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Preface

Preface

Kitakyushu has become well-known around the world as a green growth city. Today, Kitakyushu is turning its eyes towards the ultimate goal of achieving a "zero-carbon society," which has been agreed upon at the international level to be indispensable in building a bright and happy future for Asia. To this goal, the University of Kitakyushu promotes collaboration research, human development, and business development of research outcomes in collaboration with many universities in different countries.

One of the results of this effort was implementing the first ICRC (International Conference Research Collaboration) in March 2018, on Improvement of City Environmental Quality, in which 10 universities participated from 3 countries. The purpose of this conference was to build international networking between the University of Kitakyushu and the universities included Universitas Andalas, Universitas Lampung, Universitas Pasundan, Universitas Pendidikan Indonesia, Institut Teknologi Bandung, Universitas Negeri Malang, Universitas Padjadjaran, Universitas Langlangbuana, Universitas Sumatera Utara, Universitas Janabadra, and University of Malaya, Malaysia. These universities have similar research interests for the Improvement of Urban Environmental Quality. In this first conference in 2018, 54 articles of the consortium at the conference were disseminated and published through the ICRC scientific journal.

For the second ICRC, the total of 132 participants have come from 30 universities which include UPI, University of Malaya, State University of Malang, University of North Sumatra, ITB, University of Lampung, University of Pakuan, University of Diponegoro, University of Airlangga, University of Trisakti, IPB, Ndejje University, and many more. The discussions cover the following topics:

1. Solid Waste Management and Treatment
2. Air Pollution Monitoring
3. Water Treatment and Resource Management
4. Low Carbon Initiative
5. Environmental Education
6. Environmental Culture
7. Environmental Health
8. Renewable Energy

Since the active cases of COVID-19 in Japan were still increasing, the conference was held in an online meeting on April 25-26, 2021, using the Zoom Application. The organizing committee invited 5 keynote speakers: Prof. Dr. Muhammad Ali, M.A. (Universitas Pendidikan Indonesia); Prof. Yu Chun Wang (Chung Yuan Christian University); Prof. Hiroyuki Miyake (The University of Kitakyushu); Assoc. Prof. Dr. Norlidah Alias (University of Malaya); and Dina Ibrahim (Mansoura University) who is divided into 2 plenary sessions. Each speaker was given 25 minutes for the talk and 15 minutes for discussion. Then, the parallel session was conducted using the breakout room facility provided by the Zoom Application. We made 8 rooms where each room consists of 9-10 presenters. The presenter and participant were allowed to enter any room they like. However, the presenter is intended to join the room 10 minutes before they give a talk. This conference again opens opportunities for collaboration between the University of Kitakyushu and all academics interested in researching environmental management, education, and technology.

This "Collaboration Research Program" has been ongoing for 6 years. There have been plenty of scientific journals produced through the conference conducted, and more exciting research resulted from this conference.

We selected 62 high-quality manuscripts for submission in Earth and Environmental Science IOP Proceedings. These papers consist of environmental management, health, technology, science, and education. All of the manuscripts are peer-reviewed to meet the quality of a scientific publication. We want to express our gratitude to the chairwoman of this conference, distinguished keynote speaker, reviewers, moderators of the parallel session, and all of the participants. We want to acknowledge the IOPP for publishing our conference proceedings. We hope that the readers could get some valuable information and knowledge from our proceedings. We apologize for all of the mistakes that found during the conference and also found in the published papers.

Since the Japan embassy cannot accept any foreign tourist (lockdown) from January until April 2021, the conference committees held the International Conference on Research Collaboration of Environmental Science (ICRC) 2021 in an online setting using the Zoom Application 25-26, 2021. The virtual conference was successfully held by inviting 5 keynote speakers, 132 participants from 30 universities and 8 countries, 8 moderators, and 18 committees to attend this meeting. Each keynote speaker has 15 minutes to talk and 15 minutes for discussion. The presenter has 10 minutes for giving a talk and 5 minutes for questions and answers. Sixty-two (62) high-quality papers are submitted to IOP conference proceedings. We want to acknowledge all conference parties for their dedication, contributions and supports to this conference. Without their help, this meeting means nothing. We apologize for all of the mistakes found during the conference and found in the published papers.

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Calculation of heavy metals pollution load enters to Saguling dam West Java Province

Calculation of heavy metals pollution load enters to Saguling dam West Java Province

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Abstract. The current study aims to assess the trace metals concentration in water and sediments from rivers entering Saguling Dam and calculate their pollution load. Water and surface sediment samples were collected in September 2017 during the dry season. Seven rivers which are Citarum, Cihaur, Cijere, Cimerang, Cipatik, Cijambu, and Ciminyak. Trace metals were analyzed using Inductively Coupled Plasma/Mass Spectrometry (ICP-MS). Based on the measurement of the total discharge that enters the Saguling Dam from 7 rivers of 20.074 m^3s^{-1}. Cr and Cu pollute river water. Seminyak River has the highest Cr concentration of 0.096 $mg^{-1,}$ and the lowest is Cimerang River 0.054 mgL^{-1}. High Cu concentration does not meet the Citarum River, Cimerang, and Cipatik with respective concentrations of 0.038, 0.029, and 0.031 mgL^{-1}. River sediments have heavy metal content that exceeds the standard. These metals are derived from anthropogenic sources in the catchment area. Pollution load of all the rivers that go into Saguling Dam for parameter Cd, Cr and Cu respectively 7.654, 149.128, and 63.435 $kg.day^{-1}$. The most significant contributor comes from the Citarum River, which is the largest river in this area. The results obtained would help develop more effective dam management.

1. Introduction

Ever The population growth which continues to increase, accompanied by the development of supporting facilities and infrastructure, has resulted in water pollution, one of which is a lake [1,2]. Lake ecosystems have complex processes that can describe ecosystem dynamics: the interactions between biological, chemical, and physical processes. Many organisms depend on the lake ecosystem. Lake functions include drinking water sources, waste disposal, fisheries, agricultural irrigation, industrial and recreational activities [1,2]. Saguling dam is the most essential artificial lake in West Java Province. This lake dams the Citarum River, whose water quality has been polluted by heavy metals. This affects its function [3,4]. The pollution that occurs in Lake Saguling causes the accumulation of heavy metals in the sediments. The sediment quality becomes insufficient due to high Cd, Cr, Cu, and Pb [5-7]. Heavy metals such as Cd, Cr, Cu, Pb, Hg, etc., are mainly concerned because they can cause chronic poisoning in aquatic animals [2].

Heavy metals that have contaminated the reservoir must be managed not to cause a significant impact. Management must be carried out because the dam functions as a fishery, irrigation area, and water source for domestic use, closely related to public health. A study was conducted for trace metals

pollution in water and surface sediments at seven sites river input Saguling Dam. This research will also calculate the heavy metal pollution load that enters the Saguling Dam. This information can be used as primary data to determine water pollution control in the seven rivers that enter the dam.

2. Methodology

Samples were taken in September 2017 from seven rivers that entered the Saguling Dam (figure 1). River name, latitude, and longitude of rivers are given in table 1. The surface water sampling method is based on Indonesian National Standard Number 6989-57-2008 concerning the surface water sampling method by considering several conditions in the field [8]. Water and surface sediment samples were collected by the grab method. Three litters of water and 30 g of sediment samples from a depth of 20 cm under the bed river were collected. Samples of water acidified with nitric acid (pH = 2) and other samples were transferred to the laboratory. The analysis method for checking heavy metal by Inductively Coupled Plasma/Mass Spectrometry (ICP-MS) [9]. Measurement of river water discharge regarding Indonesian National Standard 03-2819-1992 regarding the method of measuring river discharge and open channels with a current meter [10].

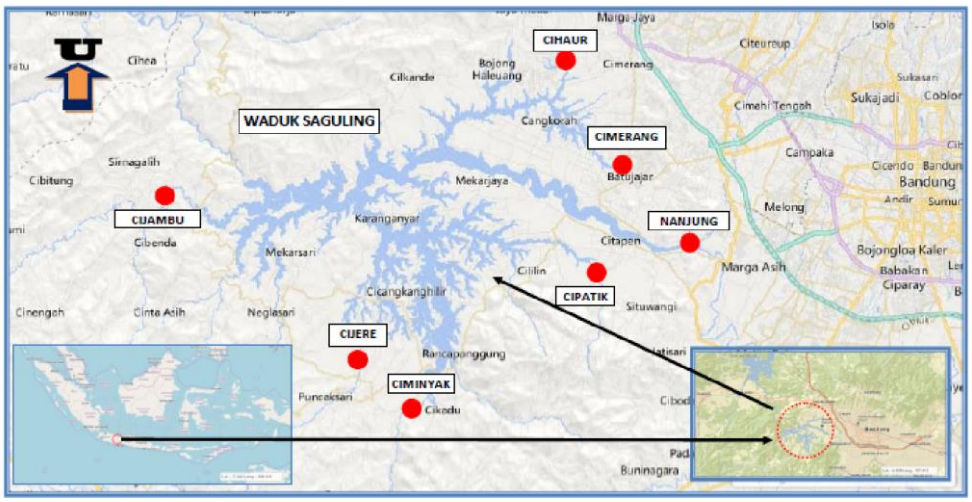

Figure 1. Sampling location.

Table 1. River name, latitude, and longitude of rivers that entered Saguling dam.

River Name	Sampling Location	Coordinates	
		South	East
Citarum	Nanjung Bridge, Cihampelas Village, Bandung Regency	06°56'29,85"	107°32'10,7"
Cihaur	Cihaur Bridge West Bandung Regency	06°51'28,84"	107°29'56,19"
Cijere	Cicangkan Hilir Village, Cipongkor District, West Bandung Regency	06°57'16,06"	107°24'22,9"
Cimerang	Batujajar Timur Village, Batujajar District, West Bandung Regency	06°54'43,56"	107°30'9,45"
Cipatik	Cipatik Bridge with DAS in Cimahi City and Bandung Regency	07°1'34,12"	107°28'36,64"
Cijambu	Cisarongge Village, West Bandung Regency	06°55'8,19"	107°20'40,08"
Ciminyak	Ciminyak Bridge Saguling District	06°58'59,46"	107°25'52,52"

3. Results and discussion

The measurement of river water discharge was carried out in September 2017 during the dry season. The river has a minimum discharge. Based on observations of the Cijere River in dry conditions. Based on the measurement of the total discharge that enters the Saguling Dam from 7 rivers of 20.074 m^3s^{-1}. The most extensive discharge comes from the Citarum River at 18.60 m^3s^{-1}. The Cimerang river discharge is 0.544 m^3s^{-1}, Cipatik is 0.544 m^3s^{-1}, Ciminyak is 0.200 m^3s^{-1}, Cijambu is 0.110 m^3s^{-1}, and Cihaur is 0.076 m^3s^{-1}. Cijere River during field observation in dry conditions. The low water discharge of the seven rivers studied is the impact of damage to the watershed. The rapid population development has resulted in converting land functions from vegetated areas to residential areas. The land conversion causing extreme fluctuation in the rainy season is substantial discharge; otherwise, dry season water is running low.

Based on the analysis of Cd concentration in water in seven rivers studied, government regulation 82/2001 of 0.01 mgL^{-1} [11]. The greatest concentration is derived from the Citarum River is 0.005 mgL^{-1}, and the smallest Chaur River is 0,001 mgL^{-1} (figure 20). Cr concentrations did not meet the standards in all the rivers observed. Government regulation 82/2001 requires a maximum Cr concentration in river water of 0.05 mg^{-1}. Seminyak River has the highest Cr concentration of 0.096 $mg^{-1,}$ and the lowest is Cimerang River 0.054 mgL^{-1}. Other rivers are Citarum, Cipatik, Cijambu, and Cihaur, respectively 0.087, 0.076, 0.056, and 0.084 mgL^{-1} (figure 3). The high Cr concentration in river water is predicted to come from human activities in the catchment area. Cr in river water comes from mining activities, industrial coolants, chromium salts manufacturing, leather tanning [4].

High Cu concentration does not meet the Citarum River, Cimerang, and Cipatik with respective concentrations of 0.038, 0.029, and 0.031 mgL^{-1}. Seminyak, Cijambu, and Cihaur River low Cu concentration respectively by 0.006, 0.01, and 0.004 mgL^{-1}. Cu standard in river water is set at 0.02 mgL^{-1} (figure 4). The high Cu in water is predicted to come from mining activities, electroplating industry, smelting operations in the catchment area [6,7]. The study examined the concentration of Pb in river water, but the concentration was so small that it was not detected by the equipment used.

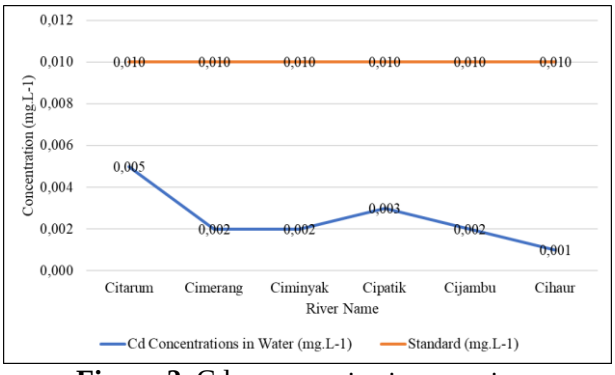

Figure 2. Cd concentration in water river.

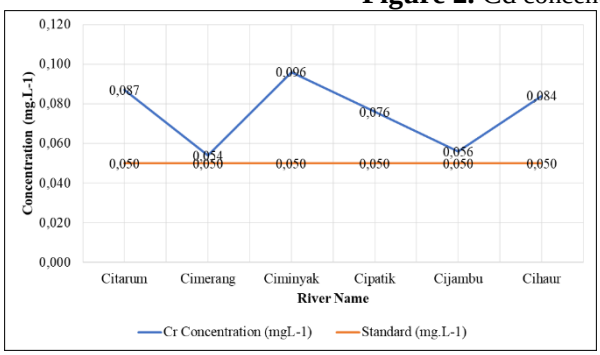

Figure 3. Cr concentration in water river.

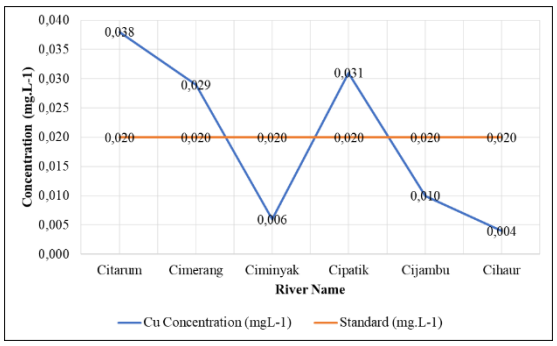

Figure 4. Cu concentration in water river.

Studies regarding the presence of heavy metals in waters must be carried out in water and sediments. Heavy metal concentrations obtained in this study were compared with the standard based on Australian and New Zealand Environment and Conservation Council (ANZECC) [12]. The concentration of Cd in all rivers was observed not to meet the standard of 1.5 mg.kg^{-1}. The highest concentration in the Cijambu River is 17.57 mg.kg^{-1}, and the smallest is in the Cihaur River, 16.12 mg.kg^{-1} (figure 5a). Similar to Cd, the concentration of Cr is also high, exceeding the standard use of 80 mg.kg-1. The highest concentration in the Citarum River is 226.73 mg.kg^{-1}, and the smallest is in the Cipatik River, 111.20 mg.kg^{-1} (figure 5b). Cu concentrations in the Citarum, Cimerang, Cipatik, Cijambu, and Cihaur River sediments exceed the standard, but in the Seminyak river, it is below standard (figure 5c). Pb concentrations in the Citarum, Cimerang, and Cihaur River sediments exceed the standard, but in the Seminyak, Cipatik, Cijambu river below standard (figure 5d).

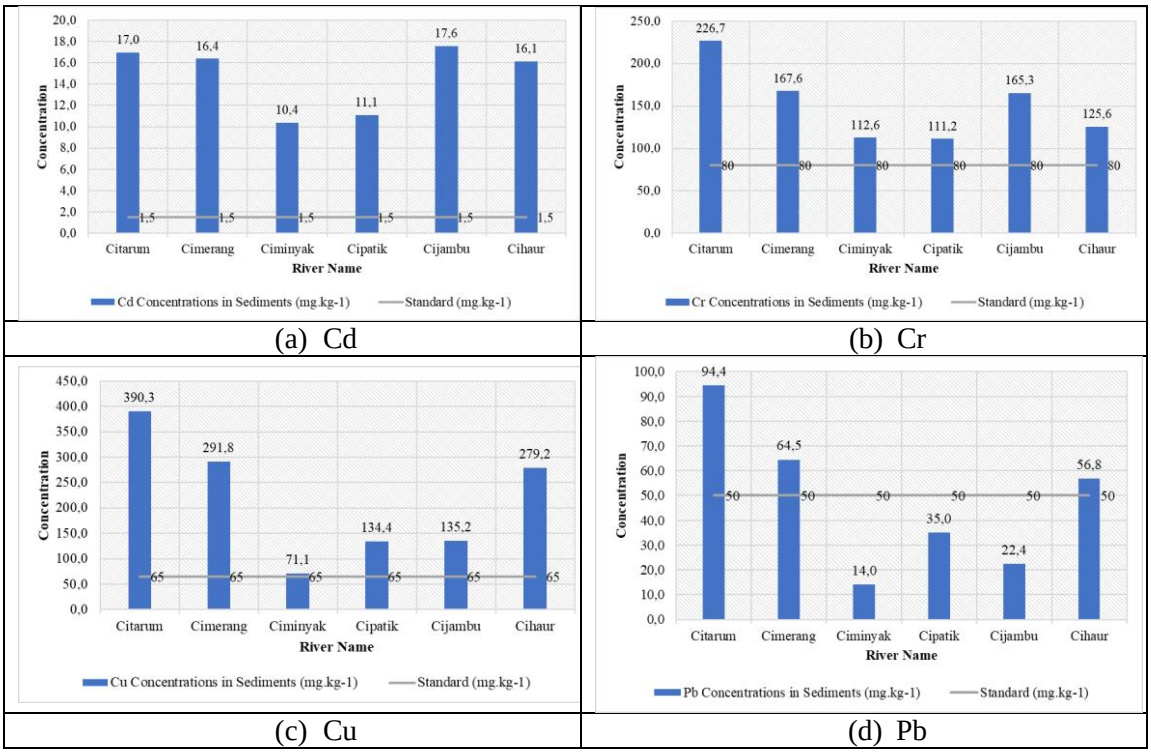

Figure 5. Heavy metal concentrations in sediments river.

The total Cd pollution load from the seven rivers entering the Saguling Dam is 7,654 kg.day^{-1}. The highest pollution load comes from the Citarum River, 7.392 kg.day^{-1}, and the lowest is from the Cipatik River, 0.118 kg.day^{-1}. The total Cr pollution load entering the Saguling Dam is 149.128 kg.day^{-1}. The highest pollution load comes from the Citarum River 140.295 kg.day^{-1}. The total Cu pollution load entering the Saguling Dam is 63.435 kg.day^{-1}. The highest pollution load comes from the Citarum River, 60.425 kg.day^{-1} (table 2). The highest concentration of heavy metals contained in water and sediment comes from the Citarum River. This river has the most extensive catchment area with various activities, which are domestic, industry, agriculture, livestock, and mining. It is recorded that 556 industries are located here, and 442 are textile industries. These industries have the potential to add heavy metal pollutants to the Citarum River. The industry composition is based on Bandung City, Cimahi City, and Bandung Regency, respectively 54, 68, and 50%. The electroplating industry in Bandung City is 16.13%, Bandung Regency is 1.17%, and Cimahi City is 7.14% [13]. The source of pollution comes from the washing process of volcanic activities such as Mount Tangkuban Perahu, Wayang, and Patuha, which heavy metals include: As, Ba, Mg, Al, Cu, Pb, Zn, Hg, Se, and Cd [14].

Table 2. Water discharge, heavy metal concentration, and pollution load.

River Name	Water Discharge	Concentration in Water (mgL^{-1})			Pollution Load ($kg\ day^{-1}$)		
	(m^3s^{-1})	Cd	Cr	Cu	Cd	Cr	Cu
Citarum	18.600	0.005	0.087*	0.038*	7.392	140.295	60.425
Semarang	0.544	0.002	0.054*	0.029*	0.089	2.533	1.358
Ciminyak	0.200	0.002	0.096*	0.006	0.028	1.666	0.100
Cipatik	0.544	0.003	0.076*	0.031*	0.118	3.553	1.434
Cijambu	0.110	0.002	0.056*	0.010	0.021	0.530	0.094
Cihaur	0.076	0.001	0.084*	0.004	0.006	0.550	0.024
Cijere	Dry	-	-	-	-	-	-
Standard*	-	0.010	0.050	0.020	-	-	-
Amount	20.074	-	-	-	7.654	149.128	63.435

Bandung Regency has Gold Mining activities. Based on the test results in the river channel and around the gold mine, parameters such as TSS, Cd, Zn, and Pb did not meet the standards. Based on this, it can be concluded that mining activities in the Citarum catchment area are a source of heavy metal pollutants that will eventually accumulate in the sediments of the Saguling Dam [13]. Industries in the Citarum catchment area use coal as fuel to heat boilers. Control of air emissions using a wet scrubber. Fly ash that has accumulated in the wet scrubber is treated at the wastewater treatment plant. Fly ash contained As, Cd, Pb, and Hg [1]. The use of industrial coal in Cimahi City is recorded at 912 $tonnes.year^{-1}$ [13]. The use of coal for the industry in Bandung Regency is 2,239 $tonnes.year^{-1}$ [13]. Based on these data, the use of coal in the Citarum Catchment area was recorded at 3,151 $tonnes.year^{-1}$.

4. Conclusion

Research stating that the total water discharge that enters the Saguling Dam from 7 rivers is 20,074 $m^3.s^{-1}$. Pollution load of all the rivers that go into Saguling for parameter Cd, Cr, and Cu respectively 7.654, 149.128, and 63.435 $kg.day^{-1}$. The most significant contributor to the pollutant load comes from the Citarum River, the largest river. The concentrations in stream water and some heavy metals studied met the specified standards, but the concentrations in the sediments were very high. This indicates that heavy metals that have settled and bound to sediments if environmental conditions are favorable will dissolve into the water. This indicates that heavy metal monitoring should be carried out in river water and sediments.

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