

PROCEEDINGS

International Conference

Asosiasi Pendidikan Teknologi dan Kejuruan Indonesia (APTEKINDO) 2018

Theme:

**“Revitalization of Technical and Vocational Education to Face
Industrial Revolution 4.0”**

Surabaya, 11-14 July 2018

Speakers:

Prof. Dr. Muhadjir Effendy, MAP.
Minister of Education and Culture, Republic of Indonesia

Michael Freiherr von Ungern – Sternberg
*Extraordinary and Plenipotentiary Ambassador of the Federal Republic of Germany to
Indonesia, ASEAN and Timor-Leste (German)*

Prof. Dr. Wenny Rahayu
*Head of School of Engineering and Mathematical Sciences
La Trobe University Victoria (Australia)*

Prof. Dr. Muchlas Samani, M.Pd.
Rector of Universitas Negeri Surabaya period 2010-2014 (Indonesia)



Faculty of Engineering
Universitas Negeri Surabaya
2018

PROCEEDINGS

International Conference

Asosiasi Pendidikan Teknologi dan Kejuruan Indonesia (APTEKINDO) 2018

Theme:

“Revitalization of Technical and Vocational Education to Face Industrial Revolution 4.0”

Steering Committee:

Prof. Dr. Warsono, M.S. (Universitas Negeri Surabaya)
Dr. Sc.agr. Yuni Sri Rahayu, M.Si. (Universitas Negeri Surabaya)
Dr. Ketut Prasetyo, M.S. (Universitas Negeri Surabaya)
Prof. Dr. Djodjok Soepardjo, M.Litt. (Universitas Negeri Surabaya)
Prof. Dr. Ekohariadi, M.Pd. (Universitas Negeri Surabaya)
Prof. Dr. Muchlas Samani, M.Pd.(Universitas Negeri Surabaya)
Prof. Dr. Harun Sitompul, M.Pd. (Universitas Negeri Medan)
Dr. Fahmi Rizal, M.Pd., M.T. (Universitas Negeri Padang)
Ernawati, Ph.D. (Universitas Negeri Padang)
Dr. Agus Dudung, M.Pd. (Universitas Negeri Jakarta)
Prof. Dr. M. Syaom Barliana (Universitas Pendidikan Indonesia)
Dr. Widarto, M.Pd. (Universitas Negeri Yogyakarta)
Dr. Nur Qudus, M.T. (Universitas Negeri Semarang)
Prof. Dr. Joko Nurkamto, M.Pd. (Universitas Negeri Surakarta)
Dr. Andoko, S.T., M.T. (Universitas Negeri Malang)
Dr. I Gede Sudirta, S.Pd., M.Pd. (Universitas Pendidikan Ganesha)
Prof. Dr. Muh. Yahya, M.Eng. (Universitas Negeri Makassar)
Prof. Dr. Herry Sumual, M.Si. (Universitas Negeri Manado)
Moh. Hidayat Koniyo, S.T., M.Kom. (Universitas Negeri Gorontalo)
Dr. Debora, M.Pd. (Universitas Palangka Raya)
Dr. Made Parsa, M.Pd. (Universitas Nusa Cendana)
Dra. Yuli Heirina, M.Pd. (Universitas Syiah Kuala)
Prof. Dr. Drs. Ir. H. Kusnan, S.E., M.T., M.M. (Universitas Negeri Surabaya, Indonesia)
Prof. Dr. Ir. Aisyah Endah Palupi, M.Pd. (Universitas Negeri Surabaya, Indonesia)

Organizing Committee

Drs. Tri Wrahatnolo, M.T., M.Pd.
Dra. Juhrah Singke, M.Si.
Puput Wanarti Rusimamto, S.T., M.T.
Rina Harimurti, S.Pd., M.T.
Hendra Wahyu Cahyaka, S.T.,M.T.
Drs. Budihardjo Achmadi H., M.Pd.
Wiyli Yustanti, S.Si.,M.Kom.
I Made Suartana, S.Kom., M.Kom.

Dodik Arwin Dermawan, S.ST., S.T., M.T.
Mahendra Widyartono, S.T., M.T.
Rifqi Firmansyah, S.T., M.T.
Wahyu Dwi Kurniawan, S.Pd., M.Pd.
Reza Rahmadian, S.ST., M.Eng.
Ricky Eka Putra, S. Kom., M.Kom.
Imami Arum Tri Rahayu, S.Pd.,M.Pd.
Amalia Ruhana, S.P., M.Ph.
Choirul Anna Nur Afifah, S.Pd, M.Si.
Yuyun Irawati, S.Pd., M.Pd.
Dwi Fatrianto, S.Kom, M.Kom.
Rahardian Bisma, S.Kom, M.Kom.
Ibnu Febri Kurniawan, S.Kom, M.Kom.
Widi Aribowo, S.T., M.T.
Yeni Anistyasari, S.Pd, M.Kom.

Editor:

Arie Wardhono, ST., M.MT., MT., Ph.D.
Dr. Lilik Anifah, S.T., M.T
Dr. Mutimmatul Faidah, M. Ag.

Reviewer:

Prof. Dr. Ekohariadi, M.Pd. (Universitas Negeri Surabaya)
Prof. Dr. Suparji, S. Pd., M.Pd. (Universitas Negeri Surabaya)
Dr. Mochamad Cholik, M.Pd. (Universitas Negeri Surabaya)
Dr. Eng. Asep Bayu Dani Nandiyanto. S.T., M.Eng. (Universitas Pendidikan Indonesia)
Dr. Ana, M.Pd.. (Universitas Pendidikan Indonesia)
Prof. Dr. Henita Rahmayanti, M.Si. (Universitas Negeri Jakarta)
Dr. Eng. Agus Setiawan, M.Si. (Universitas Pendidikan Indonesia)
Prof. Herman Dwi Surjono, M.Sc., Ph.D. (Universitas Negeri Yogyakarta)
Dr. Putu Sudira, M.P. (Universitas Negeri Yogyakarta)
Dr. Dwi Widjonarko (Universitas Negeri Semarang)
Dr. Eko Suprptono (Universitas Negeri Semarang)
Prof. Dr. Amat Mukadis (Universitas Negeri Malang)
Prof. Dr. Waras Kamdi (Universitas Negeri Malang)
Prof. Dr. Gufran D. Dirawan, E.MD. (Universitas Negeri Makasar)
Prof. Dr. Sapto Haryoko, M.Pd. (Universitas Negeri Makasar)
Prof. Dr. Nizwardi Jalinus M.Ed. (Universitas Negeri Padang, Indonesia)
Prof. Dr. Efendi Napitupulu, M.Pd. (Universitas Negeri Medan, Indonesia)
Prof. Dr. Sumarno, M.Pd. (Universitas Negeri Medan, Indonesia)
Prof. Dr. Sanggam R.I. Manalu, M.Pd. (Universitas Palangkaraya)
Prof. Dr. Muh. Nur (Universitas Negeri Surabaya, Indonesia)
Prof. Dr. Munoto, M.Pd. (Universitas Negeri Surabaya, Indonesia)
Prof. Dr. Ismet Basuki, M.Pd. (Universitas Negeri Surabaya, Indonesia)
Dr. M. Bruri Triyono, M.Pd. (Universitas Negeri Yogyakarta)
Prof. Dr. Supari Muslim, M.Pd. (Universitas Negeri Surabaya, Indonesia)
Prof. Dr. Luthfiah Nurlaela, M.Pd. (Universitas Negeri Surabaya)
Prof. Dr. E. Titiek Winanti, MS. (Universitas Negeri Surabaya)
Prof. Dr. Ir. I Wayan Susila, M.T. (Universitas Negeri Surabaya)
Prof. Dr. Bambang Suprianto, MT. (Universitas Negeri Surabaya)

Dr. Rita Ismawati, M.Kes. (Universitas Negeri Surabaya)
Dr. Mutimmatul Faidah, M.Pd.(Universitas Negeri Surabaya)
Khairuddin, S.T., M.T., Ph.D. (Universitas Negeri Yogyakarta)
Dr. Sri Handayani, M.Kes. (Universitas Negeri Surabaya)
Dr. Maspiyah, M.Kes. (Universitas Negeri Surabaya)
Arie Wardhono, M.MT., MT., Ph.D. (Universitas Negeri Surabaya)
Dr. Nanik Estidarsani, M.Pd. (Universitas Negeri Surabaya)
Dr. Lilik Anifah, MT. (Universitas Negeri Surabaya)
Dr. Ratna Wardani, MT. (Universitas Negeri Yogyakarta)
Dr. I.G.P. Asto B., MT. (Universitas Negeri Surabaya)
Yeni Anistiyasari, S.Pd., M.Kom. (Universitas Negeri Surabaya)
I Made Suartana, S.Kom., M.Kom. (Universitas Negeri Surabaya)
Dr. Meini Sondang, M.Pd. (Universitas Negeri Surabaya)
Dr. Fatchul Arifin, MT. (Universitas Negeri Yogyakarta)
Dr. H. Hakkun Elmunsyah, ST., MT. (Universitas Negeri Malang)
Aji Prasetya Wibawa, S.T., M.M.T., Ph.D. (Universitas Negeri Malang)
Eppy Yundra, MT., Ph.D. (Universitas Negeri Surabaya)
Unit Three Kartini, MT., Ph.D. (Universitas Negeri Surabaya)
Dr. Euis Ismayati, M.Pd. (Universitas Negeri Surabaya)
Dr. Tri Rijanto, M.Pd., MT. (Universitas Negeri Surabaya)
Rooselyna Ekawati, Ph.D. (Universitas Negeri Surabaya)
Dr. Elly Matul Imah, MT. (Universitas Negeri Surabaya)
Syafi'ul Anam, Ph.D. (Universitas Negeri Surabaya)
Dr. Muhaji, M.Pd. (Universitas Negeri Surabaya)
Dr. Thedorus Wiyanto, M.Pd. (Universitas Negeri Surabaya)
Dr. Djoko Suwito, M.Pd. (Universitas Negeri Surabaya)
Dr. I Made Arsana, MT. (Universitas Negeri Surabaya)
Dr. Grummy A. Wailandouw, M.Pd. (Universitas Negeri Surabaya)
Dr. Suryanto, M.Pd. (Universitas Negeri Surabaya)

PREFACE

All praises be to Allah SWT, so that the 2018 International Conference of ***Asosiasi Pendidikan Teknologi dan Kejuruan Indonesia (APTEKINDO)*** could be held in Surabaya during 11-14 July 2018. APTEKINDO International Conference is conducted biennially in which this year host is Faculty of Engineering, State University of Surabaya. There were sixteen colleges attending this year Conference, most of which were former Institutes of Teacher's Education (LPTK).

This year theme is "*Revitalization of Technical and Vocational Education to Face Industrial Revolution 4.0*" aimed to respond to the development and acceleration of the industrial revolution 4.0 that has become the most discussed issues in many countries. Industrial revolution connects machines with internet systems. In regard to facing such phenomena, Indonesian government through the Ministry of Industry has launched "Making Indonesia 4.0", of which the program focuses on industries that are driving the development of the industrial revolution 4.0 such as food and beverages, electronics, automotive, textiles and chemicals. To achieve better results of the program actualization, vocational education helps to prepare compatible and competitive workers for the areas of the aforementioned industries. Henceforth, numbers of Conferences, conventions, and meetings among Indonesian practitioners in FPTK / FT-JPTK need to be held to initiate ideas in strengthening the role of LPTK within industrial revolution 4.0 era.

The Conference's proceedings contain 121 research papers and ideas that are relevant to the following nine sub-themes: *Technical and Vocational Teacher Competencies, Technical and Vocational Education Curricula, Technical and Vocational Education Models, Technical and Vocational Education Evaluation, Technical and Vocational Education Policy, Public-private Partnership in Technical and Vocational Education, Technical and Vocational Education Management, Technopreneurship, and Competencies Certification.*

Finally, all the committees send their gratitude to the participating speakers and all parties who support the run of the Conference. They also apologize for any inconvenience and wish a better undertaking event next year.

WELCOMING SPEECH RECTOR UNESA

Conference and Convention

Asosiasi Pendidikan Teknologi dan Kejuruan Indonesia (Aptekindo) 2018

Rich Palace Hotel Surabaya, 11-14 Juli 2018

Assalammu'alaikum Warahmatullahi Wabarakatuh.

Respectable Head of Universities, members of APTEKINDO

Distinguished Keynote speakers

Honorable authors, and fellow participants of APTEKINDO Conference and Convention 2018

Alhamdulillah, first of all, let us express our gratitude to Allah SWT because of his grace and blessings, we are able to attend this international Conference and convention of the Indonesia Association of Technology and Vocational Education or ***Asosiasi Pendidikan Teknologi dan Kejuruan Indonesia (APTEKINDO)*** held in Surabaya, 11-14 July 2018.

This international and national Conference is conducted biennially as a routine agenda held by Association of Technology and Vocational Education or *Asosiasi Pendidikan Teknologi dan Kejuruan Indonesia (APTEKINDO)*, which consists of 16 different universities throughout Indonesia. We would like to thank for the opportunity given to Universitas Negeri Surabaya for hosting this year event.

In the raise of industrial revolution, Conferences, gatherings, and sharing of knowledge play an important meaning in supporting the acceleration of innovative science and technology. Therefore, this Conference's theme is ***"Revitalization of Technical and Vocational Education to Face Industrial Revolution 4.0"***. This is an interesting and challenging topic not only for academic researchers but also for stakeholders and industry owners.

Ladies and gentlemen,

Since 2011, the industrial sector has been integrated with the online system known as industrial revolution 4.0. The first industrial revolution was marked by the use of steam engines to replace human and animal power. The second stage of the revolution was marked by the utilization of electrical power and the concept of mass production. Furthermore, the application of automation technology brought the industrial revolution to its third stage. Tremendous revolution happened when information and communication technology was introduced and fully utilized in industrial area, of which the condition brought the world in the fourth stage of the industrial revolution. The utilization of this technology changed not only the production process, but also across the industrial chains that result in a new digital-based business model which can achieve higher efficiency and better quality in industrial products. The consequences of this revolution are the increase of production efficiency as well as changes in the employment prerequisite. There is an increasing demand for new manpower, whilst the machines are replacing the role of workers. This condition leads to the importance of a new and more advanced method of preparing human resources that are ready to compete in the industrial revolution.

Ladies and gentlemen, in regard to prepare Indonesian human resource in facing the era of media convergence, there are at least two aspects that need our attention, namely the quality of human resources in accordance with the requirement of the digital-based industry and the equal distribution of qualified human resources especially in suburban and urban areas. Both aspects could be meant as a challenge and an opportunity for the higher education especially technology and vocational education to innovate and harmonize curriculum that connects with the industry. Thus, this Conference becomes a perfect momentum for technology and vocational education to join and strengthen steps in preparing graduates that are ready to compete in the industrial revolution 4.0. Therefore, by starting with **“Bismillahirrahmanirrahim” The Conference and Convention of Association of Technology and Vocational Education or APTEKINDO 2018, is officially started**”

Ladies and gentlemen, we would like to thank the keynote speakers who are willing to attend and share knowledge in today’s Conference:

1. Prof. Dr. Muhadjir Effendy, MAP. Minister of Education and Culture, Republic of Indonesia
2. Michael Freiherr Von Ungern–Sternberg, ***Extraordinary and Plenipotentiary Ambassador of the Federal Republic of Germany to Indonesia, ASEAN and Timor-Leste.***
3. Prof. Dr. Wenny Rahayu, *La Trobe University Victoria (Australia)*
4. Prof. Dr. Muchlas Samani, M.Pd., *Rector Universitas Negeri Surabaya (2010-2014).*

We also would like to thank the authors and all participants of the convention who have participated and contributed to sharing the knowledge and ideas. Hopefully, what we share and get here today can give benefits and contribute to improve a competitive atmosphere in Indonesia, Aamiin YRA.

Surabaya, July 2018
Universitas Negeri Surabaya
Rektor,

Prof. Dr. Warsono, M.S.

WELCOME SPEECH BY THE DEAN OF FACULTY OF ENGINEERING
at the International Conference and National Convention of
Asosiasi Pendidikan Teknologi dan Kejuruan Indonesia (APTEKINDO) 2018
Rich Palace Hotel, 12 July 2018

Assalamu'alaikum Warahmatullahi Wabarakatuh.

His Excellency, Rector of Universitas Negeri Surabaya
Respectable the Head of Universities as the members of APTEKINDO
Distinguished Keynote Speakers
Honorable authors and Participants

Alhamdulillahirobbil alamiin. Thanks God. First of all, let us express our gratitude to Allah SWT because of his grace and blessings we are able to attend the 9th International Conference and convention of ***Asosiasi Pendidikan Teknologi dan Kejuruan Indonesia (APTEKINDO)*** and the 19th workshop of the Technology and Vocational Education for FPTK/FT/FTK-JPTK in Indonesia. It is an honor for us, the Faculty of Engineering, Universitas Negeri Surabaya, to host this year Conference and convention.

On behalf of *Asosiasi Pendidikan Teknologi dan Kejuruan Indonesia (APTEKINDO)*, we would like to welcome keynote speakers, authors, delegates and participants from technology and vocational education to the city of heroes, Surabaya.

Today, we meet in Surabaya to attend a biennial agenda named APTEKINDO International Conference and Convention and National Workshop of the FPTK/FT/FTK-JPTK. Following the mandate from the 2016 APTEKINDO Convention in Medan, this year's Conference is held in Surabaya hosted by the Faculty of Engineering, Universitas Negeri Surabaya.

Ladies and Gentlemen, the theme of this year Conference is "*Revitalization of Technical and Vocational Education to Face Industrial Revolution 4.0*". The theme is chosen due to the fact that we have to quickly respond and act accordingly to the effects of the industrial revolution on vocational education. Well-programmed and structured efforts should be undertaken to ensure if technology and vocational education can produce globally competitive graduates especially for industrial revolution era.

Numbers of important topics for technology and vocational education are discussed in this Conference. The topics include Technical and Vocational Teacher Competencies, Technical and Vocational Education Curricula, Technical and Vocational Education Models, Technical and Vocational Education Evaluation, Technical and Vocational Education Policy, Public-private Partnership in Technical and Vocational Education, Technical and Vocational Education Management, Technopreneurship, and Competence Certification.

Today's Conference has several outcomes. The accepted articles will be submitted for proceeding publication indexed by Atlantic Press. Meanwhile, the rejected articles by Atlantic Press will be published in the International Proceedings with International Standard Book Number (ISBN). Moreover, the articles written in Bahasa Indonesia will be published in the National Proceedings with ISBN.

Ladies and Gentleman, this meeting must be meaningful as a venue to communicate among researchers, academics, and members of FPTK / FT / FTK-JPTK from different universities as well as from related industries. By this regular Conference and convention, we can make a strong communication network and create innovative breakthrough and substantial blueprint of different aspects such as institutional quality, field study, and curriculum. We hope that this forum plays an important role in developing technology and vocational education to face the industrial revolution 4.0.

Finally, we would like to thank the organizing committee led by Mr.Tri Wrahatnolo, M.Pd., M.T., who gave an extraordinary support. Moreover, we would like to express our appreciation and gratitude to the members of steering committee from various regions in Indonesia, delegates, SC and OC members, sponsors, as well as personal or institutional support that make this event well-organized. I apologize if there are shortcomings from my part.

Good luck with the Conference of Indonesian Association of Technology and Vocational Education, APTEKINDO 2018, and wish the best improvement for technology and vocational education in Indonesia. Thank you.

Wassalammu'alaikum Warahmatullahi Wabarakatuh

CHAIRMAN'S SPEECH

**at the International Conference and National Convention of
*Asosiasi Pendidikan Teknologi dan Kejuruan Indonesia (APTEKINDO) 2018***

Rich Palace Hotel, 11-14 July 2018

Assalammu'alaikum Warahmatullahi Wabarakatuh.

His Excellency, Rector of Universitas Negeri Surabaya,
Respectable the Head of Universities, members of Aptekindo, Keynote speakers, Authors, and fellow participants of Aptekindo Conference and convention 2018.

Alhamdulillah, no words could represent the feelings but the gratitude of the presence of Allah SWT, for His blessings, so that we can attend APTEKINDO Conference with the theme "*Revitalization of Technical and Vocational Education to Face Industrial Revolution 4.0*".

In this pleased occasion, we would like to welcome all keynote speakers, authors, and participants of the Conference to this city of heroes, the city of heroic histories, Surabaya. We would like also to welcome to APTEKINDO 2018 Conference and convention held at the Rich Palace Hotel Surabaya, 11-14 July 2018.

The theme of this year Conference is "*Revitalization of Technical and Vocational Education to Face Industrial Revolution 4.0*". This theme is chosen to respond to the development and acceleration of industrial revolution 4.0 that has been impactful in various countries. This industrial revolution has connected the utilization of machines to an internet system. To face such phenomena, Indonesian government through the Ministry of Industry has launched a program called "Making Indonesia 4.0". Currently, the government is focusing on industries that support the development of the industrial revolution such as food and beverage, electronics industry, automotive, textile and clothing, and chemical industries.

In addition, vocational education plays an important role in preparing competent and competitive human resources. That is, Faculty of Technical and Vocational Education or *Fakultas Pendidikan Teknik dan Kejuruan (FPTK)* in Indonesia aims to compile excellent ideas and vision, which later could be shared through Conferences, conventions or meetings, and also be useful to encounter industrial revolution 4.0.

Today's Conference will present competent keynote speakers in the field of technology and vocational education, who are:

1. Prof. Dr. Muhadjir Effendy, MAP. Minister of Education and Culture, Republic of Indonesia
2. Michael Freiherr Von Ungern-Sternberg, Extraordinary and Plenipotentiary Ambassador of the Federal Republic of Germany to Indonesia, ASEAN and Timor-Leste.
2. Prof. Dr. Wenny Rahayu, La Trobe University Victoria (Australia)
3. Prof. Dr. Muchlas Samani, M.Pd., Rector of Universitas Negeri Surabaya (2010-2014).

In addition, I would like to point out that there are 602 participants from 17 different universities participating in today's Conference involving:

1. Universitas Palangka Raya
2. Universitas Gorontalo
3. Universitas Islam Negeri Ar Raniry Aceh
4. Universitas Negeri Solo
5. Universitas Negeri Manado
6. Universitas Pendidikan Ganesha
7. Universitas Nusa Cendana
8. Universitas Malang
9. Universitas Negeri Jakarta
10. Universitas Negeri Padang
11. Universitas Negeri Yogyakarta
12. Universitas Pendidikan Indonesia
13. Universitas Negeri Makassar
14. Universitas Negeri Semarang
15. Universitas Negeri Medan
16. Universitas Negeri Surabaya
17. Universitas PGRI Adi Buana Surabaya

There are 491 articles submitted to this Conferences covering papers and posters. 76 articles were accepted to Atlantic Press, 156 articles published in international proceedings with ISBN, dan 129 articles published in the national proceedings with ISBN. All articles will be available for an online access through the Atlantis Press official website and through APTEKINDO 2018 website.

Today's Conference is actually held with the helps and good cooperation of various parties. Therefore, we would like to express our gratitude to the Minister of Research, Technology and Higher Education, Rector of Universitas Negeri Surabaya, keynote speakers, participants, sponsors, and other stakeholders for the supports. We also send our highest appreciation to the committees who have worked hard to succeed this Conference.

At last, we hope that all participants get benefits and knowledge that can contribute to reinforce vocational education and technology in facing the industrial revolution 4.0. WELCOME TO APTEKINDO CONFERENCE AND CONVENTION 2018, Thank you.

TABLE OF CONTENT

Cover	i
Preface	vi
Welcome Speech Rector UNESA	vii
Welcome Speech By The Dean of Faculty of Engineering	ix
Chairman's Speech	xi
Table of Content	xiii
Sub Theme 1: Evaluation of Technology and Vocational Education (ETVE)	
1 THE DEVELOPMENT OF COMPUTER BASED LEARNING MEDIA FOR PLC COURSE USING ADOBE FLASH <i>Syufrijal, Ika Yunsita Pratiwi</i> <i>Universitas Negeri Jakarta</i>	11.1-7
2 DEVELOPMENT E-LEARNING AND E-ASSESSMENT MODEL FOR "TRANSMISSION MAINTENANCE" SUBJECT BASE ON PROBLEM BASED LEARNING AT LIGHT VEHICLE PROGRAME - SMKN 1 WEST SUMATRA <i>Wakhinuddin Simatupang, Ambiyar</i> <i>Universitas Negeri Padang</i>	11.8-13
3 ANALYSIS OF RESISTANCE FACTORS IMPLEMENTATION KKNI ORIENTED CURRICULUM WITH SIX "S TADI SUTOPOUNIVERSITAS NEGERI MEDANASK AT ELECTRICAL ENGINEERING DEPARTMENT <i>Adi Sutopo, Mustamam, Dadang Mulyana</i> <i>Universitas Negeri Medan</i>	11.14-16
4 HANDWRITING RECOGNITION BASED ON CASCADING ADABOOST CLASSIFIER FOR AN ESSAY CORRECTION <i>Kartika Candra Kirana, Slamet Wibawanto, Azhar Ahmad Smaragdina, Gres Dyah Kusuma Ningrum</i> <i>Universitas Negeri Malang</i>	11.17-20
5 THE STUDY OF STUDENT LEARNING ACHIEVEMENT IN FASHION EDUCATION PROGRAM UNIVERSITAS NEGERI MALANG <i>Nurul Aini</i> <i>Universitas Negeri Malang</i>	11.21-25
6 RELEVANCE OF STUDENT KNOWLEDGE COMPETENCY ACCORDING TO NEEDS OF CONSTRUCTION BUSINESS <i>Herry Sumual, Rolly R. Oroh</i> <i>Universitas Negeri Manado</i>	11.26-30
7 EVALUATION OF IMPLEMENTATION VOCATIONAL SKILLS LEARNING MOTORCYCLE ENGINEERING AT SPECIAL SCHOOL <i>Sriyono, Soemarto</i> <i>Universitas Pendidikan Indonesia</i>	11.31-36
8 THE PROBLEMS SOLVING SKILLS ASSESSMENT ON STUDENTS' EMPLOYABILITY SKILLS OF VOCATIONAL HIGH SCHOOL	11.37-40

	<i>Asep Hadian Sasmita</i>	
	<i>Universitas Pendidikan Indonesia</i>	
9	POTENTIAL AND NEED OF PRODUCTS BASED ON CATFISH TO IMPROVE NUTRITION QUALITY OF CHILDREN AND COMMUNITY FOOD SECURITY	14.42-48
	<i>Yuliana</i>	
	<i>Universitas Negeri Padang</i>	
10	DESIGN OF MOBILE APPLICATION TO IMPROVE THE QUALITY OF VOCATIONAL EDUCATION	14.49-53
	<i>Khoirudin Asfani</i>	
	<i>Universitas Negeri Malang</i>	
11	THE EFFECT OF A WATER EXTRACT OF BROWN SEAWEED ON THE CHARACTERISTIC OF JELLY CANDY AS A FUNCTIONAL FOOD	14.54-57
	<i>Anni Faridah</i>	
	<i>Universitas Negeri Padang</i>	
12	THE NEW INDUSTRIAL REVOLUTION IS BEGINNING: ELECTRICAL GENERATOR WITHOUT FUEL IS NOT A LIE (THEORETICAL REVIEW OF NEWTON LAW OF INERTIA PROVES THAT ENERGY CAN BE CONTINUOUSLY RESURRECTED)	14.58-61
	<i>Bambang Triatma</i>	
	<i>Universitas Negeri Semarang</i>	
13	THE VALIDITY OF ENTREPRENEURSHIP MODULE-BASED PRODUCTS IN VOCATIONAL EDUCATION	14.62-66
	<i>Asmar Yulastri</i>	
	<i>Universitas Negeri Padang</i>	
14	THE INFLUENCE OF LEARNING MEDIA AND TECHNIQUE DRAWING CAPABILITY TOWARDS THE LEARNING OUTCOMES OF CNC II TU-2A MACHINE TOOL	14.67-73
	<i>Robert Silaban, Keysar Panjaitan, and Hidir Efendi</i>	
	<i>Universitas Negeri Medan</i>	
15	HUMAN RESOURCES MANAGEMENT MODEL AS A SUPPORT FOR ELENA SYSTEM IN UNIVERSITAS NEGERI SEMARANG	14.74-77
	<i>Djuniadi</i>	
	<i>Universitas Negeri Semarang</i>	
16	COLOR QUALITY OF MARBLING TECHNIQUE MOTIFS USING GEL OF TAPIOCA FLOUR	14.78-80
	<i>Siti Nurrohmah, and Rifani Nugraheny</i>	
	<i>Universitas Negeri Semarang</i>	
17	"WATER QUALITY ANALYSIS AND THE POSSIBILITY OF HEAVY METAL CONTAMINATION Hg, Pb AND Cd ON WATER ZONE IN VILLAGE PITUSUNGGU of Pangkep Regency"	14.81-89
	<i>Subariyanto, Patang, Fajar Wiramas Prabowo</i>	
	<i>Universitas Negeri Makassar</i>	
18	ELECTRICAL EQUIPMENT CONTROL BASED RELAY RASPBERRY	14.90-94
	<i>Yunus Tjandi, Ruslan, Syarifuddin Kasim</i>	
	<i>Universitas Negeri Makassar</i>	
19	UPGRADING THE CALORIFIC VALUE OF LOW RANK COAL WITH DRYING METHOD WITHOUT OXYGEN	14.95-99
	<i>Rijal Abdullah, Joni Pradinata</i>	
	<i>Universitas Negeri Padang</i>	
20	A PILE HEAD WORK ON INTEGRAL BRIDGE CONSTRUCTION SECTOR P18- P22 ON THE	14.100-103

Water Quality Analysis and The Possibility of Heavy Metal Contamination Hg, Pb And Cd On Water Zone in Village Pitusungguof Pangkep Regency

Subariyanto, Patang, Fajar Wiramas Prabowo
Lecturer of Makassar State University
Makassar, Indonesia

ABSTRACT--This study aims to determine the water quality and the possibility of heavy metal contamination of Hg, Pb and Cd in aquatic zones in Pitusunggu village, Pangkep regency. Research is a quantitative research using descriptive method. The parameters observed in this study are water quality parameters covering physical and chemical parameters ie temperature, degree of acidity (pH), salinity, dissolved oxygen (DO), BOD (Biochemical Oxygen Demand) or biological oxygen requirement, COD (Chemical Oxygen Demand) or chemical oxygen requirement and heavy metal mercury (Hg), plumbum or lead (Pb) and cadmium (Cd) as well as the potential analysis of the development of crab. The results showed that related to water quality, then all parameters of water quality are still in the range that qualify for crab life, as well as heavy metals parameters such as mercury, Pb, Cd, all still under dangerous thresholds. Furthermore, the catching of crabs has increased along with the increase in crab demand.

Keywords: water quality, contamination, heavy metal, waters zone

I. INTRODUCTION

Pangkep Regency consists of 13 District, 65 villages and 38 urban villages, in 2011 recorded the total population of 326.357 inhabitants. Distance capital of Pangkep regency from the capital of South Sulawesi Province is \pm 52 km. Pangkep regency is located on the west coast of South Sulawesi, has an archipelago of 117 islands, 80 islands are inhabited. The area of the islands is 351.5 km² (The Central Bureau of Statistics Pangkep, 2015).

Pangkep Regency has abundant biological resources both in coastal areas, sea and small islands. The big wealth is a big capital to build the region and to improve the welfare of fishing communities whose lives are highly dependent on fisheries resources.

One of the fishery commodities that has a bright prospect in Pangkep Regency is a crab *Portunus pelagicus*. Since the first is a fishery commodity that has high economic value. KKP (2008) states that crab export destination countries, especially the United States, account for 60% of total catches, in exports in fresh form of Singapore and Japan while in the form of processed (canned) exported to the Netherlands.

Some problems that occur due to the catching of crabs *Portunus pelagicus* excessive of which is the decreasing of the catch of fishermen, the presence of smaller crab size symptom, the time of catching the longer, the trajectory fishing area tend to move away from the beach, and fishermen no longer choose the ideal catch (adult crab), but the crabs that lay eggs are also caught on the grounds that when it is released again into the sea, then other fishermen will catch it, even though the fishermen know that a crab *Portunus pelagicus* spawn should not be arrested. This is an example of human behavior that if left over time will destroy the crab ecosystem in the future.

Basically the household waste content affects the nature of the waste which can be classified as physical, chemical and biological (Suriawiria, 1986). Lead is one non-essential metal that is very dangerous and can cause poisoning (toxicity) on living things. This poison is cumulative, meaning the nature of the poison will arise when accumulated large enough in the body of living things. Lead is present in the water due to contact between water and soil or polluted air of lead, water contaminated by industrial waste or due to lead-based pipe corrosion (Riani 2012).

Cadmium (Cd) is generally detected in terrestrial and aquatic environments, is a heavy metal released from both natural sources (eg, volcanism, erosion) and anthropogenic activities (eg, pigments, nickel \pm cadmium batteries, melting and refining metals and various other sources). Cd is a powerful cell poison that causes various types of damage including cell death, and is a highly toxic environmental pollutant (Chiarelli *et al.* 2012).

PURPOSE

The purpose of this study was to determine the water quality and the possibility of heavy metal contamination of Hg, Pb and Cd in the waters zone at Pitusunggu village, Pangkep regency.

II. METHOD

Place and time of research

This research was conducted in the waters of Pitusunggu Village, Ma'rang Sub-district, Pangkep Regency from August to October 2017.

Types of research

This research type is quantitative research by using descriptive method. Descriptive research method in this research is used to describe water quality and heavy metal contamination as well as the catch of fishermen coming from the waters of Pitusunggu Village Ma'rang District of Pangkep Regency, based on field observations and laboratory checks.

This research is done by first doing observation to research area. Furthermore specified parameters will be studied are analysis of seawater quality analysis of heavy metal contamination (Hg, Pb and Cd) and fisherman catch.

Water Sampling

Direct measurements include the measurement temperature parameters directly using the Grab sampler method namely the method of sampling for a moment which shows the water characteristics only at that time (Effendi, 2003 in Mahyudinet al, 2015).

Water Quality Analysis

- Temperature was measured directly at the study site using a stem thermometer. Measurements are done in the morning at 06:00 WITA once a week for 1 month.
- Salinity measurement using salinometric method.
- Measurement Degree of acidity (pH) (SNI 6989.57: 2008).
- Dissolved Oxygen Measurement (SNI 06-6989.14-2004). This method involves the test method of dissolved oxygen (DO) of the water sample.
- Biological oxygen demand or BOD (SNI 6989.72: 2009). The standard control material in the BOD test is used glutamic-glutamic acid solution.
- Chemical oxygen demand or COD (SNI 6989.2: 2009). In principle, the measurement of COD is in the test

sample oxidized by $Cr_2O_7^{2-}$ - in a closed reflux producing Cr^{3+} . The amount of oxidant required is expressed in the ekuivalent (O_2 ppm) measured in the visible spectroscopic spectrophotometry.

Analysis of Heavy Metal Contamination

- Determination of total mercury (Hg) total weight in water by Spectrophotometric Atom Absorption (SSA) - cold-chilling at 1μ . Furthermore, the atoms are analyzed quantitatively by spectrophotometric absorption of cold atoms or Mercury Analyzer at a wavelength of 253.7 nm.
- Determining the total weight of lead and water-soluble lead in atomic absorption spectrophotometry (SSA) in a range of Pb levels of 0.1 ppm is equal to 20 mg with a wavelength of 283.3 nm or 217.0 nm equipped with a background correction.
- The method used for the determination of total cadmium metal (Cd) and dissolved in water by Spectrofotometric Absorption ato (SSA) -sala at a range of Cd level 0.005 ppm to 2 ppm with wavelength of 228.8 nm.

Data analysis

The data that has been collected is then tabulated and analyzed by descriptive analysis.

III. RESULTS AND DISCUSSION

Water quality

Temperature

Based on the value of research results on the water temperature of the village of Pitusunggu showed no change that occurred or stable for each measurement time of $29^\circ C$. From the data obtained through direct measurement in the field, the water temperature conditions on the coast of Pitusunggu village did not show a significant or stable temperature difference ie the average temperature of the water at $29^\circ C$. Data of temperature values of Pitusunggu village waters can be seen in (Figure 1).

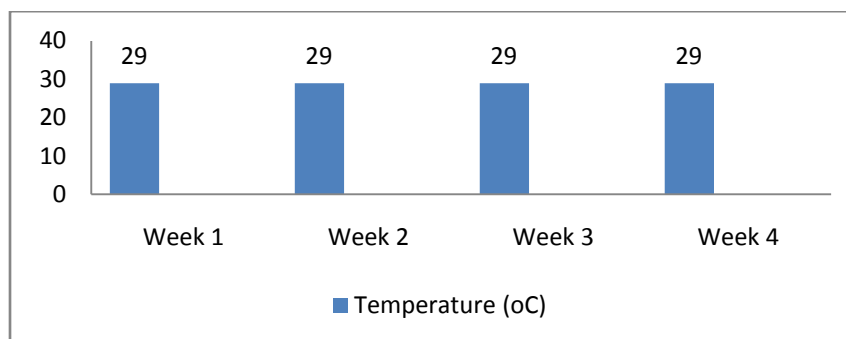


Fig 1. Histogram Concentration Values Regional Sea Water Temperature Pitusunggu

This indicates that in these waters the water temperature is reasonable because in general in the tropics sea surface temperature ranges between 27-29 ° C and subtropical regions ranging from 15-20 ° C. This is consistent with Soegiarto and Birowo (1983) temperatures in the Indonesian waters ranging *pH*

The pH is an important parameter in monitoring the quality of water that is often used as clues stating the merits of a body of water (Syamsuddin, 2014). The pH function itself becomes a limiting factor because each organism has maximum tolerance and a minimum value of pH (Al Husainy, 2014).

from 26-30 ° C, in the middle layer (thermocline) ranging from 9-26 ° C and in the inner layer (hipolimnion) ranging from 2- 8 ° C which is the lowest temperature layer. According to Nontji (1984), sea surface temperatures in Indonesian waters generally range from 28-31 ° C.

Based on the pH value of the sea water shows relatively fluctuate in the first week of 8.08, the second week 8.345, the third week 8.225, then the fourth week 8.257. However it remains at the required quality standard that is between 7-8.5 which is a pH based standard of Kep.MENLH No. 51 2004. Data of pH value of sea water in Pitusunggu village can be seen in (Figure 2).

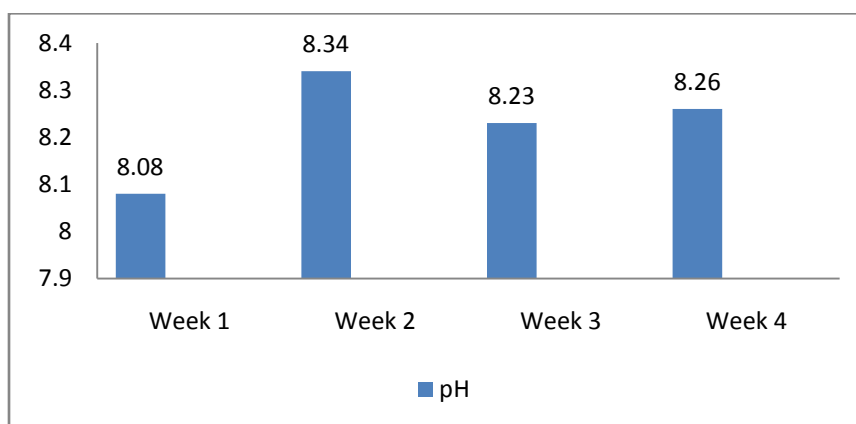


Fig2. Histogram Water pH Value of Pitusunggu Village

The results showed that the relative pH value fluctuated in the first week of 8.080, the second week 8.345, the third week 8.225, then the fourth week 8.257 (Figure 2). The pH value is quite good as is the range of established quality standards that are in the range of pH values between 7 to 8.5 is based on water quality standards for marine appropriate Kep.MENLH No.51 2004.

According to Simanjuntak (2012), the occurrence of a decrease in pH value in a waters indicates an increase of organic compounds in these waters. This is similar to Cholik et al (2005) states that water pH fluctuates following dissolved CO₂ and has an inverse relationship pattern, the higher the CO₂ content of the water, the pH will decrease and vice versa. This fluctuation will decrease when water contains CaCO₃ salt.

Salinity

The salinity of seawater fluctuates depending on the season, topography, tides, and the amount of fresh water. Salinity is a description of the amount of salt in a waters (Dahuriet al, 1996). Based on the average value of laboratory test results on salinity of sea water which shows not too significant changes that occur. Data on the average salinity salinity value in Pitusunggu village. Specific for salinity concentration shows low to high pattern ie first week 30,1 ppt, second week 31,2 ppt, third week 30,7 ppt, and fourth week 30,9 ppt. Data of salinity salinity value in Pitusunggu village can be seen in (Figure 3).

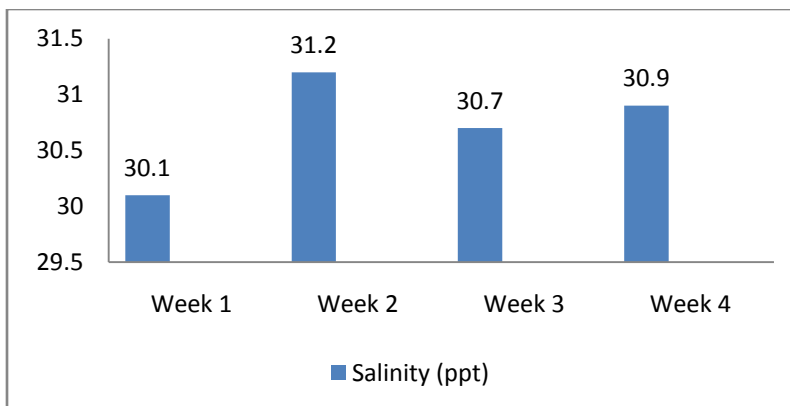


Fig 3. Histogram Mean Value of Saline Water Salinity Concentration of Pitusunggu Village

Based on the results of the study showed that the pH value was relatively fluctuating in the first week 30.1 ppt, second week 31.2 ppt, third week 30,7 ppt, and the fourth week 30,9 ppt. According to Nontji (1987) the distribution of salinity in the ocean is influenced by various factors such as patterns of water circulation, evaporation, rainfall and river flow. Similarly with the sea, the amount of rainfall in a sea area then the salinity of the sea water will be low and otherwise the smaller the rainfall then the salinity in the sea area will be high. This is in accordance with the conditions in the field that in October is the transition season which where enter the rainy season, resulting in dilution resulting in low salinity in the sea area.

Dissolved Oxygen (DO)

Based on the results of dissolved oxygen dissolved in the waters of the village of Pitusunggu is relatively unstable and shows the pattern of DO hunting with a margin of difference that is not too large. The data obtained shows the highest pattern of the highest is the first week 6.2816 ppm, the second week 6.2092 ppm, the third week 6.1742 ppm and the fourth week 6.0632 ppm, This condition is still above the minimum threshold of seawater quality standards for biota the sea is 5 ppm which is the standard DO based concentration of Kep. MENLH No. 51, 2004. Value acquisition data *Dissolved Oxygen (DO)* sea water in Pitusunggu Village can be seen in (Figure 4).

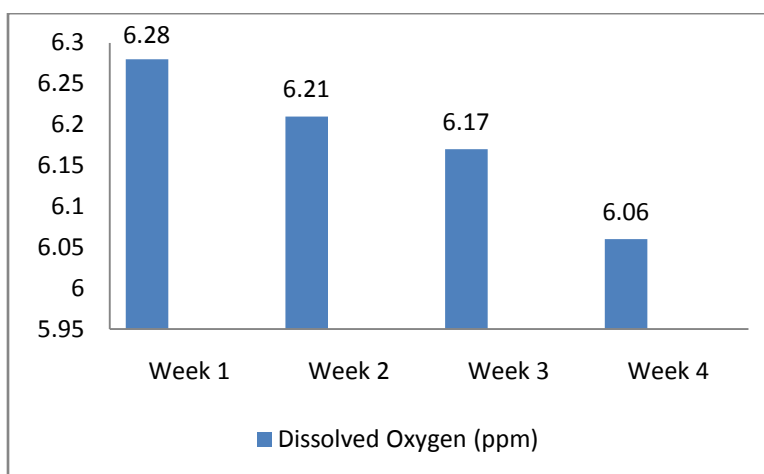


Fig 4. Histogram Mean Value Concentration DO Water Pitusunggu Village

The results of the measurement of dissolved oxygen (DO) in the waters of the Pitusunggu Village at the first week taking 6,281 ppm, the second week 6,209 ppm, the third week 6,174 ppm, and the fourth

week 6,063 ppm (Figure 4), is relatively unstable and shows a DO pattern of retard with a not too large difference in value. The dissolved oxygen concentration value of seawater is 6-6,5 ppm. This value is far beyond the minimum threshold value of

the DO value concentration in the seawater quality standard for marine biota (Kep. MENLH NO. 51, 2004) ie 5 ppm, so the seawater with DO parameters ranges from 6 to 6.5 is still good for marine biota and marine ecosystems.

Riani (2005) mentions that the decomposition of organic material and can reduce oxygen levels in the water until it reaches zero (anaerobic). Oxygen needs are strongly influenced by temperature and vary by type. The presence of waste into a waters will reduce oxygen levels in the water. When compared with the result of measurement of dissolved oxygen value in seawater in Pitusunggu village which has DO 6-6,5 is still good water and low pollution level.

Biological Oxygen Demand (BOD)

The result of BOD water concentration analysis of Pitusunggu village in the initial week was 25,73 ppm and in the final weeks week with BOD value of 122,45 (Figure 5). Significant difference in values occurred in the initial and final weeks of 96.32 ppm which means very much between the initial and final weeks of the Pitusunggu village waters sample. This value has exceeded the threshold of sea water quality standards for marine biota of 20 ppm (Kep. MENLH No. 51, 2004). Value acquisition data *Biological Oxygen Demand* (BOD) sea water in Pitusunggu village can be seen in (Figure 5).

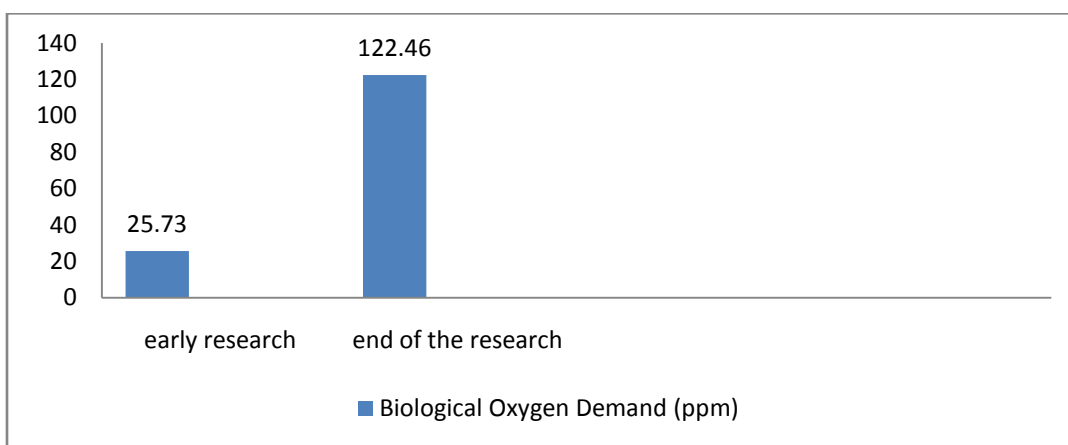


Fig 5. Histogram Mean Value of BOD Concentration of Sea Water of Pitusunggu Village

The low concentration of BOD values was in the initial week at 25.73 ppm and increased in the final week with BOD value of 122.457 ppm. The result of BOD value measurement in seawater shows BOD value which is high enough when compared with maximum limit of BOD concentration value 20 ppm based on seawater quality standard for marine biota according to Kep. MENLH No. 51, 2004.

The high levels of BOD in the last week is due to the large amount of oraganic waste that flows into the waters, this is because densely populated settlements do exist on the edge of the canal that is the route to the sea. This agrees with Mason (1980) which states one of the changes that occur due to disposal of waste marine bodies can lead to reduced dissolved oxygen levels.

The amount of BOD concentration indicates that the waters have been contaminated (Mahyudin et al, 2015). As in the final week with a BOD value of 122.45 ppm is categorized as contaminated waters. According to Hariyadi (2004), BOD and COD

measurements are still needed as parameters in wastewater quality standards or as water pollution parameters because of their role as an estimator of organic material contamination and its relation with decreasing dissolved oxygen content in waters. If you look at the condition of BOD high water value but decrease the dissolved oxygen content value so that the waters in Pitusunggu area are classified based on sea water quality standard for marine biota according to Kep. MENLH No.51, 2004.

Cemical Oxygen Demand (COD)

The concentration of COD values in the first week was very high at 205.99 ppm and decreased in the final week with a COD value of 122.457 ppm. The results of the COD measurements in seawater showed a high enough BOD value. This indicates that the condition of the sea in the first week was in poor condition good. Data of Cemical Oxygen Demand (COD) value of seawater in Pitusunggu area can be seen in (Figure 6).

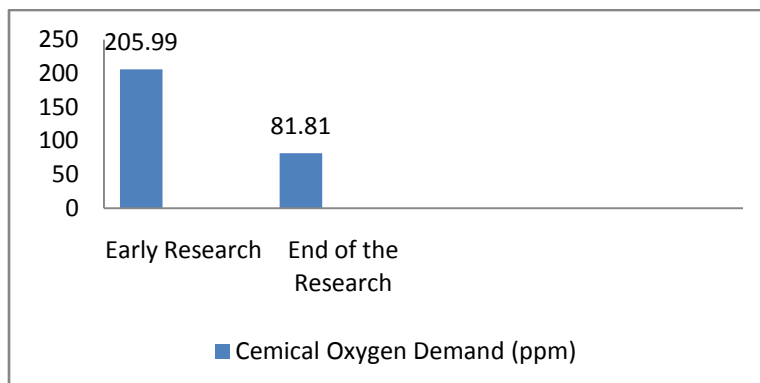


Fig 6. Histogram Mean Value of COD Concentration of Sea Water of Pitusunggu Village

The result of analysis of COD concentration of Pitusunggu village waters in the initial week was 205,99 ppm and at week of end of week with COD value 81,81 ppm (Figure 6). There was a significant difference in value in the initial and final weeks of 124.18ppm which means very much between the initial and final weeks of the Pitusunggu village waters sample. Hariyadi (2004) concluded that COD is parameter of estimating total amount of organic material present in water, both cheap and hard to decompose. COD in the analysis, the oxygen consumed by microbes for oxidation is equivalent to the amount of dichromate required in the dissolved organic matter oxidation and suspended in the water of the sample because almost all organic matter can be oxidized to CO₂ and H₂O (Syamsuddin, 2014).

Based on the results of BOD and COD analysis has a very real difference but the difference can not be concluded that the occurrence or not the

occurrence of pollution because if other parameters have increased and exceeded the quality standard then there is an indication of pollution in the water. This can happen because if there are toxic materials (toxic) in the water, heavy metals for example (Mays, 1996; APHA, 1989), BOD values may be low or still meet the quality standards, in the case of water or waters contained toxic materials or water has been contaminated. Conversely, if the BOD and COD values that have been high enough and exceed the quality standard, then it can be suspected there are indications of contamination of organic materials.

Heavy Metal contamination

Mercury

Based on the value of laboratory test results on Mercury of sea water which shows no change that occurred. Data on the average value of mercury of sea water in Pitusunggu area can be seen in Table 1.

Table 1. Residu Heavy Metals Mercury (Hg) at Water of Pitusunggu Village

Sampling (Weeks)	Heavy Metals Parameters
	Mercury
The first week	< 0.0003
Second week	< 0.0003
The third week	< 0.0003
The fourth week	< 0.0003
Threshold Limit *)	0.003

*) Sea Quality Standard Based on Kep. MENLH No. 51 Years (2004)

Source: Primary Data, (2017)

The content of heavy metals of mercury (Hg) from four sampling times shows the number <0.0003 ppm is still below the threshold of water quality standard for marine biota is 0.003. This shows that the content of Hg in the waste does not significantly affect the breeding of crabs. The results

also showed mercury (Hg) levels in the first week up to the fourth week of sampling were the same, each with a value below 0.0003 ppm. The value is the Limited Of Detection value of the AAS tool used in testing the water sample. So the mercury (Hg) content in seawater is very far below the detection

limit of heavy metal readings of Atomic Absorption Spectrophotometers which indicate the value of heavy metal contamination of Hg and Pb in seawater is very small.

The results of mercury (Hg) concentration in seawater are still far below the maximum concentration of mercury heavy metals (Hg) based on sea water quality standards for marine biota (Kep. *Metal Lead*

Based on the value of laboratory test results against Lead of sea water which shows no change

MENLH No. 51, 2004) ie maximum Hg level of 0.003 ppm (Table 1) So the sea water in the area of Pitusunggu is still quite safe to use or utilized as needed.

According to (Rolinsa, 2014), heavy metals have properties that easily bind organic materials and settle on the water and unite with sediment.

that occurred. Data on the average value of Lead of sea water in Pitusunggu area can be seen in Table 2.

Table 2. Residu Heavy Metal Lead on Sea Water Pitusunggu Village

Sampling (Weeks)	Heavy Metals Parameters
	Metal Lead
The first week	< 0.002
Second week	< 0.002
The third week	< 0.002
The fourth week	< 0.002
Threshold Limit *)	0.008

*) Sea Quality Standard Based on Kep. MENLH No. 51 Years (2004)

Source: Primary Data, (2017)

The results showed that the residual weight of heavy metal residue in household waste that potentially damaged water quality along the coast of Pitusunggu village showed a number <0.002 ppm in samples taken both the first, second, third and fourth weeks, this condition still below the water quality standard threshold for marine biota is 0.05 ppm which is the standard concentration of DO based on Kep. MENLH No. 51, 2004.

The results showed that cadartimbal in the first week up to the fourth week of sampling were the same, each with a value below 0.002 ppm. The value is the Limited Of Detection value of the AAS tool used in testing the water sample. So the cadartimbal contained in seawater is far below the detection limit of heavy metal readings of Atomic Absorption Spectrophotometers.

Cadmium (Cd)

Based on the value of laboratory test results on cadmium (Cd) sea water which showed not too

The result of cadartimbal research on seawater is still far below the maximum concentration of heavy metal timbale based on seawater quality standard for marine biota (Kep. MENLH No. 51 2004) ie maximum Pb level of 0.008 ppm (Table 2). So, the sea water in the area of Pitusunggu is still quite safe to use or utilized as needed. According to Palar (2012) Metal Lead that enter into the waters comes from human life activities such as industrial waste water disposal such as tin ore mining, remaining industrial batteries, motor vehicle emissions and coal combustion. Badan waters that have been contaminated with compounds or metal lead ions that exceeding the above normal concentration may result in death for the biota in the waters.

significant changes that happened. Data acquisition value of average cadmium (Cd) sea water in the village of Pitusunggu can be seen in Table 3.

Table 3. Residu Heavy Metal Cadmium (Cd) on Sea Water in Pitusunggu Village

Sampling (Weeks)	Heavy Metals Parameters
	Cadmium (Cd)
The first week	< 0.0005
Second week	< 0.0005
The third week	< 0.0005
The fourth week	< 0.0005
Threshold Limit *	0.001

*) Sea Quality Standard Based on Kep. MENLH No. 51 Years (2004)

Source: Primary Data, (2017)

The content of heavy metal residue of Cadmium (Cd) on the coast of Pitusunggu Village shows the result that the first week to four is at <0.0005. The water quality standard limit is 0.001 or still in the category according to below the quality standard of water quality for marine biota sebesar 0.01 which is the standard concentration of DO based on Kep. MENLH No. 51, 2004.

The results showed that the level of cadmium (Cd) in the first week up to the fourth week of **Analysis of Fishermen Catch crabs**

The potential of crab (*P.pelagicus*) is in fact not evenly distributed throughout the waters. This is partly due to differences in water environment conditions. In general, crabs (*P.pelagicus*) spread in the waters of the coastal sub-districts and the nearby archipelago sub-districts from the coast. Nowadays, the crab is excellent, because it is an export commodity and the price is quite expensive. This condition gives consequences to the crab

sampling was the same ie each with a value below 0.0005 ppm. The results of cadmium content (Cd) in seawater is still far below the maximum concentration of heavy metal cadmium (Cd) based on sea water quality standards for marine biota (Kep. MENLH No. 51, 2004) namely maximum Cd level of 0.001 ppm (Table 3) So the sea water in the area of Pitusunggu is still quite safe to use or utilized as needed.

(*P.pelagicus*) become the most sought after by all fishermen in Pangkep regency, both day and night. Furthermore, the increasing demand of crabs in the international market also encouraged the development of home industry is one of the triggers of the increase of crab catching. In addition, there are several fishing gear for crabs that cause mass death for crabs especially in the phase zoea, megalopa and young crab.

Table 4. Production and CPUE of Each Unit of Fishing Gear Crab

Years	CPUE Standard		
	Production (kg)	Effort (trip)	CPUE (kg)
2008	368.532	92.985	3.59
2009	288.088	83.314	1.63
2010	420.335	98.99	4.37
2011	367.836	122.243	1.89
2012	586.405	181.038	2.78

*) Processed based on the results of fishermen recording in 2008-2012
Source: Ihsan (2015)

Jafar (2011) states that there is a fluctuation of crab production between 2008-2012 in Pangkep regency, with problems of changing the size of crab populations due to fishing effort and technological progress of fishing gear, and if the arrest takes place continuously without regulation and control then the capacity of population growth will someday decrease so that will be harmful to the preservation of the crab populations.

IV. CONCLUSION

Based on the results of the study it can be concluded that the related water quality of all parameters indicates that water quality is still in the range that qualifies for crab life, as well as heavy metal parameters, all still below the dangerous threshold. Furthermore, the catching of crabs has increased along with the increase in crab demand.

References

- [1] Al Husainy, Irfan, DarmaBakti., & RusdiLeidonald. 2014. Content Analysis of Heavy Metals Lead in Water and Sediments On the Flow of Sungai Percut North Sumatra Province. *Journal of Aquacoastmarine* Vol 5, No. 4. Aquatic Resources Management Study Program, Faculty of Agriculture, University of North Sumatra. *Online*. <https://jurnal.usu.ac.id/index.php/aquacoastmarine/article/view/8901> (diakses 28 Oktober 2017).
- [2] APHA. 1989. Standard methods for the examination of waters and wastewater. 17th ed. American Public Health Association, American Water Works Association, Water Pollution Control Federation. Washington, D.C. 1467 p.

- [3] Central Bureau of Statistics of Pangkep Regency. 2015. Pangkajene Islands Regency in Figures. Publisher of Central Bureau of Statistics of Pangkep Regency. Pangkep
- [4] Chiarelli, R, Roccheri MC. 2012. *Heavy metals and metalloids as autophagy inducing agents: focus on cadmium and arsenic*. Cells. 1: 597-616.
- [5] Cholik, F. *et al.* 2005. Aquaculture. Fisheries Society Nusantara. Taman Freshwater Aquarium. Jakarta.
- [6] Hariyadi, Sigid. 2004. BOD & COD as Parameter of Water Pollution and Quality Standard of Waste Water of Individual Papers. Introduction to the Philosophy of Science. Graduate School/S3 :Bogor Agricultural University. *Online*. http://www.rudyc.com/PPS702-ipb/09145/sigid_hariyadi.pdf (diakses 29 Oktober 2017).
- [7] Ihsan. 2015. Resource Utilization of Rajungan (*Portunuspelagicus*) Sustainable in the Waters of Pangkajenne Regency of South Sulawesi Province. Dissertation. Bogor :Graduate School, Bogor Agricultural University.
- [8] Jafar L. 2011. Fishing Rajungan in MattiroBombang Village (Salemo, Sabangko&SagaraIsland) Pangkep Regency. Thesis. (unpublished). Aquatic Resource Management Program Department of Fisheries. Faculty of Marine Science and Fisheries Universitas Hasanuddin. Makassar 2011.
- [9] Decree of State Minister of Environment Nomor 51, 2004 About Sea Quality Standard (Sea Biota). Jakarta.
- [10] Ministry of Marine Fisheries. 2008. Crab Keep Fighting. Warta Pasarikan. Crab (*Portunussp*).
- [11] Lay, B.W. & Hastowo. 1992. *Mikrobiologi*. Publisher CV. Rajawali. Jakarta.
- [12] Mason, C.F. 1980. Cellular Responses of Molluscan Tissues. The Environmental Metals Marine Environmental Research 14: 103-118.
- [13] MAYS, L.W. (Editor in Chief) 1996. Water resources handbook. McGraw-Hill. New York. p: 8.27-8.28.
- [14] Nontji A. 1987. Archipelago Sea. Publisher Djambatan, Jakarta.
- [15] Nontji, A. 1984. Archipelago Sea. Publisher Djambatan. 372 h.
- [16] Palar, Heryando. 2012. Pollution & Toxicology Of Heavy Metals. Publisher Rineka Cipta : Jakarta
- [17] Riani, E. 2012. Climate Change and Aquatic Life (Impact on Bioaccumulation of Hazardous and Toxic & Reproductive Substances). IPB Press. Bogor. 220p.
- [18] Riani, E. 2005. Pollution load and Assimilation Capacity Jakarta Bay. LPPM-IPB. Bogar
- [19] Simanjuntak, M. 2012. Sea Water Quality Viewed from Aspects of Nutrients, Dissolved Oxygen, and pH in Banggai Waters, Central Sulawesi. Marine Dynamics field, Oceanographic Research-LIPI.
- [20] SNI 06-6989.14-2004. Water and Wastewater: How To Test The Need Of Dissolved Oxygen By Yodometri (Modifications Azide). National Standardization Agency.
- [21] SNI 6989.16:2009. Water and Wastewater: How Cadmium Test (Cd) By Atomic Absorption Spectrophotometric – flame. National Standardization Agency.
- [22] SNI 6989.2:2009. Water and Wastewater: How to Test of *Chemical Oxygen Demand/COD* with reflux Closed by atomic absorption spectrophotometry-flame. National Standardization Agency.
- [23] SNI 6989.57:2008. Water and Wastewater: Sampling Method of Surface Water. National Standardization Agency.
- [24] SNI 6989.72:2009. Water and Wastewater: How to Test Needs *Biochemical Oxygen Demand/BOD*. National Standardization Agency.
- [25] Soegiarto, A & S. Birowo. 1983. Oceanographic Features and Potential Natural Hazards of the Southeast Asean Waters. In ASCOPE Workshop on Technical Aspects of Geological an Natural Environmental Hazards. Jakarta, March, 29-30, 1983.
- [26] Suriawiria, U. 1986. Introduction to General Microbiology. Publisher Angkasa Bandung.
- [27] Sutrisno. 2001. Water purify river With Acid Seed. [http://www.republika.co.id/koran_detail.asp?id=50732&kat_id=105%kat_id1=151&kat_id2=-321-.Di aksestanggal 29 Oktober 2017](http://www.republika.co.id/koran_detail.asp?id=50732&kat_id=105%kat_id1=151&kat_id2=-321-.Di%20aksestanggal%2029%20Oktober%202017).
- [28] Syamsuddin, R, 2014. Water Quality Management: Theory And Application In The Fishery Sector. Pijar Press. Makassar.