TITRATION

Jingya ZHANG Guoping YAN*

School of Material Science and Engineering Wuhan Instituite of Technology, Wuhan 430074 China

The micro-scale analytical experiment is a new way of the analytical experiment that has been developing rapidly as an important part of the micro-scale laboratory (M.L.) in recent years. Micro-scale experiment has some advantages including the reduction of environmental pollution and raw material cost and the shortening of experimental periods, strengthening students' operation skills in standardized experiments, cultivating new thoughts, and in the meantime representing the spirits of green chemistry and environmental-friendly chemistry, etc.

Most popular burets are 10 mL, 25 mL and 50 mL types in the conventional titration experiments. 10 mL burets are usually graduated each 0.05 mL, while 25 mL and 50 mL burets are usually graduated each 0.1 mL. The novel WD-COII Micro-buret with 3.000 mL of maximum scale value and 0.001 mL of maximum precision was designed for microtitration experiments by the Wuhan University. This micro-scale titration apparatus can be used in the acid-base titration and mohr titration experiments and the potential titration curve was used to ensure stoichiometeric point.

Compared with the conventional titration with the alkali buret and acidic buret, the microtitration has no significant differences and fulfills the requirements for chemical analysis. The EBT is samller by 0.5% and the t-examine value and F-examine value are in the allowable range. It improved that the WD-COII titration apparatus can settle all the problems of the micro-scale analytical experiment and be potential to use widely in the titration experiments.

Keywords: Microburet, acid-base titration, mohr titration, micro-scale analytical experiment, microscale laboratory

References

1. X.Y. Pei. *Chemical Education*, **2001**, *3*, 15
2. W.X. Zhu. *Chemical Education*, **2001**,*1*, 27
3. Wuhan University, *Analytical Experiment (Fourth)*, the Higher Education Press, **2001**, Beijing
4. L.S. Cai, H. Xu, Y.Q. Zhang, Q. Yin. *Journal of Analytic Sciences*, **2003**, *19(6)*, 570

S-ML-B06: Microscale Titration

CHEONG Wai Man

Macao Pui Ching Middle School

Test of Vitamin C is a popular high school chemistry experiment. At first, we used regular experiment apparatus to do this test. However, we found this approach required a large amount of chemical, thus it was not environmental friendly, and the experiment took a long time. Then our students studied to use micro scale chemistry experiment apparatus to apply the redox titration method to test Vitamin C.

The basic micro scale chemistry experiment apparatus does not include burette. Usually, the number of drops from the dropper is used to calculate the liquid volume. However, the use of drop counts cannot be very accurate. So we use mainly a plastic syringe and a 2 ml pipette to make a micro scale "burette". Compare with dropper and the homemade micro scale "burette" to the regular experiment apparatus, the accuracy of "micro scale burette" was much higher than the dropper. Thus we used this apparatus to conduct the Vitamin C test. This "burette" can also be used to other titration experiments.

The details of this "burette" will be presented with focus on

1. how to ensure the "burette" is air-tight
2. how to fix the "burette" system
3. how to fill the "burette"

Keywords: Micro scale experiment, titration, burette

References

1. **Microscale Chemistry**, John Skinner, The Royal Society of Chemistry, 1997

S-ML-B07: A microscale experiment for the determination of enthalpy change and entropy change from temperature dependence of equilibrium constant

KHURMA, Jagjit R

School of Biological and Chemical Sciences
Faculty of Science, Technology and Environment
University of the South Pacific
Suva, Fiji Islands

Experiments are important component of chemistry teaching but labs normally require bulky apparatus and large amounts of chemicals. This makes teaching of chemistry very expensive and creates a problem of disposing the waste chemicals without damaging the environment. There is a great need to develop to micro scale labs which can be done with simple set ups and very small quantity of chemicals

The standard enthalpy and entropy change of a physical or chemical process can be obtained from the temperature dependence of equilibrium constant. One such experiment, which is commonly done in the first year graduate students, involves studying the equilibrium between the solid ammonium oxalate and its saturated solution. The procedure involves the preparation of saturated solutions of ammonium oxalate at different temperatures and then obtaining the concentrations using titrations. This paper reports a simple procedure of obtaining equilibrium constant at different temperatures using a simple set up and just a few grams of ammonium oxalate. The results obtained using this method compare well with the titration method.

Keywords: Microscale, equilibrium constant, enthalpy change, entropy change

khurma_j@usp.ac.fj Tel., (679) 3232476 Fax. (679) 3231512

S-ML-B08: Microscale Experiments Based on a Low-cost Electronic Thermometer

Dharmatov Rahula Albano, Jose H. Bergantin, Jr., and Fortunato Sevilla III

University of Santo Tomas, España, Manila 1008, Philippines

A number of experiments in the general chemistry laboratory involve the measurement of temperature. The instrument that is widely used for this purpose is the mercury-in glass thermometer. The physical dimensions of the common mercury-in-glass thermometer restrict its applicability in microscale chemistry experiments. Furthermore, it presents a safety and health hazard due to the fragile glass material and its mercury content.

An alternative instrument for temperature measurement was developed based on a transistor IC. It is a semiconductor device which yields a voltage that is numerically equal to the temperature. It is available in miniature sizes, which makes it useful for temperature measurement in microscale systems. It exhibits a fast response, high sensitivity and good readability.

Microscale experiments on thermochemistry, stoichiometry, solubility curves, cooling curves and colligative properties were developed based on this electronic thermometer,

S-ML-B09: Innovating on Microscale Instrument

*XU, Xiaoxue

Chongqing Educational Research Academy
12th Guihuayuan Road, Yuzhong District,Chongqing, China, 400015

Microscale Experiment was introduced in our schools since 1991. Because of its priorities such as lower cost, lower pollution, more safety, more convenient to use, it is accepted by teachers quickly. This paper introduces some innovating on microscale instruments.

1. Light Microscale Instrument

Light Microscale Instrument was designed by Prof. Guang-zhi Song, produced by Chongqing Light Science and Technology Company. It includes multi-useful micro-iron stand and a set of micro-glassware. Prof. Guang-zhi Song has designed a set of Experiment Handbooks, to suit school teaching with Light Microscale Instrument. It includes several books used in junior schools or senior schools. CD disc of performance with Light Microscale Instrument has been manufactured for instruction teachers and students.

2. Compensative Instrument Kit

In order to suit secondary school teaching, we designed a Compensative Instrument Kit. It composed by civil produced instruments, which can be bought from instrument stores. In this set of instruments, we use candle instead of burner, and use iron bar instead of iron stand. Students use this set of instruments can do most of experiments in textbook, such as making hydrogen, making oxygen, electrolyzing water and so on. The main priority is that every thing can be found in market and do not require manufacturing.

3. Substitute of Microscale Instrument

Some schools are located at mountain or remote areas. These schools lack of common instruments and chemicals. Teachers and students look for some bottles, pipes and plastic containers to carry out experiment.

That is innovation by our teachers as mentioned above. Nevertheless, the Plastic Kit designed by Prof. Ninhuai Zhou is common used in our schools, particularly in junior schools.

Keywords: Innovation, Microscale, Instrument

*x-500111@163.com ++862363631851, ++862363620646

Partially support by UNESCO

S-ML-B10: Effective Chemical Education by Microscale Chemistry Experimets for High School and University

*Teruo YOSHINO

Department of Material Science, International Christian University,
3-10-2 Osawa, Mitaka, Tokyo 181-8585, Japan

During past few years, I have been involved in training program for high school teachers by microscale chemistry experiment (MCE) as well as the development of effective teaching method for chemistry-major university students. The training programs were carried out three times at my university by inviting Dr. K. Ogino and Dr. H. Shibahara as chief trainers in 2006 and 2008 and Dr. V. Obendrauf in 2007. Several experiment kits were provided and effectively used in the programs, and the precise reports including the manuals, answer sheets from participants and photo-album were published as booklets as well as on MCE website (http://science.icu.ac.jp/MCE/) which is run by Japan MCE Research Group.
This website is regularly updated by myself and extended to various aspects of MCE, and frequently accessed by those who are interested in MCE. I will report about these activities as a potential teaching method of high school chemistry.

Along with the above activities, I have developed several microscale experiments for organic chemisty laboratory course in my university. For instance, programming MCE of idoform test, photodimerization of benzophenone, nitration of methyl benzoate. After conducting these experiments in the classes, it was found to be effective for saving the amount of chemicals and time, and decreasing wastes as expected. Moreover, it was effective for chemical education since it gives systematic understanding of chemical reactions and needs careful treatment of a. I will describe about the actual methods and the evaluation based on the response from students. chemicals

Keywords: Microscale Experiment, Science partnership project, Effective chemical education

References

1. MCE website of Japan MCE Research Group : http://science.icu.ac.jp/MCE/
2. T. Yoshino, A. Horiuchi and K. Kitahara, ICU-SPP report **"Chemsitry World viewed by Microscale Chemitry", 2006**; *et. al*, ICU-SPP report **"MCE to activate secondary school science education", 2007**; T. Yoshino, "**Iodoform experiment by MCE and photochemical reaction by MCE**" in ICU-SPP report in "**Teacher training by and practical report of MCE", 2008**.

yoshino@icu.ac.jp, Tel. +81-422-33-3281, Fax.+81-422-33-1449
Project supported by: Japan Science and Technology Agency (JST) and International Christian University.

S-ML-B11: Practices on MCE in Secondary Schools

ZHU En

Huipu High School,Linhai,Zhejiang 317000,China

Microscale Chemistry Experiment (MCE)has been the focus of educational reform in the world. MCE in secondary schools becomes more and more important. In this paper MCE is briefly introduced, and also expounded the author's practices and the progress in the projects on MCE in secondary schools.

1 Microscale Chemistry Experiment(MCE)

2 Practices on MCE in secondary schools

2.1 Projects on MCE

2.1.1 Completed projects

2.1.2 Current projects

The project *Microscale Chemistry Experiments in the New Curriculum in Secondary School* was confirmed as one of projects of Ministry of Education of the People's Republic of China by the National Office for Education Science Planning on October 26,2007.

2.2 Some microscale chemistry experiments for secondary schools

2.2.1 Preparation and properties of the gases, including O_2 ,H_2,CO_2 ,SO_2,Cl_2, C_2H_4, C_2H_2, etc

2.2.2 Fountain of HCl

2.2.3 Volume Determination of 1mol H_2

2.2.4 Electrolysis of $CuCl_2$ solution and saturated common salt water

2.3 Publications

In a word, MCE is advantageous to attract students' interest in chemistry, help each student to learn important concepts in doing chemistry by himself, promote deepen the students' understanding of situation and knowledge about the environment, develop their good skills of solving and taking precaution against environmental pollution and set up correct attitude and values facing to the environment.

Keywords: microscale chemistry experiment, low cost, secondary school chemistry

Reference

1. ZHU En, *Education in Chemistry*,Shanghai,**2002**(4): 6-8
2. ZHU En,*China Educational Technique & Equipment*, Beijing, **2004**(7):22-23
3. ZHU En, *Educational Equipment and Experiment*, Beijing, **2007**(11): 4-6
4. ZHU En, *Educational Equipment and Experiment*, Beijing, **2009**(3):24-27
5. ZHU En, *Chinese Journal of Chemical Education*, Beijing, **2009**(6):55-57(59)

wxhxsy@126.com, Tel. +86-576-8538-0188, Fax.+86-576-8538-0188

Project supported by: The Ministry of Education of the People's Republic of China, Zhejiang Research Institute of Education Science, Zhejiang Research Institute for Learning and Teaching.
The workshop is partially supported by: UNESCO

S-ML-B12: Demonstration of Microscale Chemistry Experiments in Taiwan

CHIN-HSIANG FANG [a]*, WEN-TUNG HUNG [b]

[a] Department of Early Childhood Care and Education, Tajen University, Pingtung (907), Taiwan, China
E-mail ; chfang@mail.tajen.edu.tw
[b]Department of Early Childhood Care and Education, mehio Institute of Technology, Pingtung (912), Taiwan, China
E-mail: x0023@mail.mehio.edu.tw

Abstract

This study develope five microscale experiments: (1) dry distillation, (2) electrolysis, (3) gas generator, (4) titration, and (5) fuel cell They are designed and constructed with some simple materials. These microscale chemistry experiments can enrich the learning interest and teaching effectiveness of chemistry instruction by hands-on or demonstration at high school and university in Taiwan. Also, they may carry at any places. Due to low pollution, rapid and safety, our microscale chemistry experiments are belong to green chemistry teaching.

Key words: **chemistry instruction , demonstration, microscale chemistry, green chemistry, hands-on**

References

1. Fang,C.H. *Chemistry*, 61, 297. **2003**.
2. Mayo, D. W.; Pike, R. M.; Butcher, S. S. ***Microscale Techniques for the Organic Laboratory***, Wiley, New York **1991**,.
3. Skinner, J. *Microscale Chemistry, The Royal Society of Chemistry.* London , **1995.**
4. Szafran, Z.; Pike, R. M.; Wiley, M. M. *Microscale Inorganic Laboratory*, Wiley, **1990**.

S-ML-B13: The Glassware for Microscale Chemistry

Lan TAO Ninghuai ZHOU*

Chinese Microscale Chemistry Center, College of Material, Chemistry and Chemical Engineering, Hangzhou Normal University, Hangzhou 310036 China

Microscale laboratory (M.L.) is experiments conducting by using micro-apparatus with minimum chemicals. It is an innovational reform in chemical experiments under the direction of ***green chemistry***. The minimum chemicals means using a sharply reduce amount of chemicals, usually save 90% of chemicals than corresponding traditional experiments.

Study and manufacture of micro-apparatus are the basic work for exploitation and application of M.L.The plastic kit is low cost and easy to operation but there are two main disadvantages: 1,It can't be heated directly.2, It can't store some organic solvents such as ether and ketene.

To solve these problems, micro glassware should be combined using with plastic apparatus. Through 20 years' efforts, several sets of micro glassware have been designed and manufactured by local factories in Chain to suit different levels teaching requirement. The more popular sets are two types of **the glassware for micro synthesis** .One (Hz-1) includes 34 parts with 10# ground joints. Other set (YD-1) includes 63 parts with10/15 ground joints. Other sets of micro-glassware are those such as for inorganic chemistry, for titration and for high school chemistry. Each set has its innovative parts. In this presentation, author will demonstrate these sets of micro-glassware and show their key parts.

Key Words Microscale laboratory, several sets, micro-glassware

Reference:

1, N.H.Zhou *Microscale Inorganic Chemistry* Science Press, 2000, Beijing
2, N.H.Zhou *Microscale organic Chemistry* Science Press, 1999, Beijing

***cmlc28@gmail.com Tel:++8657188972919**
Partially support by UNESCO

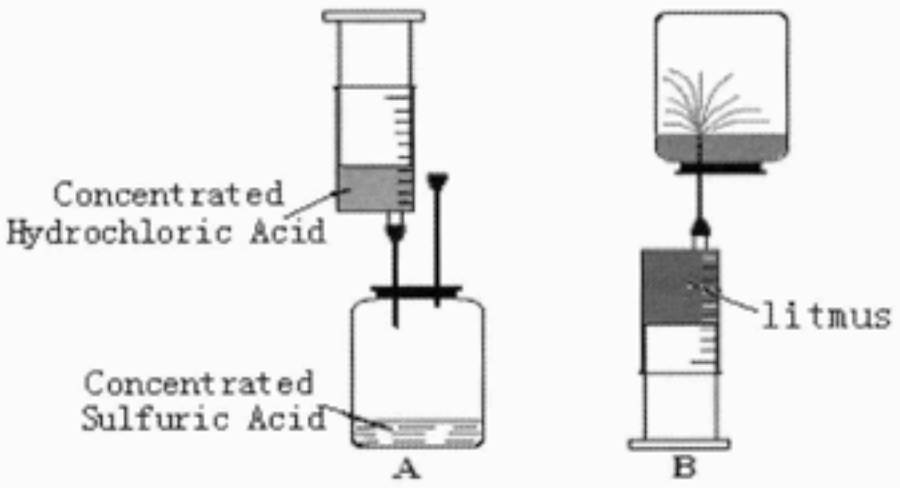
S-ML-B14: Two Microscale Chemistry Experiments in High School

[1]WANG Hui* [2]ZHU En

[1]Nanhui High School,201300 Shanghai,China
[2]Huipu High School,Linhai,Zhejiang 317000,China

Two microscale chemistry experiments for high school are introduced in this paper.

1.Fountain of HCl



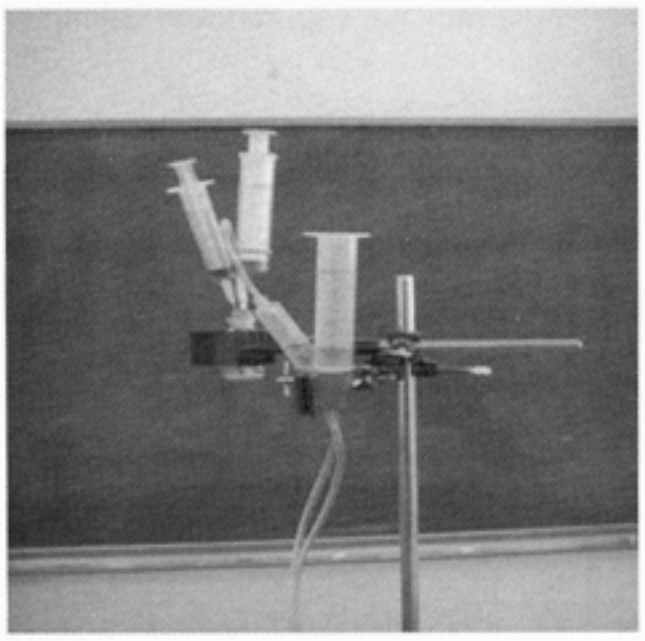
Equipment

syringe (5mL)
syringe (10mL)
syringe needle
bottle (10mL)

Chemicals

Concentrated Sulfuric Acid
Concentrated Hydrochloric Acid
litmus

2. Volume Determination of 1mol H_2



Equipment

syringe (5mL)
syringe (10mL)
syringe needle
bottles (10mL)

Chemicals

Mg (20~25mg)
2mL4mol/LH_2SO_4

Keywords: microscale experiments,green chemistry,inquiry teaching and learning

References

1. Y.Q.ZHU,N.H.ZHOU,**Chemical Activities and Microscale Laboratory**,The Democracy and Construction Press,Beijing,1999
2. WU Junming, *Education in Chemistry*,Shanghai ,**2004**(4):1-4
3. LIU Qiang,WANG Lei, *Education in Chemistry*, Shanghai ,**2004**(11):28-31

Project supported by: Ministry of Education of the People's Republic of China.

S-ML-B03: Innovative Qualitative and Quantitative Instruments For Micro-scale School Chemistry Experiments

Mr. CHAN Kwok Man*

Director, MicroChem lab, Hong Kong, China
Special Researcher, Chinese Micro-scale Chemistry Centre

The paper introduces some innovative professional qualitative and quantitative instruments suitable for micro-scale school chemistry experiments. They are low-cost, efficient and can be adapted to existing curricula and mainstream science practices. It helps schools of developing countries with limited resources to update students' practical skills at affordable cost.

(A)*Qualitative Instruments*

1. "Display Stand" – a handy aluminium equipment for fixing micro-scale glassware, suitable for substituting conventional iron stand and clamp.
2. Micro-scale glassware set – can perform dozens of experiments, especially those involving strong heat and use of organic solvents.
3. "Green Distelector" – collection of distillate at-the-source (CDS) and recycling of cooling water, excellent for enhancing "Green Awareness".
4. 8-Well reaction strip – extremely suitable for rate studies
5. "Reaction Disc" – for gas identification
6. "S" tube – prevents "sucking back"

(B)*Quantitative Instruments*

7. Using a low-cost digital multimeter (DMM) as common display readout:
   (i) pH meter – antimony electrode with a homemade sensor for direct pH measurements
   (ii) Conductivity meter – a homemade sensor that generates pulsing current which can avoid electrolysis.
   (iii) Colorimeter – a homemade sensor with a bright tri-colour LED as the illuminating source
8. Micro-scale RMM kit
9. Micro-scale calorimeter kit
10. "Electrolysis Tube" for volume measurements
11. "Meltometer" – m.pt. determination by direct flame heating instead of using electricity or liquid.

***Keywords**: Micro-scale chemistry experiments, "Green Chemistry", Quantitative measurements, pH, colorimetry, conductivity, low-cost instruments.*

The author has extensive experience in the past few years in conducting hands-on workshops in the South East Asian countries to promote innovative designs of micro-scale chemistry equipment Places include Hong Kong SAR, China, Malaysia (SEAMEO RECSAM at Penang), Singapore, Thailand and the Philippines.

* *(e-mail: mclchan@biznetvigator.com)*

The workshop partially support by UNESCO andCCS.