Journal of Social Research
P-ISSN: 2827-9832
E-ISSN: 2828-335x
http://ijsr.internationaljournallabs.com/index.php/ijsr

PROTOTYPE DESIGN OF WATER TREATMENT EQUIPMENT DOMESTIC WASTE

Ivonda Vicana Pandang[1], Sinung Rahardjo[2], Djumbuh Rukmono[3]
[1]*Program Pasca Sarjana Politeknik Ahli Usaha Perikanan, Pasar Minggu, Jakarta*
[23]*Politeknik Ahli Usaha Perikanan – Pasar Minggu, Jakarta*
ivondavicana16@gmail.com

ABSTRACT

A prototype design for domestic wastewater treatment has been carried out using the concept of filtration, in which this prototype consists of 2 filters to treat domestic wastewater, the first filter uses a 10-inch cartridge filter media in which filter materials are composed, namely cotton, ferrite, and activated carbon. Then the second filter uses an RO 75 GPD filter which consists of a hollow fiber membrane and has pores of 0.0001 microns. Domestic wastewater from the input reservoir is pumped through the PVC and into filter 1, namely the carbon filter media inside the cartridge filter, the produced water is passed through the ferrite filtration media and then inserted into the membrane, the produced water enters the membrane and RO filter then produces processed wastewater that has been clean and enter into the output reservoir. The results of the functional test explained that the flow velocity of treated wastewater passing through the ¾ inch connecting pipe was 0.22 m/s or 0.24 m3/hour and it took 2 hours to fill an aquarium with a water capacity of 57 liters.

Keywords: *filtration, waste treatment, design, prototype*

INTRODUCTION

Human health can be disrupted if the water we use contains viruses, pathogens or bacteria, one of which must be considered is waste management (Jones et al., 2013). The importance of waste management in order to avoid pollutants Bioreactoran innovative tool that can manage this, namely the Membrane Biorector (Wenten et al., 2014). Membrane Bioreactors, or MBR for short, have been widely marketed throughout the world, especially MBR for treating waste, however, buyer interest is low due to the high selling price and high maintenance costs. So that the introduction of MBR with immersion membranes is more attractive to the public because it has a low cost compared to other types (Shi et al., 2014).

The several advantages of using a Membrane Bioreactor or MBR are that the processed results are cleaner, minimal in viruses, pathogens, and bacteria, and have high-quality water free of organic and non-organic contaminants with less sludge yield compared to conventional methods. Seeing these advantages, Some industries use MBR as a means of processing their waste, which is expected to be used again, including as sanitation by the factory (Howell, 1995).

In this research, an experiment was carried out to make a prototype of a wastewater treatment tool with a filtration system, in which at the initial stage of the experiment, wastewater would be filtered in a filtration system. The performance of the filtration system on the research prototype will be compared with conventional water filters (Farid & Finahari, 2014). Wastewater from the input reservoir is pumped through the PVC and into filter 1, namely the carbon filter media inside the cartridge filter, the produced water is passed through the ferrite filtration media and then inserted into the membrane, the produced water enters the membrane and RO filter then produces clean treated wastewater and into the output reservoir.

METHOD

Research methods

This research consists of several stages, including prototype design planning, prototype dimension calculation, prototype assembly, and functional testing of prototype components (Suhardi, 2020). Prototype design planning in this study was carried out using the comparative method, namely by comparing theory (literature study) with the results of field observations (field observations) (Ulfatin, 2022). Whereas in the prototype design activities in this study using the Trail and Learn method, namely designing and testing the performance of prototype domestic wastewater treatment equipment, then evaluating and improving the product until it is in accordance with the goals to be achieved.

Time and place

ActivityThis research was conducted from March 2021 to June 2021. The research began with planning the design and selecting engineering materials to be used in pyrolysators with multilevel condensation systems. Then proceed with the assembly process and functional testing at the SUPM Tegal Wet Laboratory, Tegal City, Central Java.

Tools and materials

The main equipment and materials used to make the prototype for domestic wastewater treatment equipment in this study consisted of a Water pump 1 unit 150 Psi water mist pump, 48 VDC, Carbon and Ferrolite Cartridge Filter 10", 75 GPD RO Filter, 3 RO Pipes /8 inch 2 meters, RO pipe ¼ inch 5 meters, ruler, elbow 90o, union, gate valve.

Data collection technique

Prototype design planning in this study aims to analyze, assess, and improve the weaknesses of the prototypes that have been used especially conventional prototypes. Prototype design planning in this study was carried out by comparing the data and information obtained from the results of the literature with the results of field observations. To clarify the prototype design planning technique in this study, it is described as follows:

a. Study of Literature

Literature study is carried out by studying books, and scientific publications, as well as research that has been done previously regarding design, working principles, functions of main components, and auxiliary components on prototype performance, in order to obtain a theoretical basis in carrying out prototype designs in water treatment systems domestic waste (Azizah, 2014).

b. Field observation

Field observations were carried out by means of a survey at the waste treatment site, to obtain information and data regarding the methods and principles of wastewater treatment, the types of materials used, and the advantages and disadvantages of the prototypes used to produce wastewater treatment prototypes.

Prototype Dimension Planning

In determining the dimensions of the wastewater treatment prototype, there are several calculations that can be carried out, including the following:

a. Debt Calculation

Flow discharge states the volume of fluid flow per unit time (Tahara, 2000). The fluid flow rate can be determined using the following formula:

$$Q = \frac{v}{t}$$

Information

Q = Discharge (ml/s2)

v = Fluid flow rate (ml)

t = Fluid travel time (seconds)

b. Properties of Fluid Flow in Pipes

The nature of fluid flow in pipes is divided into 2, namely laminar flow and turbulent flow, an explanation of each of the fluid flow properties can be seen as follows

- Laminar Flow

Laminar flow is a fluid flow that is constant both in magnitude and direction flowing through the lower pipe, by calculating the Reynolds Number the value of laminar flow can be known.

$$Re = \frac{\rho v d}{\mu}$$

Information

Re= Renould Number;

ρ= Density of fluid (kg/m3)

v = Velocity of fluid flow (m/s)

d = inside diameter of the pipe (m)

μ = Dynamic viscosity (kg/m3)

- Turbulent Flow

Turbulent flow is the flow that is not constant and varies both in magnitude and direction in all directions. The flow will be turbulent if the calculation results of the Reynolds Number (Re) are above 4000 (Re > 40000, turbulent flow).

c. Installation Head

The installation head is the energy generated by the pump where the flow is from the suction direction towards the discharge.

- Head Static, consisting of:
  - *Pressure Head is* the energy resulting from the pressure difference between the suction area and the discharge of the pump.
  - *Elevation Head is* the energy generated due to the difference in the height of the suction area with the discharge area with the pump axis as the benchmark.

There are two kinds of suction pipe circuits, namely the suction head. A suction pipe installation where the surface is above the axis of the pump.

$$Hst = Hd - Hs$$

Information

Hd = Head discharge (m)

Hs = Head suction (m)

- *Suction Elevator is* a series of pipes in which the fluid surface lies below the axis of the pump. The formula for finding a suction lift is:

$$Hst = Hd + Hs$$

Information
Hd = Head discharge (m)
Hs = Head suction (m)

- Dynamic Heads

Dynamic head is a pump head consisting of:

a. *Head Loss Major*

Before calculating the major head loss, the definition of pump head will be explained. The pump head is the ability or energy possessed by a pump to move flow from one place to another, which in this case moves the flow from the suction side (input) to the discharge side (output). The unit used is meters.

$$Hf = f \frac{Lv2}{2gD}$$

Information
Hf = major head loss
L = pipe length (m)
v = Velocity of fluid flow (m/s)
g = acceleration due to gravity (m/s2)
d = inner diameter of the pipe (m)

b. *Minor Head Loss*

*Head Loss Minor*namely the energy released due to changes in cross-section (Susanto, 2006), Minor Loss is the occurrence of changes in the direction including deflection, bending, enlargement, and reduction of the cross-section. The energy released in the minor loss causes collisions and friction due to turbulence in the pipe section.

$$h = k \frac{v2}{2g}$$

Information
h = minor head loss (m)
k = coefficient of resistance
v = fluid velocity (m/s)
g = acceleration due to gravity (m/s2)
k = elbow (1 piece)

RESULTS AND DISCUSSION

Domestic Wastewater Treatment Prototype Design

The prototype design for domestic wastewater treatment is the result of collecting data and information through literature studies and field observations. The data and information obtained regarding the weaknesses and strengths of domestic wastewater treatment prototypes used in industry, aquaculture, and previous research, are then compared about the cause and effect and the causal factors, in order to create basic answers that are applied to a prototype design that is in accordance with the concept planned. The prototype design phase begins with planning a series of prototype work schemes. The following is a working diagram of the prototype of the waste processing equipment to be made. The work diagram for the prototype of the waste treatment equipment can be seen in Figure 1.

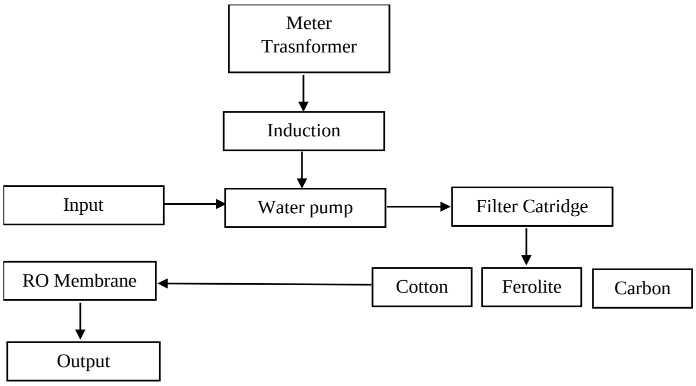

Figure 1. Work diagram of the Wastewater Treatment Prototype

Based on the figure above, the prototype for a household wastewater treatment plant consists of several components, consisting of a waste water container (input) in the form of a bucket with a capacity of 20 liters in one process, the water in the input holding container is pumped using a water pump that is connected by induction to transformer meter 48 V. Water is pumped into the filter cartridge which has been filled with cotton, ferrite, and carbon in a sequential arrangement and according to their respective functions. The top layer of the cartridge filter is cotton, according to its function cotton can absorb impurities in wastewater, then the second layer is ferrite. According to Said (1999), ferrite has a function to remove high levels of iron (Fe), and produce a pungent iron-like odor. Then it can remove the Manganese content (Mn^{++}) and remove the yellow color in the water. The third layer is activated carbon which has the function of purifying water by means of absorption or absorption, meaning that when a material or object passes through the activated carbon, the material contained therein will be absorbed. In the water filter process, activated carbon filters odors, clarifies and filters out metals contained in water, then activated carbon can absorb salts, minerals, and organic compounds in water (Bates, 2001).

After filtering in the cartridge filter, monitoring is carried out on flow *meters,* This monitoring is carried out in order to determine the optimum amount of discharge for the tool to produce filtered wastewater, the water is then carried out by a second filtration process, namely the RO (Reverse Osmosis) process, the water is directed to the 75 GPD RO membrane. RO is a filter that has a semi-permeable membrane and a pore size of 0.0001 microns which can separate water from unwanted components, thereby obtaining water with a high level of purity (Widiyanto et al., 2003). After the water comes out of the RO membrane, the filtered household wastewater is collected in a storage container before it will be used as a medium for fish farming. From the use of this tool, there is output water (waste) from the filtration process, it's just that the waste that is released is clear, after designing the working scheme of the prototype, the next step is to design the prototype design. The prototype design drawings for household wastewater treatment tools can be seen in Figure 2.

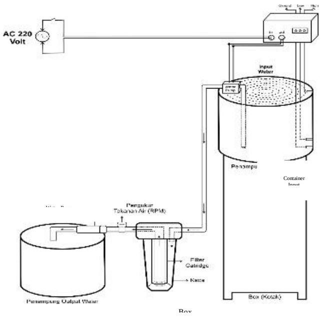

Figure 2. Waste Treatment Prototype Design

In accordance with the theory written by William (2003) in designing the design of a tool or machine there are several things that must be considered, including;

a. Make a simple design, because a simple design will facilitate the production and maintenance process.
b. Using components (parts) that have been standardized.
c. Minimize machining activities.
d. Understanding manufacturing as one part to realize the product.

Calculation of Dimensions of the Wastewater Treatment Prototype

The calculation of the dimensions of the prototype carried out in this study aims to determine the capacity of the head and pump used.

- Pump Head Calculation and Moody Diagram
  - Static Heads
  - Head Pressure
  - Head Loss
- Calculation of the velocity of water flow in the connecting pipe

The two parameters that are always present in a pumping system are pipe diameter and flow velocity. To calculate the velocity of water flow in the connecting pipe using the formula:

$$\mathbf{V} = \frac{Q}{A}$$

Q = 4 lpm ; A = 3.14 x 0.9525 cm2

Pipe diameter ¾ inch = 1.905 cm

$$V = \frac{4 \text{ liter/minute}}{3{,}14 \text{ x } 0{,}9525 \text{ cm}} 2$$

$$V = \frac{4000 \text{ cm3 /minute}}{2{,}99085 \text{ cm2}}$$

V = 1337.41 cm/min

V = 0.22m/s

So, the speed of the water flow through the waste treatment prototype connecting pipe is 0.22 m/s.

- Calculation of Head Loss on Suction

Renould Number (Re)

Then, there are 2 types of water flow through the pipe, namely laminar and turbulent flow with certain criteria. To determine the type of flow used in the waste treatment prototype research, the Reynolds number formula is used. The calculation of the Reynolds number formula from this research is

$$\boldsymbol{Re = \frac{\rho v d}{\mu}}$$

$$Re = \frac{1000\,\frac{\text{kg}}{\text{m3}}\,x\ 0{,}35\,\frac{m}{s}\,x\ 0{,}01905m}{0{,}8847\ \text{x}\ 10^{-6}}$$

Re= 7731421.07
Re= 8 x 107

From the calculation results obtained, the Re value in the study was 8 x 107, which means that the flow produced in the prototype is turbulent flow because the Re value > 4000 so that the flow is turbulent. Then to get the value to be included in the Moody Diagram, the relative roughness of the pipe must also be known. In essence, if there is a large turbulent result, the pipe will be rougher, while the relative roughness can be determined using the Relative pipe roughness formula.

Relative pipe roughness = $\boldsymbol{\frac{\varepsilon}{D}}$ = *ε* Absolute value of roughness
D = Diafrom the pipe

Relative pipe roughness = $\boldsymbol{\frac{0{,}015}{1{,}905}}$ = 0.0078

Plotting the Reynolds number and relative pipe roughness on the Moody diagram to get the value of the friction coefficient can be seen in Figure 3 below.

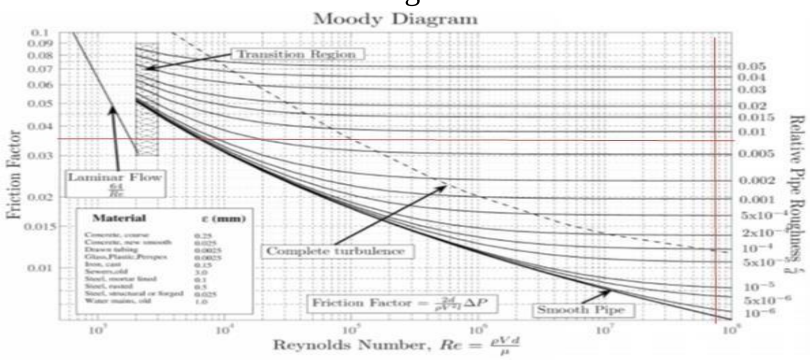

Figure 3. Moody Coefficient of Friction Diagram

The moody diagram above shows the upper right corner is turbulent and the left is laminar, to find out the friction factor, the relative hardness value of the pipe is seen from the right which shows the number 0.0078, then the Reynolds number is at the bottom right showing the number

8 x 107 and drawn to from the top to the cut, to the left and the friction factor value is 0.035. Until the results obtained from the Moody Coefficient of Friction Diagram above are 0.035.

Head Loss Major

Before calculating the major head loss, the meaning of the pump head is that the energy in the pump functions to move the fluid, which in this case moves the fluid from the suction (input) side to the discharge (output) side. The unit used is meters.

Hf =f$\frac{Lv2}{2gD}$ Hf = major head loss; L = pipe length (m); v = speed of fluid flow (m/s); g = acceleration due to gravity (m/s^2); d = inner diameter of the pipe (m)

Hf = 0.035x$\frac{0{,}5 \text{ m } x\ 3{,}6m/s\ x\ 3{,}6m/s}{2\ x\ 9{,}8\ m/s2\ x\ 0{,}01905m}$

Hf = 0.6141 m

Head Loss Minor

*Head Loss Minor*namely the energy released due to changes in cross section (Zainudin et al., 2012). The energy released at minor losses results in collisions between the liquid particles and increases friction due to turbulence, non-uniform velocity distribution on a pipe cross-section.

h =k$\frac{v2}{2g}$

h = minor head loss (m); k = resistance coefficient;

v = fluid velocity (m/s);

g = acceleration due to gravity (m/s2); k = elbow (1 piece)

h = 1 x $\frac{3{,}6\ m/s\ x\ 3{,}6\ m/s}{2\ x\ 9{,}8}$

h = 0.66122 m

Hl suction= Hl major + Hl minor

Head loss suction= 0.6141 m + 0.66122 m

Head loss suction= 1.27532 m

***Head Loss Major* (3/4inch)**

Hf = f$\frac{Lv2}{2gD}$

Hf = 0.035 x$\frac{0{,}805\ m\ x\ 3{,}6m/s\ \ x\ 3{,}6\ m/s}{2\ x\ 9{,}8\ m/s2\ x\ 0{,}01905m}$

Hf = 0.988 m

***Head Loss Minor*(3/4inch)**

h = k$\frac{v2}{2g}$

h = 7.23x$\frac{3{,}6\ x\ 3{,}6}{2\ x\ 9{,}8}$

h = 4.77m
*Head loss discharge*¾ inch = major head loss + minor head loss
*Hl discharge*pipe ¾ inch = 0.988 m + 4.77 m
*Hl loss discharge*pipe ¾ inch = 5.758 m

- *Total Head Loss*

HL = Head loss suction + head loss discharge pipe ¾ inch
HL = 1.27532 m + 5.758 m
HL = 7.03332 m

- Head Totals

HT = Head Pressure + Head Static + Head Velocity + Head Loss
HT = 0 + 1m + 0 + 7.03332 m
HT = 8.03332 m

Calculation of Pump Power

$$P = \frac{Q\ x\ H\ x\ \rho}{367\ \mathrm{x}\ \mathrm{n}} \qquad P = \frac{Q\ x\ H\ x\ \rho}{270\ \mathrm{x}\ \mathrm{n}}$$

$$P = \frac{0{,}24\frac{\mathrm{m3}}{\mathrm{jam}} x\ 8m\ x\ 1000\frac{kg}{m3}}{367\ \mathrm{x}\ 75\%}$$

P = 7 watts

$$P = \frac{0{,}24\frac{\mathrm{m3}}{\mathrm{jam}} x\ 8m\ x\ 1000\frac{kg}{m3}}{270\ \mathrm{x}\ 75\%}$$

P = 9 HP

Pump flow rate and pressure loss are indicators in determining or selecting a pump. Flow rate (Q) = 4 lpm is 0.24 m3/hour, suction head loss = 1.27532 m and ¾ inch pipe head loss discharge calculation is 5.758 m, power 7 watts or 9 HP. From these data, the RO pump (booster pump) was chosen brand: Ko Jine Type: KJ-2000, with a maximum pressure of up to 150 psi, this pump is commonly used in membrane systems from 400 GPD to 500 GPD. Specifications: DC Current, Voltage = 48 volts, Ampere = 3A, Flow Rate = 4 lpm, Maximum Pump Output = 130 Psi. For this reason, a 2 GPM pump was selected

Domestic Wastewater Treatment Prototype Assembly

At this stage, the process of assembling materials and materials obtained from design planning and calculation of prototype dimensions is carried out. From the results of design planning and dimensional calculations, it can be seen the specifications of the materials and dimensions of the components to be assembled into a prototype of a waste treatment tool with a filtration system. The prototype assembly process in this study consists of several processes which are described as follows:

a. The process of preparing tools and materials

Before assembling the prototype, first prepare the main equipment to be used such as adapters, membrane housings, RO boosters. Then the supporting parts of the prototype are filters, RO membranes, filter cartridges filled with carbon, cotton and ferroliter, RO pipes, faucet connectors, water mist sprayers, storage containers used with a capacity of 19 liters of water.

1. Adapter

The type of adapter used in the prototype assembly process for domestic wastewater treatment equipment is the Transformer model: S-184-015-2 with input AC 220 V – 240V 50/60 Hz and output: DC 48 V 3 A. The function of this adapter is connecting and as an electric stabilizer that is used to operate the prototype of the domestic waste treatment equipment that has been made.

2. Membrane Housings

The membrane housing is used as a membrane placement in the reverse osmosis (RO) process, this housing membrane must be adjusted to the size of the RO membrane to be used. In the research to lay the 150 GPd membrane using a fiberglass membrane housing which has a diameter of 4 inches, has a pressure of 300 psi/20 bar and can be filled with several membrane elements, consists of two types of connection locations, namely the side port model and the end port model.

3. Boosterpump RO

The RO booster pump functions to push water into the reverse osmosis membrane, the advantages of the RO booster pump compared to other types of pumps are using an adapter or DC system, saving in the use of electric current, the sound of the pump is smooth, not noisy, heat resistant even when used for a long time. The booster pump used in the assembly of prototype waste treatment equipment is the KO JINE KJ-2000 brand with 4 LPM open flow specifications, 48 VDC volts, 3 A, max pressure 150 psi.

b. Domestic Wastewater Treatment Equipment Prototype Assembly Process

After fulfilling several main and supporting components in assembling a prototype of a domestic wastewater treatment tool, the assembly is carried out as follows:

- Installing the 150 GPd RO membrane into the RO membrane housing by first opening the RO membrane plastic wrap (the part of the membrane that has black steal close to the lid) then inserting a cartridge filter that has been filled with components of cotton, ferrolite and activated carbon with a ratio of 25: 50: 25 into the in a 10 inch glass membrane housing and closing and tightening the membrane housing using threads.
- Installing ¼ inch RO elbow fittings to connect RO hoses to other filter components, connecting RO hoses of different sizes, namely ¼ inch RO hoses and 3/8 inch RO hoses using a T RO connector. Then install the stop RO faucet on the RO hose in ¼ inch to the outside RO hose 3/8. RO hoses are used with 2 types of sizes, namely to accelerate the release of processed water in the storage container and the last is to install a mist spray on the RO hose which produces treated wastewater that is clean and ready for reuse. The fuzzy spray functions to break up a liquid, solution and suspension into liquid droplets (droplets) or mist, with this tool the air humidity can increase, so that oxygen levels increase.

Results of Prototype Design of Domestic Waste Treatment Equipment

Results the design of a prototype for domestic sewage treatment is an innovation from the existing prototype for wastewater treatment. The working principle of the domestic wastewater treatment prototype is to utilize the nature of Reserve Osmosis (RO) itself, namely removing contaminants from water through a semi-permeable membrane. Water flows from the side that is concentrated (more contaminants) from the RO merman to the less contaminant side to provide wastewater treatment that has a value above quality standards and water that can be reused, to get maximum processed waste results in the prototype using a work system 2 filters, namely a membrane filter and a cartridge filter consisting of cotton, ferrolite and activated carbon.

Figure 4. Prototype of Waste Water Treatment Equipment

In wastewater treatment using this prototype tool, it produces permeate or wastewater that has undergone processing and also produces concentrated remaining water or rejected water, however, the resulting rejected water has a value according to the waste water quality standards that are allowed to be discharged into the environment and in the required amount. a little. The RO membrane used in the prototype has very small pores measuring 0.00001 microns and is able to block contaminants present in the waste but allows water molecules to flow. In the working system of this prototype, the water becomes more concentrated when passing through the membrane to achieve balance on both sides, when pressure is applied to the volume of domestic wastewater during the treatment process in the prototype,

Stages of Domestic Wastewater Treatment Prototype Work System

Work on the prototype domestic wastewater treatment plant is the focal point of the reverse osmosis system, but the prototype system also includes other types of filtration. The prototype system consists of several other filtrations. The prototype system consists of a reverse osmosis filter, a cotton filter, a ferrolite filter and a carbon filter which includes a filter cartridge. These filters are called prefilters or postfilters and consist of the following filters:

- Cotton Filter: Reduces particles such as dirt, dust, and rust
- Ferrolite Filter: Reduces the content of iron (Fe) in high levels. the pungent smell of iron, removes the murky color of the water.
- Carbon Filter: Reduces volatile organic compounds (VOCs), chlorine, and other contaminants that give water an unpleasant taste or smell
- RO membrane: Removes up to 98% of total dissolved solids.

The working system when the prototype is turned on is as follows:

- When water first enters the RO system, it will go through prefiltration. Prefiltration includes carbon filters, ferrolite filters and cotton filters contained in a single filter cartridge unit with the function of each filter to remove sediment and chlorine which can clog or damage the RO membrane.
- Next, the water passes through a reverse osmosis membrane where dissolved particles are removed.

- After filtering, the water flows into the temporary storage tank. The reverse osmosis system continues to filter water until the storage tank is full and then turns off.
- Produced waste water that is clear and clean so that it can be reused as a fulfillment of needs.

In running the prototype of this waste water treatment tool, a storage container or storage container for treated water is needed because the system has a supply of treated water. The course of the RO system is quite slow. It takes one minute to produce two to three liters of RO water. If you turn on the faucet for a gallon of water at the actual membrane production rate, then you have to wait at least a few minutes for it to fill up. With a storage tank, our gallons of water can be filled immediately. The working system of this prototype domestic wastewater treatment plant removes dissolved solids such as arsenic and fluoride through an RO membrane. Carbon filters, ferrolite filters and RO filters remove chlorine, bad tastes and odors, and cotton filters remove impurities. In addition, the reverse osmosis system also removes fluorine, levels of salts, sludge, chlorine, arsenic, herbicides and pesticides and also removes many other contaminants. Reverse osmosis can remove some bacteria, but bacteria can grow on the membrane and have the potential to enter the water supply so to prevent this after the water treatment process is carried out, a Reserve Osmosis (RO) membrane is washed because the dirt (fouling) is filtered out and precipitated inside. For the filter system, the cotton filter can be replaced for one time use and the carbon filter and ferrolite filter can be reused in the following processes until they look dirty due to sediment. If they look dirty due to fouling, replace the carbon and ferrolite filters. herbicides and pesticides and also removes many other contaminants. Reverse osmosis can remove some bacteria, but bacteria can grow on the membrane and have the potential to enter the water supply so to prevent this after the water treatment process is carried out, a Reserve Osmosis (RO) membrane is washed because the dirt (fouling) is filtered out and precipitated inside. For the filter system, the cotton filter can be replaced for one time use and the carbon filter and ferrolite filter can be reused in the following processes until they look dirty due to sediment. If they look dirty due to fouling, replace the carbon and ferrolite filters. herbicides and pesticides and also removes many other contaminants. Reverse osmosis can remove some bacteria, but bacteria can grow on the membrane and have the potential to enter the water supply so to prevent this after the water treatment process is carried out, a Reserve Osmosis (RO) membrane is washed because the dirt (fouling) is filtered out and precipitated inside. For the filter system, the cotton filter can be replaced for one time use and the carbon filter and ferrolite filter can be reused in the following processes until they look dirty due to sediment. If they look dirty due to fouling, replace the carbon and ferrolite filters.

CONCLUSION

Based on the results and discussion in research activities it can be concluded as follows

1. Designing a prototype of a domestic wastewater treatment tool using a filtration system is the right alternative for treating wastewater to produce clean water that can be reused to meet daily life needs.
2. The filter components used in the prototype system for domestic waste processing equipment have been able toreduce the efficiency of organic and inorganic substances so as to produce water quality values according to quality standards.

3. The domestic wastewater treatment system using the prototype can precipitate floc optimally so that froth is not formed which is difficult to settle.

REFERENCES

Azizah, N. U. (2014). *Rancang bangun prototipe alat deteksi jarak dengan sensor ping pada mobil pengangkut barang berbasis arduino*.

Bates, W. T. (2001). Cleaning your RO. *White Paper.[(Accessed on 7 August 2017)]*.

Farid, A., & Finahari, N. (2014). Pengaruh Filter Udara Terhadap Unjuk Kerja Mesin Pada Motor Matic. *PROTON*, *6*(1).

Howell, J. A. (1995). Sub-critical flux operation of microfiltration. *Journal of Membrane Science*, *107*(1–2), 165–171.

Jones, B. A., Grace, D., Kock, R., Alonso, S., Rushton, J., Said, M. Y., McKeever, D., Mutua, F., Young, J., & McDermott, J. (2013). Zoonosis emergence linked to agricultural intensification and environmental change. *Proceedings of the National Academy of Sciences*, *110*(21), 8399–8404.

Said, N. I. (1999). *Kesehatan masyarakat dan teknologi peningkatan kualitas air*. Direktorat Teknologi Lingkungan Deputi Bidang Teknologi INF.

Shi, J., Podola, B., & Melkonian, M. (2014). Application of a prototype-scale Twin-Layer photobioreactor for effective N and P removal from different process stages of municipal wastewater by immobilized microalgae. *Bioresource Technology*, *154*, 260–266.

Suhardi, S. (2020). RANCANG BANGUN PROTOTIPE SALURAN IRIGASI SKALA LABORATORIUM. *Jurnal Ilmiah Rekayasa Pertanian Dan Biosistem*, *8*(1), 58–70.

Tahara, H. S. (2000). *Pompa dan Kompresor*.

Ulfatin, N. (2022). *Metode penelitian kualitatif di bidang pendidikan: Teori dan Aplikasinya*. Media Nusa Creative (MNC Publishing).

Wenten, I. G., Hakim, A. N., & Aryanti, P. T. P. (2014). Bioreaktor Membran untuk Pengolahan Limbah Industri. *Teknik Kimia Institut Teknologi Bandung*.

Widiyanto, A., Kato, S., & Maruyama, N. (2003). Environmental impact analysis of Indonesian electric generation systems (development of a life cycle inventory of Indonesian electricity). *JSME International Journal Series B Fluids and Thermal Engineering*, *46*(4), 650–659.

Zainudin, Z., Sayoga, I. M. A., & Nuarsa, M. (2012). Analisa pengaruh variasi sudut sambungan belokan terhadap head losses aliran pipa. *Dinamika Teknik Mesin*, *2*(2).