



Testing of Desalination Equipment with Condensation Process as a Solution for Islands That Lack Fresh Water

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ABSTRACT: The purpose of this study was to find out: (1) the volume of fresh water produced from the desalination process; (2) the acidity of water produced from seawater desalination equipment using solar energy. Seawater desalination device model uses solar power. The model of the tool is made in the form of a box (Square). At the bottom there is a seawater reservoir and on the bottom side of the desalination equipment there is a desalination freshwater path connected to the freshwater storage container. In the data collection process, the tool is placed in an open area that can be exposed to direct sunlight, data collection starts from seawater sampling, seawater sampling and testing. The seawater that has been taken is then lifted to the research site and put into the seawater storage area. The conclusions that can be drawn from this study are: (1) from the tool that has been tested obtained a tool that can produce fresh water, the first test 18 ml, the second test 14 ml and the third test 23 ml and the acidity of the water is 7% pH or no acidity of water and also this tool can be applied in the tropics; (2) Seawater desalination equipment into fresh water with solar energy that has been made with a box model using glass, at the base of the desalination tool there is a seawater storage pool and on the bottom side of the desalination tool there is a freshwater path.

KEYWORDS: Condensation process, Desalination equipment, Testing.

INTRODUCTION

Water is a very important necessity for human survival. This is because humans not only need water for the needs of the body, but various other needs such as washing, cooking and others. However, not all regions have good water resources. Humans are often faced with difficult problems when freshwater resources are limited and on the other hand there is an increase in demand. Coastal areas and islands are areas that are very poor in fresh resources. Water resources found in this area are generally of poor quality, for example brackish or salty groundwater. The choice to live in the area is certainly very relevant considering the many potential biological and non-biological natural resources, which are very important for people's lives. However, this does not make coastal communities fully prosperous. Still low productivity, making it difficult for them to get out of prosperity. With this reality, there have actually been many human efforts to process salt/brackish water into fresh water using various technologies.

Desalination is a water treatment technology. Desalination is a process to obtain water with high purity or to obtain clean water from water that has high salt content, such as sea water. There are several explanations about this desalination, one of which is to mean that Desalination means only a process of separating fresh water from salt water. There are also those who mean that desalination is a process to remove salt content in water consisting of cation (positive ions) and anions (negative ions). The Desalination process is usually used to process seawater into mineral-free water that can be consumed by humans.

There are several technologies in the desalination process, namely the distillation or evaporation process, process technology using membranes or filtration, and ion exchange processes. The desalination process by distillation is a separation method by heating seawater to produce water vapor, which is then condensed to produce clean water. While the process by membrane is the separation of seawater with fresh water by applying pressure and using a Reverse Osmosis (RO) membrane or by electrodialysis.

In a desalination system using a RO membrane, the water in the salt solution is separated from the dissolved salt by flowing it through a water-permeable membrane. Permeate can flow through the membrane due to the pressure difference created between the pressurized feed and the product, which has a pressure close to atmospheric pressure. The rest of the feed will then continue to flow through the pressurized side of the reactor as brine. This process does not go through heating or phase changes.

Water is a substance or matter or element essential to all forms of life known to this day on earth. Water can be liquid or water can be a solid object called ice and can also be a gas known as water vapor. Physical changes in the shape of this water depend on the location and natural conditions. When heated to 100°C, the water will boil so that the evaporation process occurs and will arise in the

form of water vapor. At a certain temperature, water vapor turns into water again. At cold temperatures below 0°C water turns into a solid object called ice.

Water can also be fresh water and can also be salt water (sea water) which is the largest part of this earth. In the natural environment the process of transformation, the movement of water flow (at ground level, in the ground, and in the air) and the type of water follow an equilibrium or hydrological cycle.

MATERIALS AND METHOD

The desalination tool used in this study can be seen in the following figures.

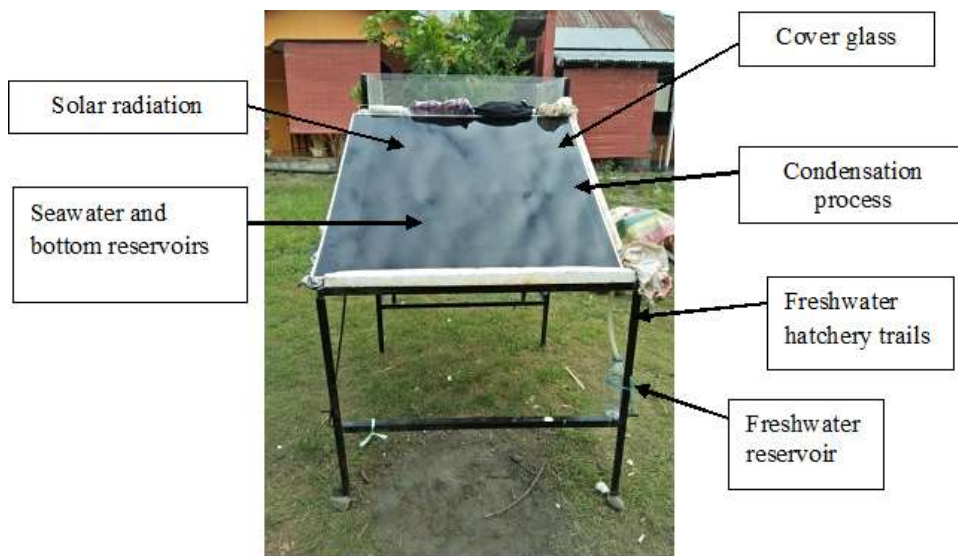


Fig.1: Distillation device top view

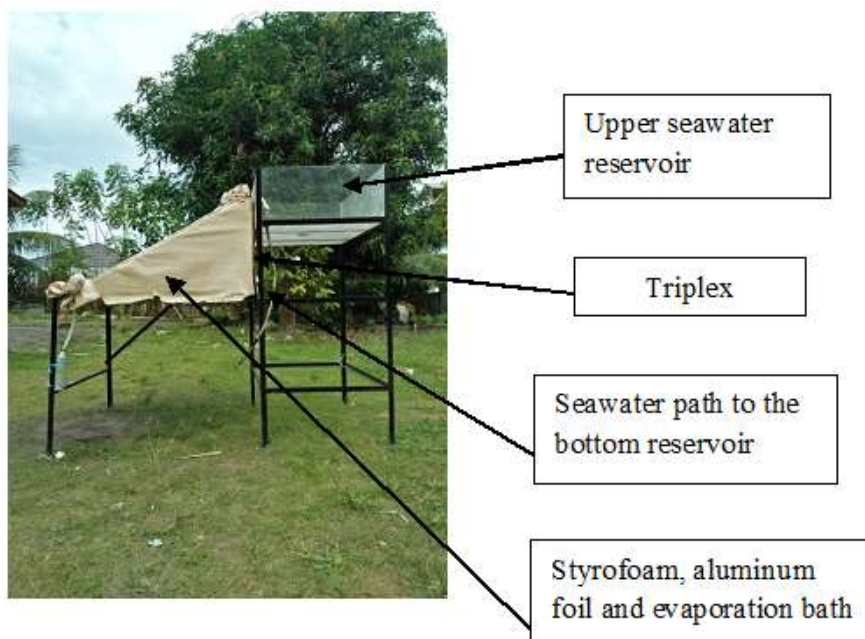


Fig.2: Distillation device side view

In this study to be well directed, the stages in the implementation of research are arranged as follows:

- a. The initial preparation stage, namely: preparing the desalination equipment, preparing the performance test of the desalination tool, preparing the test site of the desalination tool
- b. The data collection stage is testing the desalination equipment that has been prepared where the data taken is the volume of water produced and the acidity of the water from the desalination tool.

The sampling process to examine the quality of water produced in this study is:

- a. Raw water is seawater that is put into a container.
- b. Draining raw water into storage containers.
- c. From the raw water storage container, then drain the raw water to the desalination device to further experience the distillation process through sunlight radiation.
- d. Distilled water is fresh water, which is then flowed into fresh water storage containers
- e. Record the results of observations on the observation table.

RESULTS AND DISCUSSION

From the process that has been passed in the repair of seawater desalination equipment into fresh water with solar power, then continued with the process of taking data. In the data collection process, the tool is placed in an open area that can be directly exposed to sunlight, data collection starts from seawater sampling and testing is carried out in Kema Dua, North Minahasa.

Seawater that has been taken is then put in seawater storage. The process of taking this data so that it is clearer can be seen in the following picture.



Fig.3: Collecting of seawater in reservoir

Seawater was collected in a desalination reservoir; the study was carried out from 08.00 to 16.00. During the study, measurements of ambient temperature, room temperature of the desalination basin and freshwater dripping results were carried out. The test results can be seen in the following table.

Table 1: Data retrieval results

Day	Ambient temperature (°C)	Seawater reservoir temperature (°C)	Volume of fresh water produced (ml)	Weather	Condensation
1	35	59	18	Bright	Yes
2	33	49	14	Overcast	Yes
3	35	58	23	Bright	Yes



For data collection of desalination equipment with measurements of ambient temperature and seawater reservoir temperature of the desalination bath carried out every 15 minutes can be seen in the following graph:

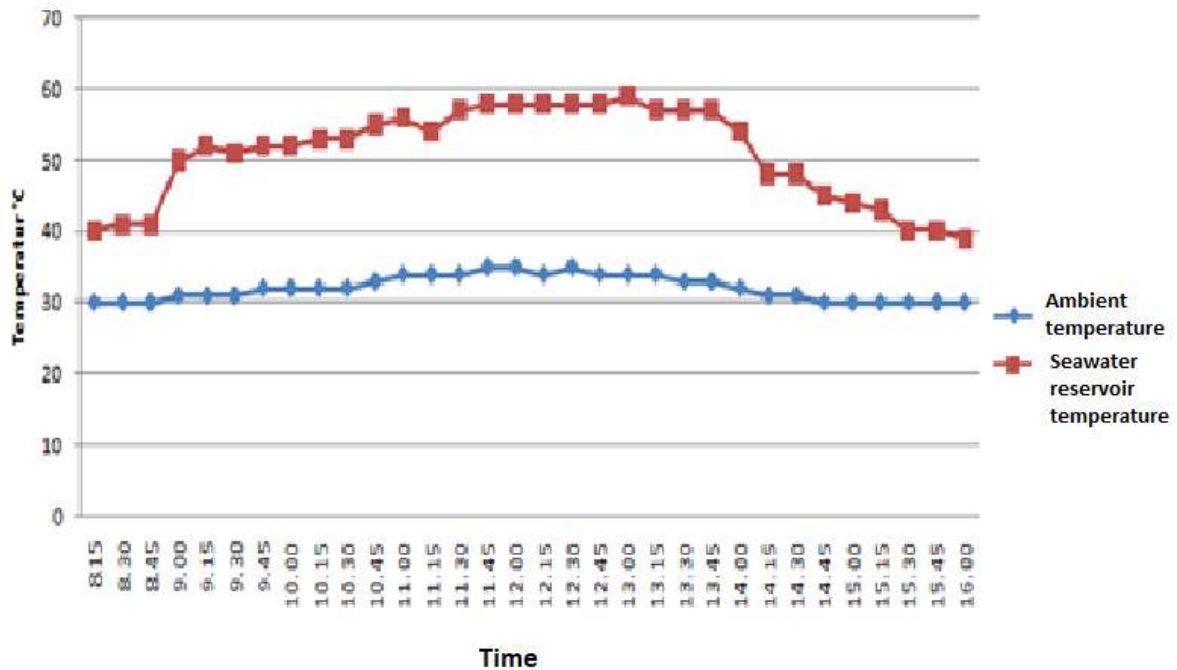


Fig.4: First day data capture graph, time and temperature

On the first day of collection at 08.00 – 16.00, a maximum ambient temperature of 35 °C and seawater reservoir temperature of 59 °C was obtained, and from 11 liters of evaporation seawater produced as much as 18 ml and water acidity 7.0% (pH).

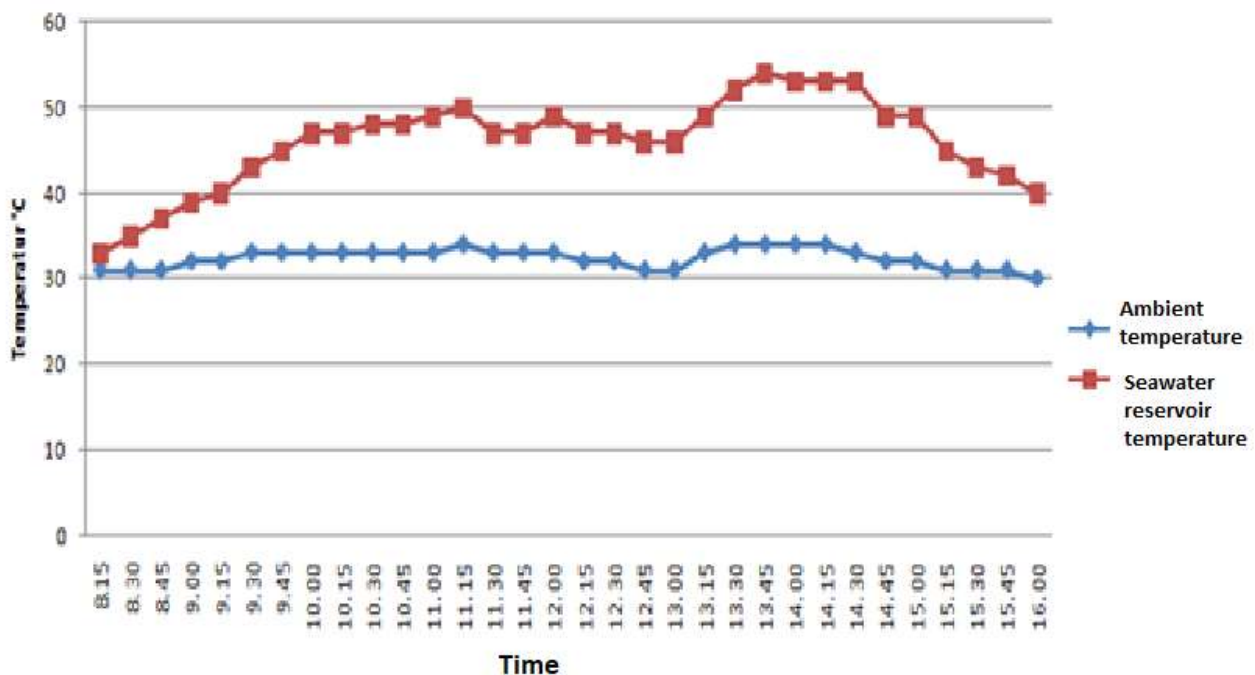


Fig.5: Second day data capture graph, time and temperature



On the second day of data collection, a maximum ambient temperature of 34 °C and seawater reservoir temperature of 54 °C was obtained, and from 11 liters of seawater, the evaporation produced was 14 ml and the acidity of the water was 7.0% (pH).

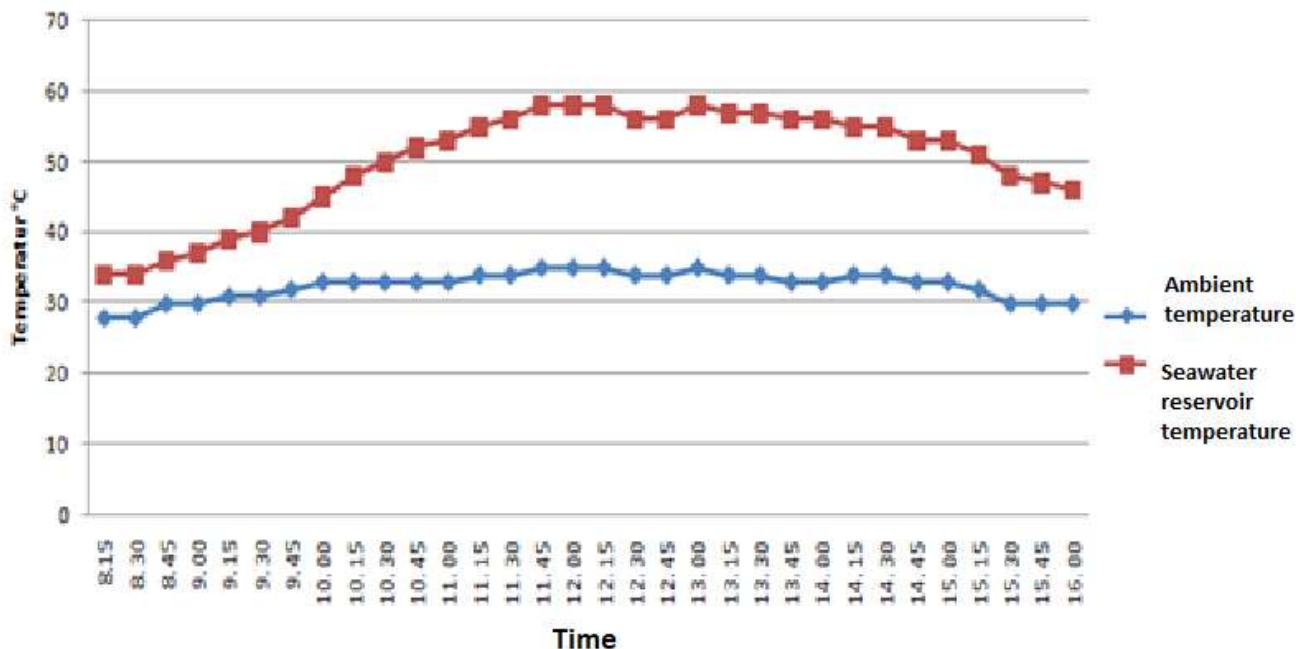


Fig.6: Third day data capture graph, time and temperature

On the third day of data collection, a maximum ambient temperature of 35 °C and seawater reservoir temperature of 58 °C was obtained, and from 11 liters, the evaporation seawater produced was 23 ml and the acidity of the water was 7.0% (pH).

Seawater desalination tool into fresh water using solar energy, which is in the form of a box using glass, this is intended so that sunlight can penetrate into the desalination tool so that it hits and heats the seawater in the desalination device turns into water vapor and finally sticks to the surface in the desalination tool. At the bottom of the desalination device, a water channel is made that functions as a place for freshwater to fall and then flow to freshwater reservoirs. The desalination device is made tilted close to 45°, this is intended so that water vapor will fall on the side of the desalination device and not fall back on the seawater reservoir that is right at the bottom of the desalination device.

This desalination tool can produce fresh water and can be consumed by the community, but for freshwater droplets that produce it cannot be maximal. The device converts seawater into fresh water with solar power, can be applied to areas that lack fresh water such as islands and coastal areas. This tool is able to convert seawater into fresh water using sunlight without the help of electricity and machinery. So, it can be applied anywhere, especially in tropical areas where more exposed to sunlight.

RECOMENDATIONS

This test has been run and completed but leaves a variety of new questions. These questions are made in the form of suggestions so that readers or future testing can find out or get even better results. The suggestions that can be given in further testing are: (1) the seawater reservoir should be lowered so that seawater evaporation and freshwater dripping can be maximized; (2) Try to have no air leakage in the desalination equipment.

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