

## FILTRATION PROCESS ON READY TO CONSUME WATER DESALINATION EQUIPMENT

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**Abstract:** Water is one of the basic needs that exist in the life of creatures on this earth. Water is very important that used for body metabolism of both humans and other living things. The lack situation of water often occurs in TNI AD troops who carry out territorial task forces in remote areas where in practice they often get experience problems in obtaining clean water sources. Therefore, to help the community's daily needs, any alternative sources of clean water are needed. Water treatment with natural filtration methods is done to treat water as the water that decent to consume. The experiment method in this study is experiment method. The working process is using a pipe filtration tube and a water pump that aims to pump water from the filtration results to the next stage, the components in the filtration tube, refill filter, zeolite stone, activated carbon, silica sand, and cation-anion resins. The results that obtained from this research process, are the value of turbidity or turbidity in contaminated water which can be compared with the value of turbidity before the filtration process. So, in this study of acidity and alkalinity levels can be obtained neutral results which are at number 7.2. In addition, several technologies have been developed to overcome the problem of providing and improving the quality of drinking water, one of which is water purification technology using Reverse Osmosis (RO) membranes. This process is the following step to obtain quality clean water that is decent for consumption.

Keywords: Filtration, turbidity, silica sand, zeloite stone, activated carbon.

**Abstrak:** Air merupakan salah satu kebutuhan pokok yang ada dalam kehidupan makhluk di bumi ini. Air sangat penting digunakan untuk metabolisme tubuh, baik manusia maupun makhluk hidup lainnya. Keadaan kurangnya air, sering terjadi pada pasukan TNI AD yang melakukan satuan tugas teritorial di daerah terpencil dimana pada pelaksanaannya sering mengalami kendala untuk mendapatkan sumber air bersih. Maka dari itu, untuk membantu masyarakat memenuhi kebutuhan sehari-harinya diperlukan alternatif untuk mendapatkan sumber ketersediaan air bersih. Pengolahan air dengan metode filtrasi alami dilakukan untuk mengolah air sebagai air siap konsumsi. Metode dalam penelitian ini dengan menggunakan studi eksperimen dimana proses kerjanya yaitu dengan menggunakan tabung filtrasi pipa dan pompa air yang bertujuan untuk memompa air dari hasil filtrasi menuju ke tahap selanjutnya, komponen dalam tabung filtrasi, refill filter, batu zeolite, karbon aktif, pasir silika, dan resin anion kation. Dari proses penelitian ini didapatkan hasil yaitu nilai turbiditas atau kekeruhan pada air terkontaminasi yang dapat dibandingkan dengan nilai turbiditas sebelum proses filtrasi. Sehingga pada penelitian tingkat keasaman dan kebasaaan ini dapat diperoleh hasil netral yang berada pada angka 7,2. Selain itu juga beberapa teknologi telah dikembangkan untuk mengatasi masalah penyediaan dan peningkatan kualitas air minum ini, salah satunya adalah teknologi pemurnian air menggunakan membran Reverse Osmosis (RO). Proses tersebut merupakan langkah kelanjutan untuk mendapatkan atau memperoleh kualitas air bersih yang siap untuk dikonsumsi.

*Kata kunci: Filtrasi, turbiditas, karbon aktif, pasir silika, batu zeolit.*

## **INTRODUCTION**

The problem of clean water is the most fundamental thing in our lives. This problem is often encountered, namely clean water that is often used by the community has poor water quality for use by the community. Every day we use clean water for household and other purposes. Clean water certainly makes our lives healthier (Ilyas et.al, 2021). This incident often occurs in TNI AD troops who carry out territorial task forces in remote areas where in practice they often experience problems in obtaining clean water sources. Therefore, to help the community meet its daily needs, alternative sources of clean water are needed. One of the methods used to obtain quality water is the filtration process as the medium. the benefits of activated carbon in the water filtration process as an absorber of several indicators, namely, color, chlorine, as well as odor, and other minerals (Abi Laksana R et.al, 2022).

The design of this filtration process requires several tools and materials to support the filtration process. This study uses three measuring instruments, namely measuring pH, turbidity, and TDS. TDS is used as a measurement of the salt content in the water, a pH measuring instrument is used to detect the acidity or alkalinity of the solution and a turbidity meter is used to detect the

level of turbidity in water (Meita et.al, 2020). The energy source used in this tool uses solar panels, solar panel components are used as light catchers, and batteries are used as electrical energy storage which is regulated by SCC (Solar cell control). Of the three types of energy that are often used in desalination equipment, namely solar, wind, and geothermal, solar energy is the most widely used up to 73% compared to other energies (Munawar et.al, 2021). Therefore, the power source used in this desalination process uses solar cells. Filtration in this filtration process uses zeolite stone, silica sand, activated carbon, and cation-anion resin. Thus, filtered water is raw water that is chemically feasible and safe for human health.

Reverse Osmosis (RO) is a cleaning method through a semi permeable membrane. In this research process, the membrane used to separate water from impurities is based on a molecular scale filtering process, where high pressure is exerted beyond the osmotic attraction so that it forces water to pass through the reverse osmosis process starting from the part that has the high concentration to the part that has a low concentration (Syahid Muhammad et.al, 2019). During this process, the impurities and materials in the hazardous water content will be separated into polluted water. The content contained in the water is smaller than

Reverse Osmosis and will pass through a filtering process with a membrane. The technology used can produce good quality and high-quality drinking water quickly because this process uses pump power. This membrane system is in the form of a hollow fibre membrane, plate or spiral wound. This membrane can reduce pollutant levels by approximately 95-98%. After going through the process, the water is free from bacteria and can be drunk safely.

The research that has been carried out aims to find out the ways and steps of filtration in solar-based ready to drink water desalination equipment to meet the needs of people in remote villages and areas where it is difficult to obtain clean water and to determine the effect of the filtration process on ready to drink water desalination consumption.

## MATERIALS AND METHOD

The research method used in this research process is by conducting experiments where the focus of the study includes experimental studies. In this research process looking for references to study the material before conducting research. The filtration process in which this process uses materials such as a refill filter, zeolite stone, silica sand, activated carbon, and cation-anion resin. In this filtration process, a study was conducted to

determine the difference in turbidity values in contaminated water. In this process using a measuring instrument, measuring pH and turbidity, the measuring instrument is used to determine the level of acidity or alkalinity and to determine the level of turbidity in the water content.

### Description



Image 1. PH Meter.  
(source: publisher)



Image 2. Turbidity Meter.  
(source: publisher)



Image 3. TDS Meter.  
(source: publisher)



Image 6. Silica sand.  
(source: publisher)



Image 4. Zeolite stone.  
(source: publisher)



Image 7. Cation-Anion Resin.  
(source: publisher)



Image 5. Activated carbon.  
(source: publisher)



Image 8. Refill Filter.  
(source: publisher)

## System description

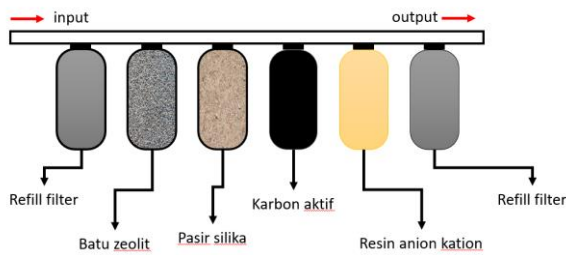


Image 9. Filtration process.

(source: publisher)

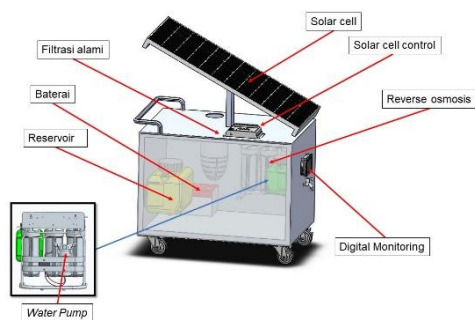


Image 10. Application of the Filtration Process on Ready to Consumer Water Desalination Equipment.

(source: publisher)

## Work Principle

The working principle of this tool works with the following steps: The standard water flows with pump pressure into one place which will flow into the filtering filter called the filtration stage. This filtration process is the first treatment to obtain good clean water results, in this filtration process, consists of various kinds of natural materials, including refill filter, zeolite stone, silica sand, activated carbon, and cation-anion resin. The purpose of this process is to obtain the results of the turbidity value or the level of turbidity in the water

which can be measured with a turbidity meter. After passing this stage the water will be accommodated into the reservoir, and the water in the reservoir will be sucked in by the pump in Reverse osmosis (RO). The next process will pass through the Reverse osmosis (RO) membranes, the end of this process is that the water will pass through UV light which can emit ultraviolet light to sterilize drinking water and kill germs in the water before finally the water is fit for consumption. For the power source from the components of this tool, namely using a Solar Cell where the solar panel is connected to the Solar charger controller which is then connected to the battery and load (pump) in Reverse osmosis (RO).

## RESULT

In this study, the results were obtained from measuring the value of turbidity or turbidity and the level of acidity and alkalinity of contaminated water, where this measurement at the level of turbidity obtained clearer results than before going through the filtration process and the results at the level of acidity and alkalinity were 7.2 where the value was 7.2. is neutral which is a condition of the water that is ready to be consumed.

Table 1. Contaminated Water Preliminary Data.

(source: publisher)

Num.	Parameter	Unit	Contaminated Water
1.	TDS	ppm	3400
2.	Turbidity	NTU	30
3.	Salinity	%	70
4.	PH		8

This data collection, it is carried out using one sample, namely using contaminated water, which is then measured using a tool that has been prepared.

Tabel 2. Measurement Results After Filtration Process.

(source: publisher)

Num.	Parameter	Unit	Contaminated Water
1.	TDS	ppm	3350
2.	Turbidity	NTU	15
3.	Salinity	%	65
4.	PH		7,2

The table above is the result of the measurement of measuring instruments where the comparison parameters use Permenkes No. 416/Permenkes/IX/1990.



Image 11. The difference before and after going through the filtration process.

(source: publisher)

## DISCUSSION

In this testing process, the materials used for the filtration process include a filtration tube with a diameter of 15 cm, a height of 30 cm, and the materials in it, namely zeolite stone (10 mm - 30 mm) which aims to filter impurities that have a size of 30 cm. larger in water content, zeolite (5 mm - 10 mm) to filter small impurities (Artiyani & Firmansyah, 2016). Silica sand is very effective at filtering silt deposits contained in water and activated carbon which functions to remove, filter the chlorine content, and at the same time purify the water. Cation-anion resin functions to absorb positive and negative ions in water, and binds calcium and magnesium ions in water to eliminate calcium and magnesium content in water. Next is the refill filter which is used to improve the results of the filtration process. The measurement process before and after the filtration stage is carried out using the parameters that have

been set by the Minister of Health Regulation No.416/Permenkes/ IX/1990.

### Conclusions and Recommendations

#### Conclusions :

Based on the results of several studies on the filtration process, the following results were obtained:

- a. Based on the results of the measurement of the acidity and alkalinity of the water, the number is 7.2, which means it is neutral and has met the quality standards of ready-to-consume water.
- b. Research on the level of turbidity of water can be distinguished before and after going through the filtration process.
- c. In this study, using cation-anion resin is very influential on the water to remove calcium and magnesium content.

#### Recommendations:

- a. The researchers hope that the development of further tools using the filtration process will greatly affect water quality
- b. For the filtration process, it can be combined with other natural ingredients that can reduce the level of turbidity and get water results that are of an appropriate standard for consumption.

### BIBLIOGRAPHY

- Abi Laksana R dkk, 2022; Artiyani & Firmansyah, 2016; Ilyas dkk, 2021; Meita, 2020; Munawar, 2021; Syahid Muhammad, 2019; Yoshi & Widiassa, 2016)Abi Laksana R dkk. (2022). *Rancang Bangun Filtrasi Air Skala Rumah Tangga dengan Analisa*.  
Artiyani, A., & Firmansyah, N. H. (2016). Kemampuan Filtrasi Upflow Pengolahan Filtrasi Up Flow Dengan Media Pasir Zeolit Dan Arang Aktif Dalam Menurunkan Kadar Fosfat Dan Deterjen Air Limbah Domestik. *Industri Inovatif*, 6(1), 8–15.  
Ilyas dkk. (2021). *Penjernihan Air Metode Filtrasi untuk Meningkatkan*.  
Meita, R. V. (2020). Rancang Bangun Filter Air Dengan Filtrasi Sederhana Menggunakan Energi Listrik Tenaga Surya. *PETROGAS*, 2(2).  
Munawar, S. (2021). Analisa Energi pada Alat Desalinasi Air Laut Tenaga Surya Model Lereng Tunggal. *Jurnal Rekayasa Mesin*, 12(1), 193. <https://doi.org/10.21776/ub.jrm.2021.012.01.21>  
Syahid Muhammad. (2019). *Pengolahan Air Minum Sistem Reverse Osmosis di Pesantren Hidayatullah Gowa*.  
Yoshi, L. A., & Widiassa, N. (2016).

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