



**Hak Cipta :**

1. Dilarang mengutip sebagian atau seluruh karya tulis ini tanpa mencantumkan dan menyebutkan sumber :
  - a. Pengutipan hanya untuk kepentingan pendidikan, penelitian , penulisan karya ilmiah, penulisan laporan, penulisan kritik atau tinjauan suatu masalah.
  - b. Pengutipan tidak merugikan kepentingan yang wajar Politeknik Negeri Jakarta
2. Dilarang mengumumkan dan memperbanyak sebagian atau seluruh karya tulis ini dalam bentuk apapun tanpa izin Politeknik Negeri Jakarta

## PREFACE

Bismillahir rahmanir Rahim,

Assalamu'alaykum Warahmatullahi Wabarakatuh

Praise be to Allah Subhanahu wata'ala, sholawat and greetings continually abound to Prophet Mihammad Sallahu'alaihi wassalam.

The writer realizes that the coaching of this very last document can not be seperated from the help, guidance and help of diverse events.

Therefore, with all humanity, the writer would love to thank;

1. Allah subhanahu wata'ala.
2. My Mother and Fathers who continually offer ethical and massive support
3. *Mr Muhammad Asyraf Bin Zulkipli* as my mentors who've guided me to finish my very last venture
4. Dr Safa Najah as the evaluator who has furnished an assessment in order that i can whole my very last venture
5. Lecture of Mechanical Engineering on the *Jakarta State Polythenic* and FISE MSU which i can not point out seperately
6. Friend from Jakarta State Polythenic for the encouragement.
7. My comrades in gands who've followed me, thanks on your encouragement and cooperation while doing this very last studies.

Finally, the writer hopes that this document may be used well and may be benefical for all of us. And the writer would love to thank diverse events that i can not point out seperately who've helped me in finishing the studies of this very last document. Hopefully what i even have performed up to now is benefical for all.



© Hak Cipta milik Politeknik Negeri Jakarta

## PENGISYTIHARAN

Saya/Kami,

Ardi Surya Ardian Calon bagi ijazah

*I/We*

Ardi Surya Ardian candidate of the degree of

Bachelor of Science in Mechanical Engineering, Management & Science University  
mengakui bahwa:

Management & Science University certify that:

- i. Tesis saya/kami telah dijalankan, digubal dan ditulis sendiri dibawah penyeliaan  
*My/Our thesis was personally developed, conducted and written by us under the supervisor of Mr. Muhammad Asyraf Bin Zulkipli*
- ii. Data saya/kami adalah data asal dari saya/kami sendiri mengumpul dari menganalisisnya; dan  
*My/our data are original and personally collected and analysed; and*
- iii. Saya/Kami akan senantiasa mematuhi syarat, polisi dari peraturan MSU mengenai penulisan, thesis, termasuk undang undang Hak cipta dari paten Malaysia  
*I/We shall at all times be governed by the conditions, policies and regulations of the MSU on thesis writing, including the copyright and Patent laws of Malaysia*

Jika saya/kami didapati melanggar perkara-perkara di atas, saya/kami dengan relanya menepikan hak penganugerahan ijazah saya/kami dan tertakluk kepada syarat dan peraturan disiplin Management & Science University,  
*In the event that my/our thesis be found to violate the conditions mentioned above. I/We voluntarily waive the right of conferment of my/our degree and be subjected to the disciplinary rules and regulations of Management & Science University.*

Ardi Surya Ardian

4/June/2022

Nama Calon  
*Candidate's Name*

Tanda Tangan Calon  
*Candidate's Signature*

Tarikh  
*Date*

Hak Cipta :

1. Dilarang mengutip sebagian atau seluruh karya tulis ini tanpa mencantumkan dan menyebutkan sumber :
  - a. Pengutipan hanya untuk kepentingan pendidikan, penelitian , penulisan karya ilmiah, penulisan laporan, penulisan kritik atau tinjauan suatu masalah.
  - b. Pengutipan tidak merugikan kepentingan yang wajar Politeknik Negeri Jakarta
2. Dilarang mengumumkan dan memperbanyak sebagian atau seluruh karya tulis ini dalam bentuk apapun tanpa izin Politeknik Negeri Jakarta





© Hak Cipta milik Politeknik Negeri Jakarta

## PERAKUAN KERJA KERTAS PROJEK

(Certification of Project Paper)

Saya, yang bertandatangan, memperakukan bahwa  
(I, the undersigned, certify that)

**ARDI SURYA ARDIAN**

Calon untuk ijazah

Candidate for the degree of

***Bachelor of Science Mechanical Engineering (Hons),***

Telah mengemukakan kertas projek yang bertajuk

(Has presented his/her project paper of the following title)

**DESIGN AND FABRICATION OF WATER PURIFICATION WITH MULTI SYSTEM  
FILTRATION**

Seperti yang tercatat di muka surat tajuk dari kulit kertas projek

(As it appears on the title page and from cover of project paper)

Bahwa kertas project tersebut boleh diterima dari segi bentuk serta kandungan, dan meliputi bidang ilmu dengan memuaskan.

(that the project paper acceptable in form and content, and that a satisfactory knowledge of the field is covered by the project paper)

Nama Penyelia

(Name of Supervisor)

Tanda Tangan

(Signature)

SIR MUHAMMAD ASYRAF ZULKIPLI

:

:

:

:

:

:

:

:

:

:

:

:

:

:

:

:

:

:

:

:

:

:

:

:

:

:

:

:

:

:

:

:

:

MUHAMMAD ASYRAF ZULKIPLI  
Program Manager  
Department of Engineering and Technology  
Faculty of Information and Sciences and Engineering  
Management and Science University

2 January 2023

Tarikh

(Date)

Hak Cipta :

1. Dilarang mengutip sebagian atau seluruh karya tulis ini tanpa mencantumkan dan menyebutkan sumber :
  - a. Pengutipan hanya untuk kepentingan pendidikan, penelitian, penulisan karya ilmiah, penulisan laporan, penulisan kritik atau tinjauan suatu masalah.
  - b. Pengutipan tidak merugikan kepentingan yang wajar Politeknik Negeri Jakarta
2. Dilarang mengemukakan dan memperbanyak sebagian atau seluruh karya tulis ini dalam bentuk apapun tanpa izin Politeknik Negeri Jakarta



Hak Cipta :

1. Dilarang mengutip sebagian atau seluruh karya tulis ini tanpa mencantumkan dan menyebutkan sumber :
  - a. Pengutipan hanya untuk kepentingan pendidikan, penelitian, penulisan karya ilmiah, penulisan laporan, penulisan kritik atau tinjauan suatu masalah.
  - b. Pengutipan tidak merugikan kepentingan yang wajar Politeknik Negeri Jakarta
2. Dilarang mengumumkan dan memperbanyak sebagian atau seluruh karya tulis ini dalam bentuk apapun tanpa izin Politeknik Negeri Jakarta

## ABSTRACT

Abstract of the Project presented to the Senate of Management & Science University in partial fulfillment of the requirements for the degree of Bachelor Of Science in Mechanical Engineering (Hons).

### DESIGN AND FABRICATE WATER PURIFICATION WITH MULTI SYSTEM FILTRATION

By

ARDI SURYA ARDIAN

JUNE 2022

Faculty: Information Science and Engineering

Indonesia, In line with population growth, specifically in rural areas, the needs for clean water tends to increase. Some rural areas haven't received a support a clean water from governments had to drink a polluted water. So it's is needed a stuff to process a raw water into a clean water. A filter device that is cheap and easy to operate is needed. For that we need a simple water filter design that does not require expensive costs. Conceptually the filtering process in this tool is carried out from the bottom of the media tao the top so that the filter cleaning process can be carried out in very simple way, namely by opening the drain valve. The desing of this simple water filter using 3 filter media has been made using PVC PIPE. The Three filter media contains of Flocculation, Sedimentation, and Filtration tubes. This filter is capable of changing turbidity from a maximum of 200 NTU to 10 NTU, with a pH of 6.8 – 7.5 . This means that the water can also be drank. So overall, this simple water filter is able to change the physical quality of raw water into clean that meets the WHO standard clean water quality requirements that have been regulated in the *Regulation of Minister of Health of the Republic Indonesia No; 416/MENKES/PER/IX/1990*





## Contents

CHAPTER I .....	8
INTRODUCTION.....	8
1.1 PROFILE BACKGROUND.....	8
1.2 PROBLEM STATEMENT.....	8
1.3 OBJECTIVE .....	8
1.4 SCOPE OF PROJECT .....	8
1.5 SIGNIFICANT OF PROJECT .....	9
1.6 LIMITATION .....	9
CHAPTER II .....	10
LITERATURE REVIEW .....	10
2.1 REVIEW OF CURRENT SITUATION .....	10
2.2 REVIEW OF CURRENT SITUATION .....	10
2.2.1 DESIGN WATER TREATMENT USING ACTIVATED CARBON OIL PALM SHELL.....	10
2.2.2 WATER PURIFICATION USING SOLAR ENERGY.....	11
2.2.3 WATER PURIFICATION USING SLOW SAND FILTRATION .....	12
2.3 REVIEW OF RELATED PRODUCTS .....	13
2.3.1 HYDRO 4000.....	13
2.3.2 NICO water filter .....	13
2.3.3 J- Water type J-200 .....	14
CHAPTER III .....	15
RESEARCH DESIGN AND METHODOLOGY.....	15
3.1 PROJECT METHODOLOGY .....	15
3.2 DEVELOPMENT METHODOLOGY .....	18
3.2.1 BLOCK DIAGRAM.....	18
3.2.2 FLOWCHART OF THE MECHANISM .....	19
1. Coagulation .....	20
2. Flocculation.....	20
3. Sedimentation.....	20
4. Filtration.....	20
3.3 TOOLS AND HARDWARE .....	21
3.4 SOFTWARE REQUIREMENTS .....	29
3.4.1 SOLIDWORKS.....	29
3.5 BILL OF MATERIALS .....	32
CHAPTER IV .....	33

### Hak Cipta :

1. Dilarang mengutip sebagian atau seluruh karya tulis ini tanpa mencantumkan dan menyebutkan sumber :
  - a. Pengutipan hanya untuk kepentingan pendidikan, penelitian , penulisan karya ilmiah, penulisan laporan, penulisan kritik atau tinjauan suatu masalah.
  - b. Pengutipan tidak merugikan kepentingan yang wajar Politeknik Negeri Jakarta
2. Dilarang mengumumkan dan memperbanyak sebagian atau seluruh karya tulis ini dalam bentuk apapun tanpa izin Politeknik Negeri Jakarta



© Hak Cipta milik Politeknik Negeri Jakarta

Hak Cipta :

1. Dilarang mengutip sebagian atau seluruh karya tulis ini tanpa mencantumkan dan menyebutkan sumber :
  - a. Pengutipan hanya untuk kepentingan pendidikan, penelitian , penulisan karya ilmiah, penulisan laporan, penulisan kritik atau tinjauan suatu masalah.
  - b. Pengutipan tidak merugikan kepentingan yang wajar Politeknik Negeri Jakarta
2. Dilarang mengemukakan dan memperbanyak sebagian atau seluruh karya tulis ini dalam bentuk apapun tanpa izin Politeknik Negeri Jakarta

RESEARCH AND DISCUSSION.....	33
4.1 OVERVIEW.....	33
4.2 BASED DESIGN.....	33
4.2.1 INSTALLATION OF WATER PURIFICATION.....	34
4.2.2 WATER QUALITY TECHNICAL REQUIREMENTS .....	35
4.3 DESIGN CRITERIA.....	36
4.4 DEVELOPMENT OF DESIGNING THE WATER PURIFICATION.....	39
4.4.1 COAGULATION PROCESS.....	39
4.4.2 FLOCCULATION PROCESS.....	42
4.4.3 SEDIMENTATION PROCESS .....	45
4.4.4 FILTERING PROCESS .....	47
4.5 TESTING.....	48
4.6 SYSTEM TEST .....	49
4.6.1 RAW WATER FOR TEST.....	49
4.6.2 SUBMERSIBLE PUMP.....	51
4.6.3 DISINFECTION AND CHLORINATION .....	51
4.6.4 ADDITION OF PAC COAGULANT.....	53
4.6.5 FLOCCULATOR.....	54
4.6.6 SLUDGE CHAMBER.....	55
4.6.7 SEDIMENTATION PIPE.....	55
4.6.8 RAPID SAND FILTER (FILTRATION).....	57
4.7 SUMMARY.....	58
CHAPTER V .....	59
CONCLUSION AND RECOMENDATION.....	59
REFERENCES.....	60

POLITEKNIK  
NEGERI  
JAKARTA





**Hak Cipta :**

1. Dilarang mengutip sebagian atau seluruh karya tulis ini tanpa mencantumkan dan menyebutkan sumber :
  - a. Pengutipan hanya untuk kepentingan pendidikan, penelitian , penulisan karya ilmiah, penulisan laporan, penulisan kritik atau tinjauan suatu masalah.
  - b. Pengutipan tidak merugikan kepentingan yang wajar Politeknik Negeri Jakarta
2. Dilarang mengumumkan dan memperbanyak sebagian atau seluruh karya tulis ini dalam bentuk apapun tanpa izin Politeknik Negeri Jakarta

## CHAPTER I INTRODUCTION

### 1.1 PROFILE BACKGROUND

In the context of providing clean and healthy drinking water for rural communities where the quality of groundwater is poor and has not received services from the Government Service, which is quite expensive so it is difficult for small people to suffice, to overcome the above problems, alternatives are needed that need to make simple tools that are cheap and can be made by the community using local market materials.

### 1.2 PROBLEM STATEMENT

The water crisis has disrupted the stability of water availability for the community. Many people have difficulty getting access to water, so they have to walk many kilometers to get water. The water obtained is often of sub-standard quality. The provision of drinking water in Indonesia is still a complex thing.

### 1.3 OBJECTIVE

1. To Design a Water Purification with Multi system Filtration using Solidworks
2. To Fabricate a Water Purification With Multi System Filtration

### 1.4 SCOPE OF PROJECT

1. This Project will be designed by using Solidworks
2. Materials are easy and cheap to get and easy to be assembled
3. To Fabricate the Water purification to represent for the household



## 1.5 SIGNIFICANT OF PROJECT

The Purpose of making this project is to inform and provide the people who lives in rural area / small village who had a difficulties for getting a clean water. They're able to make the water purifier by their self because the materials also cheap and easy to get in common store. So they're able to drink a germ-free water without bacteria. The supply system must be cheap, easy to operate, easy to maintain/clean and use materials available in the local market.

## 1.6 LIMITATION

Water is very important to the human body. Every one of your cells, organs and tissues use water to help with temperature regulation, keeping hydrated and maintaining bodily functions. In addition, water acts as a lubricant and cushions your joints. Drinking water is great for your overall health. By making this projects, hopefully this project able to help a people who had a difficulties getting a clean water

### Hak Cipta :

1. Dilarang mengutip sebagian atau seluruh karya tulis ini tanpa mencantumkan dan menyebutkan sumber :
  - a. Pengutipan hanya untuk kepentingan pendidikan, penelitian , penulisan karya ilmiah, penulisan laporan, penulisan kritik atau tinjauan suatu masalah.
  - b. Pengutipan tidak merugikan kepentingan yang wajar Politeknik Negeri Jakarta
2. Dilarang mengumumkan dan memperbanyak sebagian atau seluruh karya tulis ini dalam bentuk apapun tanpa izin Politeknik Negeri Jakarta





## CHAPTER V

### CONCLUSION AND RECOMMENDATION

From the experimental results of this water purification unit, it turns out that all given theories are appropriate and work well, starting from the coagulation unit (fast mixing), the flocculation unit (slow mixing), the sedimentation unit (tube settler sedimentation), and the sand filter unit (rapid sand filter), all operate almost according to existing theory.

This unit uses 32 watt submersible pump with maximum pressure of 2 meters deep, it can be replaced if in actual conditions by replace the torrent drum reservoir (200 liters) so that this unit can be operated without electricity at all so that it can be used in villages in Indonesia such in rural areas like river bank, murky lake, etc.

#### Hak Cipta :

1. Dilarang mengutip sebagian atau seluruh karya tulis ini tanpa mencantumkan dan menyebutkan sumber :
  - a. Pengutipan hanya untuk kepentingan pendidikan, penelitian, penulisan karya ilmiah, penulisan laporan, penulisan kritik atau tinjauan suatu masalah.
  - b. Pengutipan tidak merugikan kepentingan yang wajar Politeknik Negeri Jakarta
2. Dilarang mengemukakan dan memperbanyak sebagian atau seluruh karya tulis ini dalam bentuk apapun tanpa izin Politeknik Negeri Jakarta



POLITEKNIK  
NEGERI  
JAKARTA