

Ph.D. Thesis Defense by Kanokwan Kiwfo in Chiang Mai University

Tadao Sakai,¹ Norio Teshima,¹ Kate Grudpan²

¹ *Aichi Institute of Technology, Japan*

² *Chiang Mai University, Thailand*

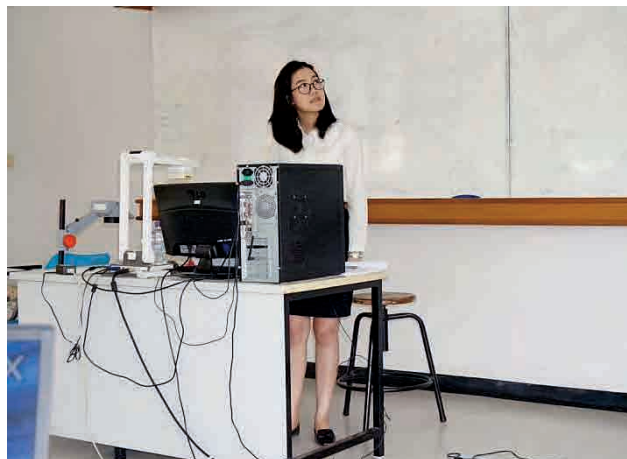
A Ph. D thesis oral examination was held on February 27, 2016 in Faculty of Science of Chiang Mai University. The examination is supported by the TRF Royal Golden Jubilee program. Chief supervisor was Professor Kate Grudpan (Chiang Mai University) and co-supervisors were Assistant Professor Sunanta Wangkarn (Chiang Mai University), Assistant Professor Tinakorn Kanyanee (Chiang Mai University), Professor Norio Teshima (Aichi Institute of Technology) and Emeritus Professor Tadao Sakai (Aichi Institute of Technology). Professors Norio Teshima and Tadao Sakai were invited as the co-supervisor and looked after Kanokwan Kiwfo, Ph. D. student in CMU, from April in 2014 to March in 2015, for research at Aichi Institute of Technology, including the study of Sequential Injection-Lab at Valve work. It was supported by Royal Golden Jubilee program and with addition support by Aichi Institute of Technology. There was also an external examiner as a Chair of the examination, Dr. Ponlayuth Sooksamiti.

The Ph.D. thesis title is “Development of Green Chemical Analysis with Downscaling and Natural Materials Based for Determination of Iron, Hydrogen Peroxide, Glucose, Albumin and Creatinine and Chemical Kinetics Study”. The thesis consists of Abstract, Chapter 1 Introduction, Chapter 2 Experimental, Chapter 3 Investigation on flow behaviors in some downscaling systems; 1) Study of phenomena in paper platforms 2) Flow phenomena in lab on noodle, Chapter 4 Downscaling chemical analysis for iron determination; 1) Lab on paper for iron determination using guava extract as a natural reagent 2) Lab on paper for iron determination using potassium thiocyanate, Chapter 5 Downscaling systems for hydrogen peroxide determination, Chapter 6 Downscaling systems for acidity determination, Chapter 7 Downscaling for determination of glucose, albumin and creatinine using SI-LAV, Chapter 8 Downscaling system for determination of horseradish peroxidase activity using lab on chip, Chapter 9 Downscaling systems for chemical kinetics study, Chapter 10 Conclusion and Chapter 11 References.

Abstract and Conclusion are as follows;

Abstract: Green chemical analysis with downscaling and natural materials based approaches for the determination of iron, hydrogen peroxide and glucose, albumin and creatinine together with chemical kinetics study have been developed. Natural materials based analytical platforms include paper and cotton cloth. Noodle based analytical device is for the first time proposed. The paper-, cotton- and noodle- based analytical devices were studied. Under a set of conditions, flow in laminar behavior could be established. Natural reagents including simple guava leaf extract, simple maple leaf extract and indigo (similar natural dye) have been employed together with above developed platforms. The developed analytical platforms have been applied together a mobile phone camera as detector, and with employing the simple extracts of guava leaf, maple leaf and indigo as well as other

common



reagents for the determination of iron, acidity and hydrogen peroxide. Development of sequential injection with lab-at-valve systems for simultaneous determination of glucose, albumin and creatinine has been attempted. The above developed downscaling instrumentation has also been proposed for the chemical kinetics study for oxidation-reduction of hydrogen peroxide, indigo carmine and enzymatic reaction of horseradish peroxidase. The above development offers novel green chemical analysis.

Conclusions: The work has been performed to develop green chemical analysis with downscaling and natural materials based approaches for determination of iron, hydrogen peroxide, glucose, albumin and creatinine and chemical kinetics study.

Paper based analytical device, or lab on paper with various designs could offer laminar flow behavior (as described in Chapter 4). This could lead to chemical analysis in steady and no steady state conditions Simple guava leaf extract could serve as a natural reagent for iron determination, apart from KSCN.

Cotton cloth based analytical device or lab on cloth, also with various design could be easily fabricated. The

determination of hydrogen peroxide by employing the cloth immobilized with indigo, a natural like dye was proposed, as described in Chapter 5.

The other natural material based platform, noodle based analytical device or lab on noodle is for the first time introduced, as discussed in Chapter 6.

Sequential injection lab at valve instrumentation (SI-LAV) for simultaneous of glucose, albumin and creatinine was investigated as described in Chapter 7.

The developed instrumentation was also employed, as downscaling for chemical kinetics studies, as detailed in Chapter 9.

It could be concluded that the work which has been performed offer various novelties for green chemical analysis.

The oral presentation started at 10 am and after presentation, Questions and answers were made for 1.5 hour.

Some questions are as follows:

1) Although you applied Guava extract to the determination of iron (III), please show the color development mechanism. And is the extract stable for 1 week at the room temperature?

2) Is it possible to determine iron (II) and iron (III) simultaneously?

3) Natural materials have different quality. Can you obtain the reproducible results?

4) You proposed the on-line dilution system using SI-LAV for the urine analysis. The system is effective for multi elements analysis. The dilution system is a nice idea for application of real urine samples. Anyway, you used TBPE for the albumin determination. Of many anionic dyes, why do you select TBPE dye staff?

5) You determined glucose with glucose oxidase. Did you use the immobilized column?

6) Why did you measure creatinine?

After the meeting for getting the examiners' opinions/comments, it was concluded that she passed the examination on common ground. It was observed that her thesis works provide various novelties and new approaches in green analytical chemistry and the works should be further investigated.

It was also noted that Kanokwan Kiwfo was the last Ph.D. student of Professor Tadao Sakai who supervised 6 Ph.D. students.

Also, it was noted for acknowledgements due to the Thailand Research Fund (TRF) Royal Golden Jubilee program, Chiang Mai University and Aichi Institute of Technology for their support, and Dr. Wasin Wongwilai for his academic contribution.

Congratulations !!!