



Report
The 13th WaQuAC-NET Webinar
Study on Effect of Particle Size on
Coagulation and Advanced Treatment
of Fine Particles
Reported by Mr. Hiroshi Sasayama
(WaQuAC-Net Office)

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Date and time: 19:30 to 21:00 Japan,
17:30 to 19:00 Thailand
Presenter: Ms. Khodseewong Sirapat ,Dr.,
Thailand
Commentator: Mr. Yoshinobu Ishibashi, Dr.,
Japan
MC: Mr. Hiroshi Sasayama, WaQuAC-Net

Ms.Khodseewong Sirapat (here after Nan as her nickname) showed the result of her study. She came to Japan from Khon Kaen, Thailand 2019. She has studied water treatment at under Prof. Nishimura at the Ecological Engineering Laboratory, School of Engineering, Tohoku University, Japan. She has successfully obtained the doctorate by this study, August 2022.

1.Participants: 22 persons+3 above, from 5 countries

- [Cambodia]
Ms. Chem Kimyon, Mr. POR KUNNARITH,
Mr.Keo Heng, Cambodia, Ms.Lao Chansayna,
Ms. SREANG Sreypov, Ms.Ky Monycharya,
[Japan]
Mr. Natsuki Iwao, Mr.Mitsuhiro FUJITANI,
Mr.Tohru MIYAGAKI, Ms. Yukiko Ohno,
Mr. Yoshinobu Ono,
[Myanmar]
Ms.Nwe Nwe Zin

- [Thailand]
Mr. Chanathip Eujongdee, Ms. Siwilai Kitpitak,
Mr. Rittirong Junggoth, Dr.,
Ms. Sangrawee Chomsuwan,
Ms. Chaweepan Suangkiattikun,
Ms. Nipaporn Mahasaen,
Ms. Wasana Watanakul,
[United Kingdom]
Mr. Jin Igarashi,
[WaQuAC-Net Office]
Ms.Mina Yariuchi, Ms. Keiko Yamamoto,

2.Outline of presentation

Removal of fine particles such as picophytoplankton (PPP) and microplastics (MPs) is a problem for water supply. Its removal efficiency is low with conventional treatment. The purpose of this study is to find the cause of low removal efficiency and to develop an advanced treatment method.

Coagulation and sedimentation experiment with PPP was carried out. Excess dose of coagulant, polyaluminum chloride (PAC), caused lower removal efficiency of particles than optimum dose though removal efficiency of turbidity was not changed. The number of particles with a size of 2 µm or less was increased after the coagulation and sedimentation. Increased particles are non living particles. It shows that

small particle, less than 2µm, does not react with coagulant well.

Same experiment with MPs was carried out. Polystyrene (PS), standard material of turbidity, was used as MPs. Kaolin (KL) was used as reference. Both materials have nearly same size distribution as PPP. Removal efficiency of KL was higher than its of PS. KL has higher density than PS. Higher density particle has more collision opportunity than lower one. Then KL showed better efficiency though its particle size is same as PS.

By the experiment with PS above, excess dose of coagulant cause remarkable increasing of particle. It is considered that particles produced from coagulant is increasing. To confirm it, further experiment was carried out. After rapid mixing of coagulant in PS solution, pH was adjusted below 3 using 0.1N HCl. Then the number of particles were constant at any dose. Especially, the number of particles which size of less than 2µm were not changed at any dose with acidification. It is considered that aluminum hydroxide particles from coagulant in size of 0.5 to 2µm is increased and inhibited coagulation of MPs or PPP without acidification.

Enhancement of coagulation method to remove fine particles was studied. KL was added in

coagulation and sedimentation process to produce floc well with fine particles because KL has higher performance of sedimentation with its higher density. The result showed that KL addition method can improve efficiency of PPP removal.

Slide:

https://www.waquac.net/pdf/data/data_2022_1206.pdf

3. Follow up comments

Picophytoplankton (PPP) causes some problems on water supply. They are coagulation inhibition, reducing sedimentation efficiency, breakthrough of fine particles from filters, offensive taste, and odor, and producing toxin. Ministry of Health, Labor and Welfare has set the turbidity of filtered water at 0.1 degree as a countermeasure against Cryptosporidium. But it is difficult to keep lower turbidity less than 0.1 under rich PPP in raw water by coagulation and sedimentation.

There are few papers on the coagulation theory of PPP behavior, and her research will be a valuable knowledge. She reaffirmed the coagulation theory that the difficulty in removing PPP and microplastics by coagulation is due to particle sizes smaller than 0.5 to 1µm.

4. Q&A

Q: Do you have any plan of pilot plant scale or actual plant experiment using kaolin?

A: I have ever visited Moniwa treatment plant. The plant is using activated carbon to remove musty odor. So, kaolin method can be used if the water supply wants to remove picophytoplankton. I think



sludge can be used instead of kaolin at an actual plant.

Q: I think you will continue your research for more utilizing the knowledge you have found. How will you step up your research to modify for actual water treatment? One more question. Can you use your method in Khon Kaen area?

A: My study is based on abundance of picophytoplankton in eutrophication lake. In my home area, there are many reservoirs in eutrophication. I want to research their condition and find good treatment way to remove plankton. I might find different treatment method from this study.

Q: How did you decide the experiment conditions such as pH 7 and 35mg/L of alkalinity?

A: I decided those parameters according to the result of preliminary experiments.

Q: How did you count the particles and measure their size?

A: I used a picophytoplankton counter. It shows each number of picophytoplankton and non living particles, and size of all particles.

Q: Have you ever experienced the mixture of polystyrene and picophytoplankton?

A: No, I have not. I think removal efficiency of polystyrene and picophytoplankton is not so different.

Q: We are using alum in water treatment process. Dosing alum causes more lowering pH and decreasing alkalinity than PAC. Can we use alum as coagulant for your method?

A: By previous studies, PAC shows higher removal efficiency of picophytoplankton than alum. So, I investigated only PAC in my research.

The webinar was successfully finished with many questions and answers and some comments.

(By Mr. Sasayama)

[Additional information](#)

• **A case of picoplankton measure by the waterworks bureau in Japan**

I remember that picoplankton became a problem in waterworks bureaus in Japan before, and the staff in charge of biology were actively researching it. Recently, I heard on the picoplankton issue from an experienced person who worked at the waterworks bureau.

“It is important to remove picoplankton by coagulation-sedimentation process. When picoplankton was generated, we changed the treatment process from intermediate chlorination to pre chlorination, or changed the water intake position (water level with less picoplankton). Since the pre-chlorination method was adopted, there has been no leakage of picoplankton in our waterworks bureau.” he said.

(By Mr. Nagashio)

Report

The 14th WaQuAC-NET Webinar

Development and Challenges of Rural

Water Supply in Thailand

-Cases of Khon Kaen and Chiang Mai-

Reported by Ms. Keiko Yamamoto

(WaQuAC-Net)

WaQuAC-Net invited Ms. Sopa and Mr. Mongkol as the lecturers in the 14th webinar. They have contributed to the development of Thai rural water supply long time. The Outline is as follows,

★**Date and Time:** 12th January, 2023,

10:00-11:30: Rwanda 15:00-16:30: Thailand,

17:00-18:30: Japan

★**Style:** ZOOM Webinar

★**Lecturers:**

Ms. Sopa SONGKRAM, The Environment and Pollution Control Office (EPO) in Chiang Mai

Province, Ministry of Natural Resources and Environment, Thailand

Mr. Mongkol Thannanawanukul, EPO in Khon Kaen Province

☆ **Commentator** : Dr. Yoshinobu Ishibashi, Former professor in Khon Kaen University.

☆ **MC** : Dr. Khodseewong Sirapat (Tohoku University)

☆**Participants** :

[Cambodia]: Mr. Sinat PHEA, Ms. Sreang Sreypov, Mr. Por Kunnarith, Ms. Lao Chansayna, Mr. Ramylun, Mr. Vichhainin KHEM,

[Indonesians]: Mrs. Siti Zainab LUBIS,

[Laos]: Ms. Vadsana THAMMAVONGSA,

[Malawi]: Mr. Chipokosa, Mr. Mphatso MTAMBO, Mr. Linga MAKWIZA,

[Myanmar]: Ms. Ei Khaing MON, Ms. May Myat MON,

[Pakistan]:Mr. Muzaffar Abbas,

[Tanzania]:Mr. Rajab Said MOHD,

Mr. Abbass Mgeni KASSIM,

[Thailand]:Ms.Chaweeapan SUANGKIATTIKU,

Ms. Sivilai KITPITAK,

Ms. Thitima SANGPRAPHAKORN,

[Japan]: Mr. Jin Igarashi, Mr. Kenichi Umerama,

Mr. Noboru Ozaki, Mr. Tohru Miyagaki,

Mr. Daiji Nagashio, Dr. Mari Asami, Ms. Junko Uno,

Mr. Natsuki Iwao, Mr. Hiroyuki Ushie,

Mr. Tomohiko Wakiya, Mr. Keisuke Fujii,

Mr. Yoshinobu Ono, Ms. Keiko Yamamoto.

35 persons from 9 countries participated.

☆**Summary**

1) Introduction:

There are 77 provinces in Thailand. See the location of Chiang Mai and Khon Kaen Provinces on the right map.

In 1948, the Public Works Department, the Ministry



of Interior started the development of a rural water supply.

In 1960-1970s: Several agencies carried out the rural water supply

In 1982~: Department of Health provided training to the village water committee members.

In 1990s: Local Administrative Organizations (LAO) managed the rural water supply directory.

2) Government Policy of Water Supply and Action Plan:

National Water Resources Management Master Plan (2018-2037) was enacted and the Office of National Water Resources was established for providing clean drinking water widely as one of objectives which aims to achieve safe water supply to all 75,032 villages in Thailand by 2030. Many government agencies have been involved for water supply development such as Department of Local Administration, Ministry of Interior, Department of Water Resources, Ministry of Natural Resources and Environment, Environment and Pollution Control Office, Pollution Control Dpt., Ministry of Natural Resources and Environment, Department of Health, Ministry of Public Health. They are working for making the manuals of facilities maintenance, providing simple kits for water quality test, sampling water for water quality examination, training the managers for their capacity building, designing model facilities of rural water supply, evaluating rural water management and so on.

3) Existing conditions of rural water supply

There are the model facilities proposed by each water sources. In 2018-2022, water quality examinations were implemented for all rural water supply systems.

The results show the percentages of rural water supply systems that exceeded water quality standards in each parameter as follows.

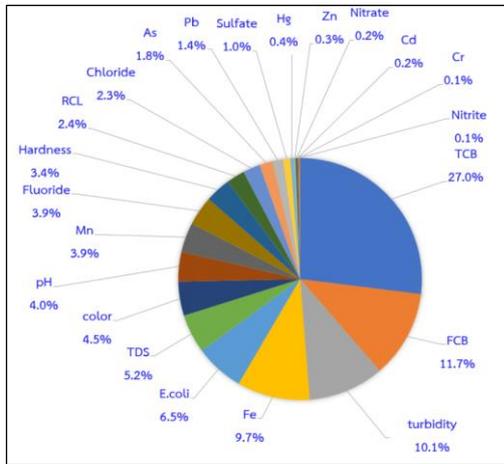


Figure: Percentages of systems exceeding water quality standards for each parameter

Water sources in rural areas of Thailand, especially in the mountain areas, are rarely polluted with chemical substances, and most of them are contaminated with bacteria such as E. coli.

4) Current status of rural water supply

4-1) Case of Khon Kaen Province

The most common problems are inadequate disinfection and flocculation process, therefore, there are many water quality problems. Their maintenance including daily cleaning is inadequate. Water pollution is also occurring due to multi-purpose use of water sources (water sources are also used by livestock such as cattle). In addition, the water sources have high turbid during the rainy season. And water volumes decrease in the dry season. On the other hand, the LAO, the supporting agency, does not have enough staff and has limited skills. Financial support is also insufficient. The local working group of the LAO in Khon Kaen has just started to support the



Mr. Mongkol

rural water project, and it has no visible improvement yet.

4-2) Case of Chiang Mai Province:

Chiang Mai is also like Khon Kaen. Operator's training is required to operate the facilities. There are the water quality problems which E-coli was found in the tap water, because there are no chlorine dose facilities. Turbidity is also high because lack of back washing. As improvement activities, they implemented site survey,



Ms. Sopa

training for improving operator's skill, finding the water quality problems by sampling, and checking the ability of operators. Based on the Action Plan for Integrated Water Resources Management, by the project performance 2018 - 2022 of the EPC Office (1-16), the reservoir for the village water supply has been inspected and be conserved to provide tap water with suitable quality for consumption and consumption covering 76 provinces (all over Thailand).

* Please access bellow URL, and see the Presentation PDF

https://www.waquac.net/pdf/data/data_20230112.pdf

☆ Q&A

Q: What kind of measures are taken to gain the understanding of village residents?

A: As an example, volunteers teach elementary school students how important clean water.

Q: Do you have anything to have from other organizations to improve your staff's skill?

A: We share information with countries in similar situation and organizations

Q: Do you introduce WSP (Water Safety Plan)? I think it is useful to small water supply system too.

A: WSP has been adopted by PWA (Provincial Waterworks Authority), which supports rural water supply development together.

Q: Concerning the water quality, E. coli contamination is serious. Is there a program for educating villagers how to boil water to drink at home?

A: In a mountain village in Chiang Mai, exactly the water source is heavily contaminated with E. coli, we guide to boil the water before drinking because they do not have any water purification system.



Participants in the 14th Webinar

☆Post questionnaire

- ◇ The lecture was very interesting. However, I would like to have known more water quality.
- ◇ It was exactly same as current situation of rural water supply in Cambodia.
- ◇ In this webinar, I learned the government's current measures and improvement projects for rural water supply in Thailand, and through that, I understood the problems of rural water supply.
- ◇ I was involved in a rural water project in Rwanda before. The problems which Thailand people face is very similar to those of Rwanda. Thank you for your wonderful lecture.
- ◇ The lecture on the rural water supply situation in Thailand was very understandable.

(By Ms. Yamamoto)

Report
 ~ Year-end party and international student get-together ~
Tomohiro MINAMI (JICA)

The year-end party and international student get-together was held in Shinjuku, Tokyo on 20th December, 2022. It was the first face-to-face meeting after the spread of the COVID-19 pandemic, and was conducted with infection measures. Attendees of international students and trainee were 9 persons, and their information is as follows.



- Mr. MOHD Rajab Said, Toyo University, Tanzania, Zanzibar Utilities Regulatory Authority
- Mr. Tihologelo MOGOATLHE, Toyo University, South Africa Department of Water and Sanitation
- Ms. Umuhoza Marie Grace, Toyo University, Rwanda, Water and Sanitation Corporation Ltd
- Mr. Ankit Man Shrestha,

University of Tokyo, Nepal,
Ministry of Water Supply

- Ms. Masayu Nadiya Zikrina,
University of Tokyo, Indonesia,
Ministry of Public Works and Housing
- Mr. Sunti CHANDAENG
University of Tokyo, Laos
Luang Prabang Water Supply State
Enterprise
- Mr. Saiful amin,
Tokyo University, Indonesia,
Ministry of Public Works and Housing
- May Myat Mon,
University of Tokyo, Myanmar,
Yangon City Development Committee
(YCDC)
- Ms. Thitima Sangraphakorn,
Kanagawa Prefecture Overseas Technical
Trainee, Thailand,
Metropolitan Waterworks Authority

The Japanese members participated widely from water works bureaus and private companies, as follows.

Mr. Akaishi, Mr. Arimura, Mr. Ono,
Ms. Kamegai, Mr. Sasayama, Mr. Morita,
Ms. Yamamoto, Ms. Yariuchi

The total number of participants was 18. Everyone introduced themselves with announcement by Ms. Yariuchi, after opening remarks by Ms. Yamamoto. All attendees talked on the problems of their agencies and on their life in Japan. It was not enough to do that for only about two and a half hours.

All the international students and trainee seemed to be happy with the Christmas present given by the WaQuAC Santa Claus. It was valuable opportunity to make connection of WaQuAC-Net members and exchange information by conducting the face to face meeting this time.

We will have more opportunities to meet the Waquac-Net members in person in 2023.

(By Mr. Minami)



Photo: Participants at the bar restaurant

Self-introduction of member

Ms. Maki Suzuki

(JICA, Consulting firm)

First business trip: Came across people drinking contaminated tap water in slums of Lahore City, Pakistan



When I first became in charge of an infrastructure project in the water and sanitation sector at JICA, my boss encouraged me to visit slums and learn firsthand how people get affected by the poor water supply and sanitation infrastructure. I remember visiting a house and being shocked to find turbid drinking water coming out of the tap. The toilet was not



connected to the sewer system and, during the rainy season, even inside of houses got flooded. I always think of this visit and people I met whenever I work in water and sanitation projects.

Unsuccessful project for Water Supply and Sanitation Agency: impact was unsustainable

I was next assigned to a project to transform operations of Water Supply and Sanitation Agency to be more efficient and financially competitive. We believed that major obstacles and our team believed mission accomplished delivering certain impact. However, we found that the situation at the Agency was back to business-as-usual when I visited them after a few years. I learnt how difficult it was for a third party to support organizational transformation and change, and especially to make it "sustainable" even after the project was complete. This experience made me decide to

study business and management and to change career to work for a consulting firm to gain practical experiences of organizational transformation.

Someday I wish I would be able to help execute organizational transformation of water and sanitation agencies for improving public service delivery

While studying MBA, I was fortunate to gain a summer internship at Manila Water. Through this experience, I learned a lot about its internal talent management practice – such as talent recruitment in Philippines, the curriculum for the executive development program, KPI setting and personnel evaluation aligned with performance management of each department, as well as customer-facing operations like complaint handling operations and the daily work of Key Account Managers.

Beside work, I very much enjoyed Filipino cuisine every time I had lunch with my colleagues there and talk about work and private life.



In my current work at a consulting firm, I support Japanese companies on transformation – from developing turnaround strategy to implementation. Our transformation project starts with a launch of a company-wide program that empowers employees to ideate, evaluate and execute initiatives that they can think of to improve company performance. With clear tracking of execution status and impact estimation, the program continues till it delivers clear financial improvement for companies. Furthermore, the program also focuses on

people. We support clients not just come up with initiatives to improve skills of employees but change mindsets and create positive working environments. While it is always a struggle to get the program going at the beginning, it's a really rewarding to see how our support helps employees become more engaged and come alive. Leveraging my experiences of these successful organizational transformations, I would like to help the water supply and sanitation sector in developing countries in future.

In private life, I'm struggling but enjoying raising my one-year-old son.

I enjoy going for walks with my one-year-old son along a river or in a park during weekends. My personal goal is to improve my skiing skills that I am not good at. I am currently receiving intense coaching from my husband this year, but not sure how far I can improve ...

Dear members in WaQuAC-Net

In every session, I have learnt a lot from all the fellow participants, who clearly have deep knowledge in the fields of water supply and water quality. I would be happy if I could connect with people who share similar interests in organizational transformation or people and talent areas.



Introduction of new members

- Ms. Thitima Sangraphakorn (Thailand)
- Mr. Prosper MUHIRWA (Rwanda)
- Mr. Emmanuel Frazer (South Sudan)
- Mr. Rajab Said MOHN (Tanzania)
- Mr. Akimasa Mochizuki (Japan)

We welcome new members anytime.

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(Yariuchi, Yamamoto)

URL: <https://www.waquac.net/english/index.html>

Next Activity

February 28: The 15th Webinar “Cost of Urban Sanitation in Narok Town, Kenya”

March : The 16th Webinar “Leadership”

May: The 17th Webinar “Experience /WSP”