Sidement Characteristics on Hydropower Plant Bakaru South Sulawesi

by Firman Firman

Submission date: 14-Feb-2022 07:27AM (UTC+0000)
Submission ID: 1761987478
File name: nt_Characteristics_on_Hydropower_Plant_Bakaru_South_Sulawesi.pdf (3.12M)
Word count: 4549
Character count: 25129

Preface: International Conference on Engineering, Science and Nanotechnology 2016 (ICESNANO 2016)

Cite as: AIP Conference Proceedings **1788**, 010001 (2017); https://doi.org/10.1063/1.4968247
Published Online: 03 January 2017

PREFACE: International Conference on Engineering, Science and Nanotechnology 2016 (ICESNANO 2016)

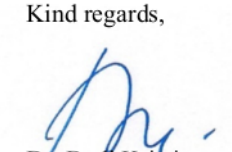
Dear colleagues,

On behalf of the Committees, It is our great pleasure to welcome you to Solo for International Conference on Engineering, Science and Nanotechnology 2016 (ICESNANO 2016) held at The Alana Hotel & Convention Center - Solo, INDONESIA on August 3 (Wed) ~ 5 (Fri), 2016. The joint committee between Mechanical Engineering Department, Sebelas Maret University (UNS) and Microelectronics & Nanotechnology - Shamsuddin Research Centre or MiNT-SRC, Universiti Tun Hussein Onn Malaysia (UTHM) are very proud to be performing the first ICESNANO 2016. In this year, the conference theme is "*Empowering innovation in engineering, science and nanotechnology*". This conference aims to communicate and distribute knowledge of fundamental and applied research in the field of engineering, science and nanotechnology. It also provides the premier interdisciplinary forum for participants to present and discuss the most recent innovations and practical challenges in this field.

We are very proud and honored to have a welcoming and opening speech by Prof. Dr. Ravik Karsidi, M.S. (Rector of UNS) and Prof. Datuk Dr. Mohd Noh Dalimin (Vice-chancellor of UTHM), respectively. We would like to great thank the keynote speakers given by Prof. Abdul Latif Ahmad (Universiti Sains Malaysia), Prof. Akio Miyara (Saga University) and Assoc Prof. Takahiko Miyazaki (Kyushu University), who will present their recent work and will give new insights and ideas to the conference participants. The committees are very grateful to the invited speakers, i.e. Assoc Prof. Keishi Kariya (Saga University), Dr. Koichi Nakaso (Kyushu University), Prof. Masaya Ichimura (Nagoya Institute of Technology), Prof. Dr. Yuli Aries Himawanto (Sebelas Maret University) and Dr. Ir. Astu Unadi, M.Eng. (Director of ICAERD, Indonesian Center for Agricultural Engineering Research and Development - Ministry of Agriculture) who present their innovative works.

The organization of ICESNANO 2016 is very much a team effort. I want to especially thank all the members of the conference committee, who have carried out a huge and complicated workload. I also wish to acknowledge the members of the scientific committee, who had the arduous task of peer review process for a lot of the submitted abstracts. I also wish to thank the Ministries of Research, Technology, and Higher Education Republic of Indonesia for an international conference grant. We are also very grateful to our sponsors and exhibitors i.e. Preston Shipyard Sdn. Bhd., REI, and PT. Horiba Indonesia. Finally, let me wish you are going to enjoy this exciting conference regarding both its academic and social programs.

Kind regards,



Dr. Budi Kristiawan
Conference Chair, ICESNANO 2016Solo, INDONESIA
August, 3rd 2016

International Conference on Engineering, Science and Nanotechnology 2016 (ICESNANO 2016)
AIP Conf. Proc. 1788, 010001-1–010001-1; doi: 10.1063/1.4968247
Published by AIP Publishing. 978-0-7354-1452-5/$30.00

Welcome !

Welcome all scientists, researchers, and students to our event, ICESNANO 2016. This International Conference on Engineering, Science and Nanotechnology will be held in Solo, Indonesia on 3 – 5 August 2016. ICESNANO 2016 constitutes the joint seminar between Sebelas Maret University (UNS) Indonesia and Universiti Tun Hussein Onn (UTHM) Malaysia in the field of engineering, science and nanotechnology.

In this event, our conference theme is “empowering innovation in engineering, science and nanotechnology”.

The conference program will consist of pre-conference workshops, plenary/keynote speeches, invited sessions as well as oral sessions. This conference aims to communicate and distribute knowledge of fundamental and applied research in the field of engineering, science and nanotechnology.

It also provides the premier interdisciplinary forum for participants to present and discuss the most recent innovations and practical challenges in this field.

Publishing

icesnano@ft.uns.ac.id

By double-blind review, all extended abstract submissions are reviewed by the Scientific Committees. To cover the research results, all extended abstracts accepted in ICESNANO 2016 will be arranged into official website. There will be no served Proceedings of ICESNANO 2016 for full paper. Instead, the authors could prepare the manuscript after presenting their results of the research according to full paper submission. For publishing, the papers presented in ICESNANO 2016 will be published at AIP Conference Proceedings. To avoid plagiarism, please note that the manuscripts have not been or will not be published elsewhere.

In the proceedings services of ICESNANO 2016, we use **OPEN ACCESS OPTION** for online publication. **OPEN ACCESS** is an online proceeding that will be permanently free-to-read and available to researchers worldwide without any fee to access or download the papers. You do not need a username or password to access the papers. All online publication fees are completely independent of the number of pages in your proceedings papers. However, all contributions must be full articles with a preferred minimum of 4 papers per paper.

AIP Conference Proceedings

ISSN:0094-243X E-ISSN: 1551-7616

AIP Conference Proceeding is indexed by SCOPUS with SJR indicator of 0.16 and H index of 29.
http://scitation.aip.org/content/aip/proceeding/aipcp

WORKSHOPS

Pre-conference workshop will be held on 1-2 August 2016 before ICESNANO 2016 is undertaken. In this event, there are three types of workshops offered to participants including natural dye-sentitized solar, synthezied nanofibre for piezoelectric, and thermal analysis and thermal conductivity characteristics of nanofluids.

In collaboration with :

RISTEKDIKTI

Sponsored by :

UPDATES

Click here to download the AIP Conference Proceedings template.

Conference flyer of ICESNANO 2016 is available here

Click here to download Conference Registration Form

Click here for submission of your extended abstract(s) via EasyChair.

EasyChair Instructions for ICESNANO 2016 can be downloaded from this link.

SNTM-UNS II
SEMINAR NASIONAL TEKNIK MESIN UNS ke-2

The selected papers will be published at the following journals

Publisher:
Directorate of Research and Community Engagement, Universitas Indonesia
ISBN/ISSN, 2355-2786
Indexed in Emerging Sources Citation Index (Thomson Reuters), Directory of Open Access Journals (DOAJ), EBSCO, ISJD, IPI, and Crossref.
http://journal.ui.ac.id/science

Publisher:
Department of Biology, Faculty of Mathematics and

AIP American Institute of Physics

PRESTON SHIPYARD SDN BHD (480536-D) PROFESSIONAL • PRO-ACTIVE • PRODUCTIVE

Garuda Indonesia The Airline of Indonesia

Rei OUTDOOR GEAR

Organized by :

UNIVERSITAS SEBELAS MARET UNS

UTHM Universiti Tun Hussein Onn Malaysia

Teknik Mesin
Fakultas Teknik - Universitas Sebelas Maret

MiNT-SRC
Microelectronics & Nanotechnology
Shamsuddin Research Centre

Supported by :

QuantumLeap Transformation

Sciences, Semarang State University
P-ISSN: 2085-191X; E-ISSN: 2338-7610
Indexed in Indonesian Publication Index (IPI), EBSCO Open Science Directory, Google Scholar, Directory of Open Access Journals (DOAJ), and International Digital Publishing Forum.
http://journal.unnes.ac.id/nju/index.php

Publisher:
National Institute of Science Communication and Information Resources (NISCAIR)
ISSN 0975-1084 (Online); 0022-4456 (Print)
Scopus indexing with 0.24 SJR indicator, 33 H-index, 0.5 IF, and Q2 quartile.
http://www.niscair.res.in/sciencecomm

Publisher:
Taylor's University College
Print ISSN: 1823-4690
Scopus indexing with 0.24 SJR indicator, 9 H-index, 0.058 IF, and Q2 quartile.
http://jestec.taylors.edu.my/index.htm

Publisher:
© INSIGHT - Indonesian Society for Knowledge and Human Development
P-ISSN: 2088-5334; E-ISSN: 2460-6952
International Journal on Advanced Science, Engineering and Information Technology has been indexed and abstracted and displayed in Elsevier products (Scopus, EMBASE, Engineering Village and Reaxys)
http://ijaseit.insightsociety.org/

Committees

International Advisory Board

Dr. Hari Singh Nalwa (Editor-in-Chief of Advanced Science Letters)
Dr. Sanjay Sen Gupta (Editor-in-Chief Journal of Scientific and Industrial Research, JSIR)
Dr. Abdulkareem Sh. Mahdi Al-Obaidi, CEng MIMechE (Executive Editor, Journal of Engineering Science & Technology, JESTEC)
Prof. Abdul Latif Ahmad (Universiti Sains Malaysia)
Prof. Yanuar (University of Indonesia)

Scientific Committees

Prof. Nandy Setiadi Djaya Putra, Prof. Samsul Kamal, Prof. Kuncoro Diharjo
Prof. Stefanus Adi Kristiawan, Prof. Dwi Aries Himawanto, Prof. Muhammad Nizam
Assoc Prof. Suhanan, Assoc Prof. Soon Chin Fhong, Assoc Prof. Nafrizal bin Nayan
Dr. Reza Azizian, Dr. Miftahul Anwar, Agung Tri Wijayanta, Ph.D.

Independent Selection Committee

Prof. Ildoo Chung (Pusan National University, Korea)

Conference Chair

Budi Kristiawan

Conference Co-Chairs

Marlia binti Morsin, JokoTriyono

Secretary

Indri Yaningsih, Siti Salmah binti Senain

Treasury

Sukmaji Indra Cahyono, Faezahana binti Mokhter

Organizing Chairs

Nurul Muhayat, Mohd. Zainizan bin Sahdan
Syamsul Hadi, Triyono

Technical Program Chairs

Dominicus Danardono DPT, Agung Tri Wijayanta, Budi Santosa
Muhammad Suhaimi bin Sulong, Mohd. Khairul bin Ahmad

Journal & Publication Chairs

Miftahul Anwar, Govinda Lulus Lambang H

icesnano@ft.uns.ac.id

Nafarizal bin Nayan, Soon Chin Fhong

Corporate Partnership Chairs
Zaenal Arifin, Feri Adriyanto

Preconference Workshops Chair
Suyitno

Webmaster
Purwadi Joko Widodo

Publicity
Zuhri Nurisna, Asmah Binti Mat Taib

UPDATES

Click here to download the AIP Conference Proceedings template.

Conference flyer of ICESNANO 2016 is available here

Click here to download Conference Registration Form

Click here for submission of your extended abstract(s) via EasyChair.

EasyChair Instructions for ICESNANO 2016 can be downloaded from this link.

SNTM-UNS II
SEMINAR NASIONAL TEKNIK MESIN UNS ke-2

The selected papers will be published at the following journals

Publisher:
Directorate of Research and Community Engagement, Universitas Indonesia
ISBN/ISSN, 2355-2786
Indexed in Emerging Sources Citation Index (Thomson Reuters), Directory of Open Access Journals (DOAJ), EBSCO, ISJD, IPI, and Crossref.
http://journal.ui.ac.id/science

Publisher:
Department of Biology, Faculty of Mathematics and

Sciences, Semarang State University
P-ISSN: 2085-191X; E-ISSN: 2338-7610
Indexed in Indonesian Publication Index (IPI), EBSCO Open Science Directory, Google Scholar, Directory of Open Access Journals (DOAJ), and International Digital Publishing Forum.
http://journal.unnes.ac.id/nju/index.php

Publisher:
National Institute of Science Communication and Information Resources (NISCAIR)
ISSN 0975-1084 (Online); 0022-4456 (Print)
Scopus indexing with 0.24 SJR indicator, 33 H-index, 0.5 IF, and Q2 quartile.
http://www.niscair.res.in/sciencecomm

Publisher:
Taylor's University College
Print ISSN: 1823-4690
Scopus indexing with 0.24 SJR indicator, 9 H-index, 0.058 IF, and Q2 quartile.
http://jestec.taylors.edu.my/index.htm

Publisher:
© INSIGHT - Indonesian Society for Knowledge and Human Development
P-ISSN: 2088-5334; E-ISSN: 2460-6952
International Journal on Advanced Science, Engineering and Information Technology has been indexed and abstracted and displayed in Elsevier products (Scopus, EMBASE, Engineering Village and Reaxys)
http://ijaseit.insightsociety.org/

icesnano

Klik di sini guna mengaktifkan notifikasi desktop untuk Gmail. Pel

Gmail

Pindahkan ke Kotak Masuk

TULIS

Kotak Masuk (14)

Berbintang

Email Terkirim

Draf

[Gmail]

Notes

Selengkapnya

Masuk

Masuk akan memasukkan Anda ke Hangouts di seluruh Google

Pelajari lebih lanjut

CP 1788 - Online access

Kotak Masuk x

icesnano committee <icesnano@ft.uns.ac.id>

ke yukh001, kade001, sigit, kanza, gwibawa, Anggita, Annisa, toni.prahasto, awid, Mu

Inggris Indonesia Terjemahkan pesan

Dear Author(s),

I hope this e-mail finds you well. I am happy to inform you that your papers presented access will be available in perpetuity without the need for a token.

To access your volume go to the following link: http://aip.scitation.org/toc/apc/1788/1?

In addition, we would like to remind you that AIP CP Volume 1788 will be available for efficient through the web-based ordering system.
For a limited time, the AIP publisher would like to offer you 35% off of your print proce
How to Order:

1. Visit the print-on-demand store http://printorders.aip.org/proceedings/1788
2. Click "Add to Cart"
3. Enter coupon code JAN2017 and click "Apply to Order" to receive the discount.

Thank you.

Klik di sini untuk Balas, Balas ke semua, atau Teruskan

0,4 GB (2%) dari kuota 15 GB telah digunakan

Kelola

Persyaratan -

AIP Conference Proceedings

Table of Contents

INTERNATIONAL CONFERENCE ON ENGINEERING, SCIENCE AND NANOTECHNOLOGY 2016 (ICESNANO 2016)

PREV NEXT

Conference date: 3-5 August 2016
Location: Solo, Indonesia
ISBN: 978-0-7354-1452-5
Editors:
Volume number: 1788
Published: Jan 3, 2017

DISPLAY : 20 50 100 all

article

n . January 2017

15

Effect of anneal temperature on fluorine doped tin oxide (FTO) nanostructured fabricated using hydrothermal method

M. K. Ahmad, N. A. Marzuki, C. F. Soon, N. Nafarizal more...

31

AIP Conference Proceedings 1788, 030044 (2017); https://doi.org/10.1063/1.4968297

SHOW ABSTRACT

n . January 2017

19

The influence of co-sintering Bi_2O_3 on $Yb_{0.2}Ce_{0.8}O_{2-\delta}$ ceramic SOFC

BROWSE VOLUMES

Open . January 2017

The effect of different graphene surface area on photocatalytic activity of $LaFeO_3$ nanoparticles

Nur Afifah, and Rosari Saleh

AIP Conference Proceedings **1788**, 030080 (2017); https://doi.org/10.1063/1.4968333

SHOW ABSTRACT

Open . January 2017

Fault diagnosis of roller bearing using parameter evaluation technique and multi-class support vector machine

Didik Djoko Susilo, Achmad Widodo, Toni Prahasto, and Muhammad Nizam

AIP Conference Proceedings **1788**, 030081 (2017); https://doi.org/10.1063/1.4968334

SHOW ABSTRACT

Open . January 2017

Preparation of activated carbon from mangrove propagule waste by H_3PO_4 activation for Pb^{2+} adsorption

Widi Astuti, Rizki Agus Hermawan, Hariono Mukti, and Nurul Retno Sugiyono

AIP Conference Proceedings **1788**, 030082 (2017); https://doi.org/10.1063/1.4968335

SHOW ABSTRACT

Open . January 2017

Sediment characteristic on hydropower plant Bakaru, South Sulawesi

Firman, A. M. Shiddiq Yunus, and M. Yusuf Yunus

AIP Conference Proceedings **1788**, 030083 (2017); https://doi.org/10.1063/1.4968336

SHOW ABSTRACT

Open . January 2017

Finite element analysis of electric bicycle frame geometries

Sukmaji Indro Cahyono, Miftahul Anwar, Kuncoro Diharjo, Teguh Triyono more...

AIP Conference Proceedings **1788**, 030084 (2017); https://doi.org/10.1063/1.4968337

SHOW ABSTRACT

BROWSE VOLUMES

Sediment characteristic on hydropower plant Bakaru, South Sulawesi

Firman, A. M. Shiddiq Yunus, and M. Yusuf Yunus

Citation: **1788**, 030083 (2017); doi: 10.1063/1.4968336
View online: http://dx.doi.org/10.1063/1.4968336
View Table of Contents: http://aip.scitation.org/toc/apc/1788/1
Published by the American Institute of Physics

Sediment Characteristic on Hydropower Plant Bakaru, South Sulawesi

Firman[1,a)], A.M. Shiddiq Yunus[1,b)] and M. Yusuf Yunus[1,c)]

[1]*Mechanical Engineering Department, Politeknik Negeri Ujung Pandang, Makassar, Indonesia 90245*

[a)]Corresponding author: firmananoor@yahoo.com
[b)]shiddiq_96@yahoo.com.sg
[c)]yusuf200880@gmail.com

Abstract. This research is aimed to determine the distributed sediment composition and its size particle impact on flow profile in the pipe. The sediment sample is collected from Hydropower Plant's dam located at Bakaru Sulawesi Selatan. The sample is dried in the oven then steered up using a screen with 0.25; 0.5; and 0.75 mm. Sediment identification is measured using Fourier Transform Infrared Spectrophotometer (FTIR) and X-Ray Fluorescence Spectrophotometer (XRF). The assessment of flow type in the pipe with five flow rate variation for every single sediment diameter is assessed in Fluid Measurement Laboratory under Mechanical Engineering Department, State Polytechnic of Ujung Pandang. As a result of steered up processed, it is obtained that the sediment distribution with diameter of ø = 0.25 mm is 55.80%; for ø = 0.5 mm is 7.91%; and ø = 0.75 mm is 36.29%. From FTIR test, it is obtained the spectra with wave number of 466.77; 536.14; 644.22; 694.37; 788.89; 912.33; 1006.77; 1031.92; and 105.21 cm^{-1}. From XRF assessment, it can be obtained that composition of SiO_2 is 53.64%, Al_2O_3 is 22.93%, Fe_2O_3 is 9.24%, MgO is 4.0%, K_2O is 3.84%, Na_2O is 2.4%, CaO is 1.71%, and TiO_2 is 1.06%. From the flow profile assessment, it obtains Reynolds number is lesser than 500 for these three particle diameters variation. It can be concluded that sediment characteristic consists of fine sand about 55.80% and coarse sand about 44.20%, where SiO2 dominates it by about 53.64% where flow in the pipe shown the laminar type.

INTRODUCTION

Bakaru Hydropower Plant (BHPP) is a runoff river type hydropower where water that is used for generating power is obtained from damming up the river. The dammed river is Sungai Mamasa that the stream-up is located at Mamasa District of West Sulawesi. The capacity of Bakaru Hydropower Plant is 2 x 63 MW supplies power to part of South and West Sulawesi.

Bakaru Hydropower Plant supports development progress of many sectors in South Sulawesi for example various industries from small to large scale industries, education, health and other economic activities. This condition should be maintained to improve the quality of life for most of the society in South Sulawesi.

Besides positive impact on economics life, BHPP is also affecting the environment where sediment deposit is increased at the Dam of Bakaru Hydropower Plant. Research that was conducted by PLN in June 2005 concluded that sediment volume is significantly increased from 0 m^3 in 1990 to 6.331.400 m^3 in 2005 [1]. Laboratory test shows that at the Dam of BHPP consist of coarse sand and fine sand [2]. Coarse sand is containing SiO_2 55.30 – 99.87% and the rest Fe_2O_3, Al_2O_3, TiO_2, etc. [3]. The rapid increase of sediment is causing a serious damage to turbine component so-called moving blades. Consequently, maintenance interval becomes shorter (4 years) where according to the manual book of Hydropower Operation, the maintenance interval is in the range of 8 to 10 years. Therefore, with shorter maintenance period, the maintenance cost will also be increased and could lead to hydropower shutdown when the damage is extremely serious.

High concentration of sediment could cause abrasion and erosion at some water turbines [4]. The statement mentioned that abrasion and erosion not solely occur in the environment but also on water turbines. Moreover, besides high concentration of sediment, sediment size will also contribute to micro-erosion of the runner of the turbines [5]. Therefore, concentration and size of the sediment are two things that significantly contribute to the water turbine damage.

Erosion on turbine blades is not only caused by cavities but also caused by particle coalition on the surface of turbine blades [6]. Damage on turbine's blades as the cavity is usually caused by steam vesicles that occur due to low pressure on the turbine's blades. In general, there are four zones where cavities occur at Francis turbine blades [4] where these cavities affect the efficiency of the turbine [8]. Besides, three factors influence on turbine blades

International Conference on Engineering, Science and Nanotechnology 2016 (ICESNANO 2016)
AIP Conf. Proc. 1788, 030083-1–030083-4; doi: 10.1063/1.4968336
Published by AIP Publishing. 978-0-7354-1452-5/$30.00

damage; concentration, size and particle energy when to collide the turbine's blades. These three factors are also affecting the flow profile of the sediment that is entering the turbine. It can be said that laminar flow profile is Reynolds Number, Re < 500 and turbulence if Re > 2000 [7]. This statement shows that the damage of turbine blades is strongly related to the flow profile of the sediment. These entire phenomena show the complexity of the factors that contribute to the turbine's blades damage.

In these zones, pressure decrease due to vortex flow around the turbine's blades. The cavity occurs not only caused by the dropped pressure of water flow in the four zones but also caused by particle concentration, the higher the particle intensity, the higher potency of cavity [9]. Besides cavity, the damage around the four zones, could also caused by erosion that occurs due to particle collision with the surface of turbine's blades.

Erosion on turbine's blades can cause system efficiency decrease [10]. From the information above that the runner damage of water turbine can be caused by abrasion, erosion, and cavity. Besides, it also affected by concentration and size of sediment particles. This information shows that it is very important to identify the cause and the influence of the runner damage of water turbine. Therefore, it is necessary to conduct an introduction research regarding a characteristic of sediment at Bakaru hydropower plant that continued by depth research about the influence of sediment on the moving blade damage of water turbine. The research is important because it is related to the electric power supply in South and West Sulawesi. This research aims to determine the particle and composition of sediment at Bakaru Hydropower Plant. Moreover, in this research, profile flow in the pipe will also be determined with various size of the particle.

EXPERIMENTAL METHOD

Sediment sample is collected in three different points at the Dam of BHPP for 10 kg each. The samples are dried using an electric oven. The dried sediment then steer up using a screen with diameter hole of 0.25 mm; 0.50 mm; and 0.75 mm. to identify the sediment, Fourier Transform Infrared Spectrophotometer (FTIR) Shimadzu is used. Each 50 gram of particle with diameter of 0.25 mm; dan 0.5 mm; and 0.75 mm are tested using XRF (X-Ray Fluorescence Spectrophotometer) Br- S2 Ranger to determine silicon oxide and other oxide particles. The velocity of flow profile also varies from 1 m^3/s, 2 m^3/s, 3 m^3/s, 4 m^3/s, and 5 m^3/s for every single diameter of 0.25 mm; 0.5 mm; and 0.75 mm. All these experiments are conducted at Fluid and Thermal Measurement Laboratory, Energy Conversion Study Program, Mechanical Engineering Department, State Polytechnic of Ujung Pandang

RESULTS AND DISCUSSION

From steering up the sediment particle, it is obtained that the composition of fine sand is 55.80% where 44.20% is coarse sand (as shown in Figure 1). This result is confirmed the results that obtained in [2]. The high composition of coarse sand by about 44.20% shows that the sediment composition is potential to cause a serious damage to turbine's blades.

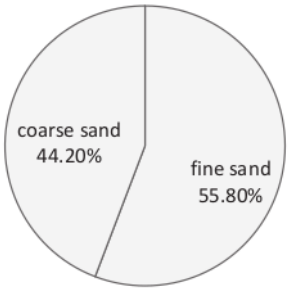


FIGURE 1. Sediment composition

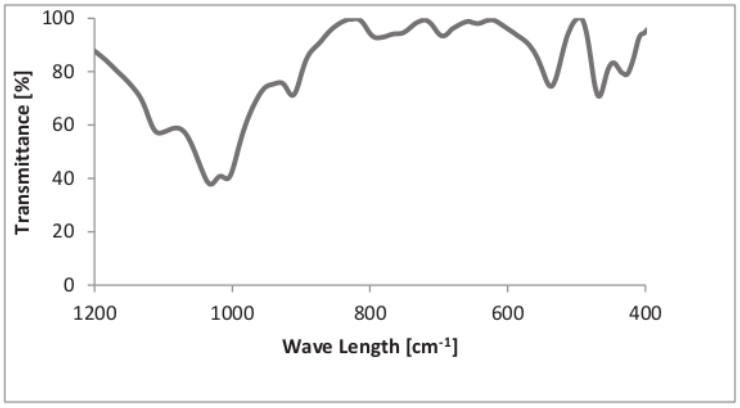


FIGURE 2. FTIR Test result Spectra of sediment

From Figure 2, it can be seen that the result of FTIR test spectra is 466.77 cm^{-1} indicating Aluminum oxide (Al_2O_3), 536.14 cm^{-1} indicating Titanium dioxide (TiO_2), 694.37 cm^{-1} indicating Ferric oxide (Fe_2O_3), 788.89 cm^{-1} indicating Magnesium oxide (MgO), and spectra 1031.92 cm^{-1} indicating Silicon oxide (SiO_2).

TABLE 1. XRF sediment test result

Formula	Concentration [%]	Formula	Concentration [%]
SiO_2	53.64	CaO	1.71
Al_2O_3	22.93	TiO_2	1.06
Fe_2O_3	9.24	P_2O_5	0.32
MgO	4.0	SO_3	0.19
K_2O	3.84	MnO	0.15
Na_2O	2.4	Cr_2O_3	0.05

Table 1 shows the results of XRF test and obtains composition of SiO_2 53.64%, Al_2O_3 22.93%, Fe_2O_3 9.24%, MgO 4.0%, K_2O 3.84%, Na_2O 2.4%, CaO 1.71%, and TiO_2 1.06%. Data shows that concentration of Silicon oxide (SiO_2) is 53.64%, lower compare to the concentration of SiO2 according to [3] that is in the range from 55.30 – 99.87%. Although the concentration of SiO_2 is only 53.64%, it is significantly enough to cause serious damage on turbine's blades. These problems could occur if the characteristic of SiO_2 is harder than turbine's blade material. Other components such as Fe_2O_3, Al_2O_3, TiO_2, etc. that are contained in the coarse sand is still complied with requirements mentioned in [3]. The concentration of TiO_2 although small (1.06%), still potential to cause damage on the turbine's blade because Titanium is harder than the material of turbine's blade.

From flow profile test, Reynolds Number is obtained from 22 to 31 for each diameter variation of the particle; 0.25 mm, 0.50 mm, dan 0.75 mm. The test result shows that Re<500 where according to the flow profile it can be categorized as laminar type [7].

CONCLUSION

It can be concluded that sediment characteristic consists of fine sand about 55.80% and coarse sand about 44.20%, where SiO2 dominates it by about 53.64% where flow in the pipe shown the laminar type.

ACKNOWLEDGEMENTS

Authors would like to thanks Director of State Polytechnic of Ujung Pandang for research funding support of Fundamental Research Scheme 2016.

REFERENCES

1. A. Wahid, Identifikasi Kondisi Sedimentasi di Waduk PLTA Bakaru Dalam Upaya Menanggulangi Krisis Energi Listrik di Provinsi Sulawesi Selatan dan Sulawesi Barat. Jurnal Rutan dan Masyarakat, **2**, 229-236 (2007).
2. A.S. Pratiwi, *Laporan Kerja Praktek Lapangan di PLTA Bakaru,* (Jurusan Teknik Mesin Politeknik Negeri Ujung Pandang, Makassar, 2015), pp. 17-25.
3. T. Prayogo dan B. Budiman. Survei Potensi Pasir Kuarsa di Daerah Ketapang Propinsi Kalimantan Barat. Jurnal Sains dan Teknologi Indonesia. **2**, 126-132 (2009).
4. P.J. Gogstad, *Hydraulic design of Francis turbine exposed to sediment erosion*, (Department of Energy and Process Engineering, Norwegian University of Science and Technology, Trondheim, 2012), pp. 8-15.
5. V.Y. Karelin and C.G. Duan, *Design of hydraulic machinery working in sand laden water*. Vol. 2, 1 edition (Imperial College Press, London, 2002), pp. 155-187.
6. N. Thakkar, S. Chaudari, C. Sonvane, S.V. Jain, R.N. Patel, and M. Bhojawala, Cavitation Detection in Hydraulic Machines. International Journal on Theoretical and Applied: A Review Research in Mechanical Engineering **4**, 2319-3182 (2015).
7. N. Gary, *Sedimentilogy and Stratgraphy*. Second edition (Wiley-Blackwell, New Jersey, 2009), pp. 5-15.
8. F. Avellan, Introduction to Cavitation in Hydraulic Machinery. The 6th International Conference on Hydraulic Machinery and Hydrodynamics Proceeding, edited by R. Susan-Resiga (Universitatea "Politecnica" Timisoara, Romania, 2004), pp. 11-22.
9. B. Gregore, A. Predin, D. Fabijan, R. Klasine, Experimental Analysis of The Impact of Particles on the Cavitation Flow. Journal of Mechanical Engineering **58**, 238-244 (2012).
10. B. Thapa , P. Chaudary, O.G. Dahlhaug, and P. Upadhyay, Study of Combined Effect of Sand Erosion and Cavitation in Hydraulic Turbines. International Conference on Small Hydropower- Hydro Sri Lanka Proceeding, edited by N. Rupasinghe et al (Central Engineering Consultancy Bureau , Srilanka, 2007), pp. 22-24.

Sidement Characteristics on Hydropower Plant Bakaru South Sulawesi

ORIGINALITY REPORT

16%	12%	7%	4%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to Universitas Sebelas Maret Student Paper	1%
2	Submitted to American Intercontinental University Online Student Paper	1%
3	purehost.bath.ac.uk Internet Source	1%
4	asa.scitation.org Internet Source	1%
5	Wangxiao He, Hongen Huang, Jin Yan, Jian Zhu. " Photocatalytic and antibacterial properties of Au-TiO nanocomposite on monolayer graphene: From experiment to theory ", Journal of Applied Physics, 2013 Publication	1%
6	gtproxy.info Internet Source	1%
7	research.caluniv.ac.in Internet Source	1%

8	www.researchsquare.com Internet Source	1 %
9	A. M. Shiddiq Yunus, Imran Habriansyah, Ahmed Abu-Siada, Mohammad A. S. Masoum. "Sag and Flicker Reduction Using Hysteresis-Fuzzy Control-Based SMES Unit", Canadian Journal of Electrical and Computer Engineering, 2019 Publication	<1 %
10	eng.unhas.ac.id Internet Source	<1 %
11	sitizuliatulumaroh-unipdu.blogspot.com Internet Source	<1 %
12	indico.icc.ub.edu Internet Source	<1 %
13	Marhatang Marhatang, Muhammad Ruswandi Djalal. "Optimal economic dispatch using particle swarm optimization in Sulselrabar system", IAES International Journal of Artificial Intelligence (IJ-AI), 2022 Publication	<1 %
14	ikasetiarin.blogspot.com Internet Source	<1 %
15	libmast.utm.my Internet Source	<1 %
	voyager.ce.fit.ac.jp	

16	Internet Source	<1%
17	zenodo.org Internet Source	<1%
18	Submitted to Universitas Pendidikan Indonesia Student Paper	<1%
19	sinta3.ristekdikti.go.id Internet Source	<1%
20	www.semanticscholar.org Internet Source	<1%
21	ar.kalasalingam.ac.in Internet Source	<1%
22	docplayer.info Internet Source	<1%
23	journals.itb.ac.id Internet Source	<1%
24	akademiabaru.com Internet Source	<1%
25	usanotebook.com Internet Source	<1%
26	Mohamad, Fariza, Connie Anak Abang, Nik Hisyamudin Muhd Nor, and Masanobu Izaki. "The Effect of Solution Temperature on	<1%

Electrodeposit-ZnO Thin Film", Key Engineering Materials, 2013.
Publication

27	link.springer.com Internet Source	<1 %
28	www.docstoc.com Internet Source	<1 %
29	Tariq Ali, Abdul Rasheed Razwan, Imran Baig, Muhammad Irfan, Umar Draz. "Efficient Shadow Encoding Scheme Towards Power Spectrum Density in Digital Network Communication", Wireless Personal Communications, 2021 Publication	<1 %
30	un-csam.org Internet Source	<1 %
31	D. O. Oyewole, R. K. Koech, R. Ichwani, R. Ahmed et al. "Annealing effects on interdiffusion in layered FA-rich perovskite solar cells", AIP Advances, 2021 Publication	<1 %
32	documents.mx Internet Source	<1 %
33	eprints.ums.edu.my Internet Source	<1 %
34	nardus.mpn.gov.rs Internet Source	

		<1%
35	www.foodandnutritionjournal.org Internet Source	<1%
36	www.maltepe.edu.tr Internet Source	<1%

Exclude quotes	On	Exclude matches	< 10 words
Exclude bibliography	On		