Design and Constuction of Sea Water Treatment Equipment with Filterization Process

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Abstract: The use of membranes is the most well-known method of water purification. Membrane filtration is a method used to purify water from a salty source, such as the ocean, so that it can be used in household settings. The filtration procedure uses a semipermeable membrane that can bind and accommodate the salt content of the water. Another method is a filration method based on reserve Osmosis membrane technology. In the Reverse osmosis process, raw water with a high concentration of pollutants is transferred to a reservoir with much purer water.the water under high pressure raw water then passes through a semipermeable membrane to filter out the pollutants present in the seawater. From the result of the study, before filtering seawater TDS of 1735 mg/liter and after filtering the TDS sediment (dissolved Solids) producec about 77 mg/liter is still smaller than the standard water standard of 1000mg/liter, before filtering the water smells and tastes salty, and after filtering the smell, the taste is in accordance with the water standard, which is odourless and tasteless, the water capacity produced after filtering, starting from the first test to the fourth test, was the largest in the fourth tests, which was 11,4 liter/minute.

1 INTRODUCTION

Clean water is water that is safe for human consumption because it has been purified from all disease-causing microorganisms and chemical pollutants. There is growing evidence that the global population is growing every year. The availability of water, especially fresh, potable water, is threatened by human activities (Sonny,2021).

Humans have developed very complex water purification technologies to meet the demand for drinking water. The use of membranes is the most well-known method of water purification. Membrane filtration is a method used to purify water from a salty source, such as the ocean, so that it can be used in household settings. The filtration procedure involves passing seawater through a semipermeable membrane that can bind and retain the salt content of the water (Camila,2019)

Therefore, a good building is a building that has sufficient lighting in each room so that it can increase maximum work results, As for providing services on reflexology, it is not only with massage skills, However, lighting is also beneficial in adding a sense of calm to consumers, therefore in the field of reflexology service providers require lighting that is neither too bright nor too dark (Camila,2019)

Based on the above problems, we plan to research the feasibility of converting salt water into drinking water through a filtration method based on Reserve Osmosis membrane technology. In the Reverse Osmosis process, raw water with a high concentration of pollutants is transferred to a reservoir with much purer water. an additional method is to use a semipermeable membrane to filter out water-soluble pollutants. Here it refers to the regulation on drinking water quality as regulated in Regulation no. 492/Menkes/Per/IV/2010 issued by the Minister of Health of the Republic of Indonesia.

2 LIBRARY REVIEW

The presence of salt in seawater is the main distinguishing feature between seawater and fresh water. All the mineral salts in the earth's rocks and soil contribute to the saltiness of the oceans. Such as sodium, potassium, calcium, and so on. Salt is carried with water from rivers to the sea. Salt in the rocks can

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also be created when ocean waves hit the beach. Salt builds up in seawater over time because salt naturally exists in the ocean. Salt water weighs much more than fresh water (Harahap et al.,2018).

Filtration is the removal of suspended and colloidal fine particles from a liquid (liquid or gas) by passing the liquid through a porous medium or other porous material. Filtration is a common method for removing contaminants (particles) from water during the purification process. As a result, water collects on the surface of the filter and in the channels that flow through the depths of the medium as it seeps and seeps through it. Filtering out microbes, viruses and soil colloids, among others, is a breeze thanks to the filter's adjustable micron settings (Camila,2019).

In filtration, particles suspended in a liquid are removed. Screening can be an initial step in a process (primary treatment) or a step in a series of processes (such as a filter in a chain starting with coagulation, for example) (Henri,2018).

Table 1: Standard Content of Dissolved Solids in Water.

TDS content(mg/L or ppn)	Assessment of water
Less than 300	Very good
300-600	Fine
600-900	drinkable
900-1200	Poor (branckish taste)
over 1200	Dangerous (too salty)

In the table above, the standard water content that is suitable for household use is from 600-900 TDS and that is not suitable for households, which is from 900 to more than 1200 TDS.

Nanofiltrasi

Nanofiltration Membrane Specification

a. Membrane used: composite membrane
b. Thickness : sublayer = 150 m, toplayer = 1 m
c. Pore size : < 2 m
d. Driving force : pressure (10 – 25 bar)
e. Separation principle: solution-diffusion
f. Membrane material: polyamide (interfacial polymerization).

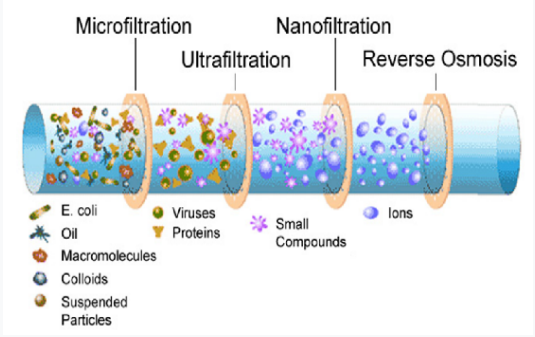


Figure 1. Process of Nanofiltration

Reverse Osmosis Membrane Specification

a. Membrane used: asymmetric or composite membrane
b. Thickness: sublayer: 150 m, toplayer: 1 m
c. Temperature: 400C
d. Pore size: < 2 m
e. Driving force: pressure, brackish water: 15 – 25 bar, sea water: 40 – 80 bar
f. Separation principle: solution-diffusion
g. Membrane materials: cellulose triacetate, aromatic polyamide, and polyamide.

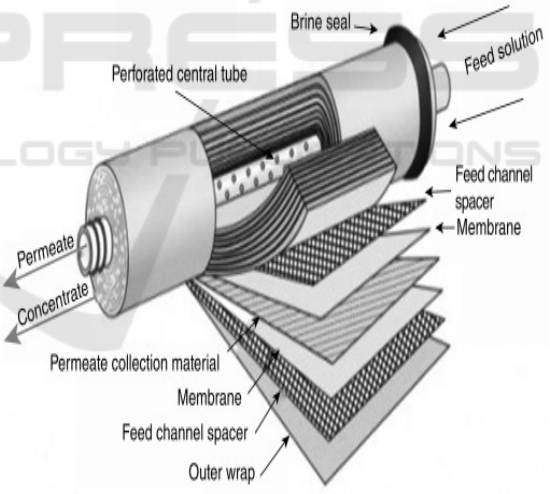
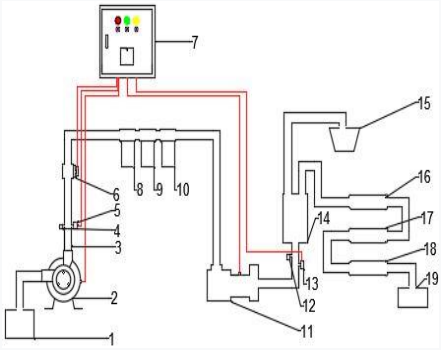


Figure 2. Reserve Osmosis Membrane Structure

3 RESEARCH METHODOLOGY

3.1 Tool Design



1.Reservoir
2.Pump 1
3.Pipe
4.Kontrol tekanan low
5.Low presure switch
6.Selenoid
7.Panel
8.Filter 1
9.Filter 2
10.Filter 3
11.Pump
12. Control tekanan higt
13. Hight presure switch
14. Membrane
15. Dirty water reservoir
16. Karbon 1
17. Karbon 2
18. Karbon 3
19. Clean water reservoir

Figure 3: Tool Design.

3.2 Sea Water Filter Fabrication Process

Figure 4: Sea Water filter Fabrication Process

3.3 Assembly Process

Figure 5: Assembly Process.

3.4 Testing the Water Content of the TDS Tool

Figure 6: Testing the water content of the TDS tool.

3.5 Testing with PH Meter

Figure 7: The results of the first test of water content.

4 RESULTS AND DISCUSSION

From the results of the design and testing of the filtering tool, the following conclusions can be drawn:

1. After designing and testing, the pump specifications and frame materials used for filtering seawater into fresh water are obtained with the following specifications:
   - Pump power = 250 Watt
   - Pump capacity = 28 liters per minute = 0.467 liters/sec
   - Frame material = hollow iron
   - Pipe material = PVC
2. Before filtering the TDS of seawater was 1735 mg/liter and after filtering the sediment TDS (Total DissolvedSolids) produced was around 77 mg/liter which was still smaller than the standard water standard of 1000mg/liter.
3. Before filtering the water smells and tastes salty, and after filtering the smell, the taste is in

accordance with the water standard, which is odorless and tasteless.

4. The water capacity produced after filtering, starting from the first test to the fourth test, was the largest in the fourth test, which was 11.4 liters/minute.

4.1 TDS Test

Total dissolved solids (TDS) meter is used to measure the amount of matter that has been dissolved in a certain volume of water. Hydroponic plant nutrient solutions are not the only tool used to measure; it also checks the total dissolved particles in water for human consumption. The following diagram displays the results of this test using the TDS instrument:

Table 2: Comparison of the analysis of the characteristics of seawater with seawater that has been filtered

Parameter Physical Color Smell	Water (Before filtered) Yellowish Stench	Water Filter Whiter and cleaner No fishy smell
Test I (TDS)	1735	442
Test II (TDS)	1735	424
Test III (TDS)	1735	412

4.2 Testing with PH Meter

PH is a term that is widely used in chemistry, biology, and agronomy. PH level is usually used as a measure of the acidity or alkalinity of water. PH is a scale that can help determine how acidic or basic an aqueous solution is. The test results obtained from the PH meter can be seen in the following table

Table 3: Comparison of the analysis of the characteristics of seawater with seawater that has been filtered.

Parameter Physical Color Smell	Water (Before filtered) Yellowish White Stench	Water Filter Whiter and cleaner No fishy smell
Test I (PH)	77	76
Test II (PH)	77	73
Test III (PH)	77	67

4.3 Testing the Water Content by Physical Color and Taste

In the process of testing the seawater filtering tool, that is, the water produced by filtered seawater is clear white in color the same as the color in drinking water. While the resulting taste is no taste (bland). It can be assumed that the filtered water is included in the category of fresh water. The physical results of fresh water from filerization can be proven by the following fresh water photos:

4.4 Results of Filtering Test with Water Standards

Comparison after testing with a filtering tool there are differences ranging from TDS (Total Dissolved Solid), PH (potential Hydrogen), color and taste, namely the color and taste before being filtered there is a yellowish white color and tastes salty, after filtering it looks white clear, and taste bland.

Table 4: Table of filtering test results with water standards.

Parameter (TDS, Taste,Odor), PH	Test Results (TDS, Taste, Odor)	Maximum (TDS, Taste, Smell)
Total dissolved solids (TDS)	77mg/L	1000mg/L
Taste	No taste	No taste
Smell	No smell	No smell
Temperature	2,7^{o}C	3^{o}C
PH	6,7	7,7

Table 5: Table of filtering test results with water standards.

Tank volume (L)	Charging time (t)	water capacity (L/s)	Capacity (L/min)
19	137	0,14	8,4
19	120	0,16	9,6
19	112	0,17	10,2
19	102	0,19	11,4

5 CONCLUSIONS

From the results of the design and testing of the filtering tool, the following conclusions can be drawn After designing and testing, the pump specifications and frame materials used for filtering seawater into fresh water are obtained with the following specifications: Pump power = 250 WattPump capacity = 28 liters per minute = 0.467 liters/ secFrame material = hollow ironPipe material = PVC, Before filtering the TDS of seawater was 1735 mg/liter and after filtering the sediment TDS (Total DissolvedSolids) produced

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REFERENCES

Sonny Eli Zaluchu. 2021. 3(March):6.

Camila. 2019. "Air Dan Salinitas." *Journal of Chemical Information and Modeling* 53(9):1689–99.

Harahap, Sorimuda, and Muhammad Iqbal Fakhrudin. 2018. "Perancangan Pompa Sentrifugal Untuk Water Treatment Plant Kapasitas 0.25 M3/S Pada Kawasan Industri Karawang." *Seminar Nasional Sains Dan Teknologi 2018* 1–9.

Henri. 2018." *Angewandte Chemie International Edition, 6(11), 951–952.* 5–25.

Ii, B. A. B., and Tinjauan Pustaka. 2002. "BAB II Tinjauan Pustaka BAB II TINJAUAN PUSTAKA 2.1." 1–64.

Ii, B. A. B., and Tinjauan Pustaka. 2016. "Pengertian Fitrasi." 3–14.

Jeklin, Andrew. 2016. (July):1–23.

Nengsih, Sri. 2020. "Potensi Air Laut Aceh Sebagai Sumber Energi Listrik Alternatif." *CIRCUIT: Jurnal Ilmiah Pendidikan Teknik Elektro* 4(2):81. doi: 10.22373/crc.v4i2.6496.

Nugroho, Tryo. 2019. "Macam-Macam Filtrasi." 3–15.

Osmosis, Proses. n.d. "Prinsip Kerja Reverse Osmosis."

Patty, Simon I. 2013. "Distribusi Suhu, Salinitas Dan Oksigen Terlarut Di Perairan Kema, Sulawesi Utara." *Jurnal Ilmiah Platax* 1(3):148–57.

Permenkes RI. 2010. "Peraturan Menteri Kesehatan Republik Indonesia Nomor 492/Menkes/Per/IV/2010 Tentang Persyaratan Kualitas Air Minum." *Peraturan Mentri Kesehatan Republik Indonesia* MENKES.

Persamaan, Pemodelan, Nonlinier Miniatur, Pintu Air, Terhadap Debit, and Air Irigasi. n.d. "TEKNO." 30(1):37–44.

Syahid, Muhammad, Mukhtar Rahman -, Nasruddin Azis - , Syahrier Arief, and Irwan Fathar. 2019. "Pengolahan Air Minum Sistem Reverse Osmosis Di Pesantren Hidayatullah Gowa." *JURNAL TEPAT : Applied Technology Journal for Community Engagement and Services* 2(2):60–65. doi: 10.25042/jurnal_tepat.v2i2.112.

Yuliwati, Erna, . Elfidah, and Ani Meilani. 2018. "Modifikasi Membran Polivinylidene Fluoride Untuk Pengolahan Limbah Cair Industri." *Jurnal Inovator* 1(1):16–20. doi: 10.37338/ji.v1i1.10.

Yunanda, Elsya Arily, and DELFI MELINDA NURUL RIYADI. 2017. "Desalinasi Air Payau Menjadi Air Bersih Dengan Menggunakan Metode Reverse Osmosis." *Tugas Akhir* 94.