

Visit to a Science Club

Science Club at Rikkyo Ikebukuro Junior & Senior High School (Part 2)

Introduction

In our previous issue, we gave a report about the club activities and recent study achievements of the science club of Rikkyo Ikebukuro Junior & Senior High School. On this occasion, let us focus on what the students study. We were just fully amazed to see their capabilities such as a self-constructed spectroscope, research collaboration with universities and overcoming the limited environment of a high school laboratory. Please note that this report is about the students of academic year 2012.



Mr. Goto, teacher/advisor, has TCI's popular ballpoint pen in his hand. Students are looking at a scroll paper hidden inside with much interest.



Experiment by the club members. (From the left, Mr. Soejima and Mr. Arima, former captain.) Both are attending a science university since this April. On the right, a whiteboard is placed for sharing member's schedules.

Award-winning studies of Japan Science & Engineering Challenge (JSEC2012)

T. Soejima (12th grade), Crystal growth control of MOF-5 with coordination modulation (Honor award).

This is a study that examines the synthesis of MOF-5, a metal organic frameworks (or porous coordination polymers), from terephthalic acid and zinc with crystal growth controlled by adding benzoic acid. For the analysis and observation of MOF-5, PXRD (Powder X-Ray Diffractometer, with the assistance of Professor Oyama, Rikkyo University) and SEM (Scanning Electron Microscope, with the assistance of Professor Kasuga, Tokyo Metropolitan University, and Dr. Qiang Xu, AIST) are used.

Y. Takahashi (11th grade), Consideration of phthalocyanine synthesis by Wyler's method (Honorable mention award).

This is a study that performs the Wyler's method for phthalocyanine synthesis under aqueous conditions at room temperature, which is environmentally-friendly and suitable for experiments at a high school laboratory. What is surprising is that Mr. Takahashi made a self-constructed spectroscope from a store-bought single layer DVD, utilizing the diffraction and interference phenomenon of its reflective surface.

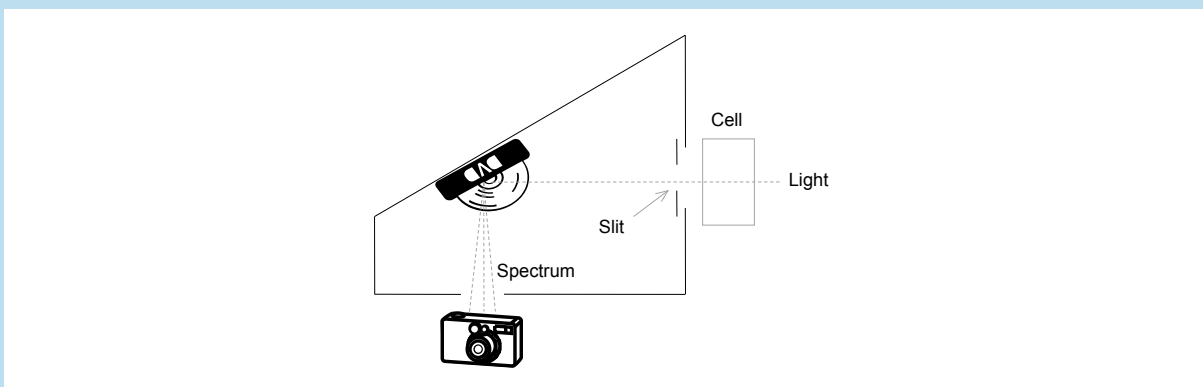


Figure Outline drawing of the DVD spectroscope.

He constructed the DVD spectroscope by reference to an article¹⁾, and performed this visible spectroscopic analysis by processing the obtained spectral data of phthalocyanine with image analysis software. The line density of diffraction on a DVD surface is about 1350 lines/mm. Thus, a DVD can be used as a high-resolution spectroscope inexpensively. We are very much impressed with his creative attempt even to an analyzing tool in this way.

1) F. Wakabayashi, K. Hamada, *J. Chem. Educ.* **2006**, *83*, 56. <http://dx.doi.org/10.1021/ed083p56>

Award-winning studies of Japan Student Science Award Tokyo round (High school category)

H. Arima (12th grade), Alteration of a complex based on differences of cations (Grand Award).

This is a study that examines a change of solution color and crystal structure of Fe(III) ion complex $[\text{Fe}(\text{C}_2\text{O}_4)_3]_3$ through alteration of co-existing cations (alkali metals, group 2 elements, transition elements and main group elements). Mr. Arima considers crystal systems and causal factors based on X-ray crystal structural analysis (with the assistance of Professor Morimoto, Rikkyo University).

K. Ohira (12th grade), Depolymerization of PET resin without metal catalyst (Incentive Award).

This is a study that aims to reproduce the depolymerization of PET (Polyethylene terephthalate) with a metal-free catalyst and short heating time, suitable for experiments at a high school laboratory. It is expected that this study can lead to an effective application of PET recycling.

Award-winning studies of Japan Student Science Award Tokyo round (Junior high school category)

Y. Koike (8th grade), S. Hirai (8th grade), Creation of a fine copper mirror (Grand Award).

A fine copper mirror is produced on an inner wall of a test tube by reducing Fehling's solution. This study examines conditions to form a fine copper mirror by varying amounts of silver nitrate water solution, tin(II) chloride water solution, Fehling's solution A/ B and formaldehyde as reducing agent. Reactions with other reducing agents are also performed.

Y. Tsujimoto (7th grade), S. Nagata (7th grade), Staining of vinylon (Incentive Award).

Vinylon is synthesized by an acid-catalyzed reaction of polyvinyl alcohol with formaldehyde. Vinylon has high-strength, high modulus, and also has high resistance to heat, weather and chemicals. But on the other hand, it has limited usefulness due to the difficulty of dyeing it. In this study, he tries to dye it with BTB and litmus solutions.

Other studies performed in 2012

T. Kuramochi (7th grade), T. Okura (8th grade), Making bronze.

This study observes the luster and color of bronze by regulating the amounts of copper and tin.

N. Masaki (8th grade), Study of azo compounds.

In this study, he synthesizes azobenzene, and monitors the light-induced (355 nm) *cis-trans* isomerization of its azo group as changing data on a spectrometry chart.

T. Uraki (9th grade), Observation of the surface temperature of rocks.

This study examines a mutual relationship between surface temperature and water absorption value using light-irradiated water-retentive rocks. This result can be applied to external wall materials of buildings, and is expected to reduce energy consumption.

T. Matsumoto (9th grade), Variation of the clock reaction under various conditions.

The clock reaction demonstrates the appearance of products after a period of time from the mixing of reactants. This study analyzes the relationship between concentration and the reaction rate of various reagents, focusing on the iodine-starch reaction as an example of the clock reaction.

T. Matsumoto (9th grade), Study of the influencing factors of a copper electrolysis reaction.

In this study, he examines the influence of the changes of the concentration of a copper (II) sulfate aqueous solution and the voltage in the electrolysis reaction. Next, he has a plan for electrolysis reactions using complex ions.

Y. Nishio (10th grade), Effects on the forming of alumite by various negative plates.

Forming of alumite (anodic oxide) layers with high corrosion resistance is achieved by giving pretreatment to an aluminum plate with steel wool. This study also demonstrates that alumite layers on a negative plate are rapidly formed when zinc is used as the negative plate instead of aluminum.

R. Maruyama (11th grade), Making of non-woven fabrics by nylon.

Mr. Maruyama synthesizes 6,6-nylon with his self-produced winder and makes it into non-woven fabrics. He also analyzes the difference in the making and strength of non-woven fabric by using various binders during the production process.

S. Motohashi (11th grade), Study of chromic molecules with pH indicators.

The chromic molecule is a compound that changes its visible absorption spectrum by external stimuli. This study measures the changes of the absorption spectrum of pH indicators (phenolphthalein and bromothymol blue) as chromic molecules, using a self-constructed DVD spectroscopy as described above.

Closing Remarks

We visited the school again on April 12, 2013 after the entrance ceremony was held, and saw students performing demonstration experiments to welcome new students. The scene was just representing the start of a new school year. In May, they installed a new experiment facility with a local exhaust ventilation system on each table. Also in July, they plan to attend the “Cambridge Science Workshop” at the University of Cambridge to interact with cutting-edge researchers and British high school students as a part of international exchange experience through science. We wish them continued success and further growth in their activities.

We have given a series of two reports about the science club activities of Rikkyo Ikebukuro Junior & Senior High School. We have great hopes in young and aspiring future researchers. We will continue to give you other reports and introductions on science clubs in junior and senior high school.



Demonstration experiments are performed to welcome new students (hydrogen generation experiment).



A local exhaust ventilation system is placed in the new experiment laboratory. A fume hood is on the back. Electronic balances and spectrometers will be placed on the left table.