Energy Efficiency of Clean Water and Performance of Laboratory Equipment With the Utilization of Air Conditioning Flue Water Circulation System

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Abstract. In this case, with clean water in Indonesia, energy reserves are increasing day by day shrink. This is also exacerbated by wastage in its use; On the other hand, clean water is still often used excessively tends to be wasted. Let's look carefully at some government agencies that still encounter wasteful practices. The use of clean water is usually found in several leaky faucets in the room, office showers, ablution places, and toilets and sinks in water laboratories flow is wasted. Laboratory equipment that requires groundwater that flows continuously as long as the equipment is operating is one of the practices of wasting energy, clean water. Besides that, it has the potential moss growth and movement of the heating plate occurs.

1. Introduction

Energy Efficiency is an effort to conserve energy. According to Government Regulation No. 70 of 2009 concerning Energy Conservation, what is meant by energy conservation is a systematic, planned, and integrated effort to conserve domestic energy resources and increase the efficiency of their utilization. Energy efficiency is a general term that refers to using less energy to produce the same amount of valuable services or output using energy as effectively and efficiently as possible.

There is a need for public awareness of energy conservation so that efficient and efficient habits are formed in using energy entrenched in the future. There are many ways to save energy, including saving water. Energy efficiency, including water efficiency, is one solution to overcome the energy crisis and reduce the environmental damage that can occur. There are many ways to save water, including limiting its use. Even though this water is a renewable resource, it turns out that this resource cannot be renewed for clean water. (Madonna S. 2014).

The quality of water used for daily needs for humans is water that meets clean water criteria. Clean water is water that can be used for everyday needs whose quality meets health requirements and can be drunk when cooked. What is called drinking water is water that has gone through a processing or processing stage that meets health requirements and is consumed immediately. Health requirements for drinking and clean water include bacteriological, chemical, and physical conditions. (Waluyo, 2009).

The criteria for the quality of water used for human life are different from the criteria for water required for the industrial world. Industrial raw water treatment is the main activity of various industrial processes, including heating. A water heater is a device used to heat water that uses energy as a heating source, namely electricity, gas, or the sun. Of the three types of energy sources used, electrical energy is more widely used because it is more practical in its use and installation. Inadequate water treatment

procedures can have a significant adverse impact on the process and the quality of the final product; the surfaces of pipes and vessels may suffer corrosion and scale or rust. The scale is an oxide layer of inorganic compounds that settles and forms crystal deposits on the surface of a substrate. The process of crust formation is the result of hydrodynamic and thermal conditions in a system or the result of chemical kinetics, thermodynamic conditions, and chemical properties of substances such as alkaline, calcium, chloride, sulfate, nitrate, iron, zinc, copper, phosphate, or aluminum which are affected by various factors such as water content, supersaturated solution conditions, water rate, temperature, type and type of impurity, number of inhibitors to absorb ions, calcium index level, pH, and other factors. (Merdah & Yassin, 2007). thermodynamic state and chemical properties such as alkaline, calcium, chloride, sulfate, nitrate, iron, zinc, copper, phosphate, or aluminum which are influenced by various factors such as water content, supersaturated solution conditions, water rate, temperature, type, and the type of impurity, the amount of inhibitor to absorb ions, the level of calcium index, pH, and other factors. (Merdah & Yassin, 2007). thermodynamic state and chemical properties such as alkaline, calcium, chloride, sulfate, nitrate, iron, zinc, copper, phosphate, or aluminum which are influenced by various factors such as water content, supersaturated solution conditions, water rate, temperature, type, and the type of impurity, the amount of inhibitor to absorb ions, the level of calcium index, pH, and other factors. (Merdah & Yassin, 2007).

In the water purification process, the goal is to soften the water or remove the mineral content. The water will be softened by using a kind of resin that contains a charge of Na+ cations which will bind Ca2+ and Mg2+ ions more strongly than the Na+ bonds in the wax. When water passes through the resin, Ca2+ and Mg2+ ions will be bound by the resin, and Na+ ions will be released, making the water more 'soft.' If all the mineral content in the water is to be removed, the water will be passed through a resin containing an H+ charge and through a second resin containing an OH- charge. The H+ and OH- ions will react and will produce more water. The result of this process is mineral-free water.

Incoming raw water contains hardness, silica, alkalinity, and oxygen, all of which can harm evaporation. These components must be handled effectively to protect the heat exchanger lining from scale and corrosion. (Rahayu 2019). AC exhaust water results from the condensation process from the air in a room; thus, it has Physico-chemical properties and characteristics almost the same as distilled water. The results of the study obtained that the pH measurement data for Aquadest was 6.85; AC Water 6.64, negative Aquadest Mineral Qualitative Test, damaging AC Water, buoyant Faucet Water, Aquadest Absorbance Test 0.001, AC Water 0.006, Faucet Water 0. 374 Thus, AC wastewater which is managed in such a way can be used as a substitute for distilled water and maintain laboratory equipment to save on lab costs and maintenance of laboratory equipment. (Subandi, 2018).

In this study, the authors will use air conditioning wastewater from previous research as feeder water for the heating chamber and at the same time as a cooler for extraction and distillation equipment in the laboratory with the circulation method, by utilizing a water aspirator equipped with a controlled water pump so that the water flow rate can be adjusted later. Water circulates from the water aspirator to the cooling pipe and then back to the water aspirator. To control the temperature of the cooling water, a thermometer is installed. To cool the water, a water cooler is prepared with increased water temperature. Thus it can reduce the use of clean water and can avoid damage to laboratory equipment.

2. Methods

2.1. Cleaning of cooling ducts/pipes and heating plates.

Cleaning the cooling channel/pipe (Condenser). The first step of the research process is to clean the cooling tube (Condenser) on the dirty Sohlet on the inside through which the cooling water flows. The cleaning step for this cooling pipe is to remove one by one from the Soxhlet apparatus, then the spiral tube is filled with a dilute NaOH solution and then allowed to stand for 3 to 5 hours; this is intended to clean the moss and deposits that stick to it. The inside of the pipe is then washed using clean water flowing into the tube at high flow speed so that the moss and dirt in the line fall out and are carried away by the flow of water. Next, the clean cooling pipe (Condenser) is reassembled on the Soxhlet device.

It was cleaning the water heater room (Water heater). The water heater in the Soxhlet is cylindrical made of glass in which there is a pair of electrodes made of stainless steel. The cleaning step is to fill the heating chamber with a dilute NaOH solution and then let it stand for 3 to 5 hours; this is intended to clean rust and scale attached to the electrodes, then wash using clean water flowing into the heating chamber with a high flow speed so that rust and scale that sticks to the electrodes fall out and are carried away by the flow of water so that the heating chamber becomes clean.

2.2. Installation of the circuit for cooling water circulation

A tub made of fiber with a capacity of 20 liters is equipped with a pump to drain water and a thermometer to control the temperature of the water used; an elastic-plastic hose is installed to drain the cooling water. Some of the flowing water is used as a steam feeder to be heated as a producer of heat energy. . Furthermore, the exhaust pipe from the cooler is connected to an elastic-plastic hose so that the water is used for the cooling process flows back from the cooling tube to the reservoir.

2.3. Operation of the appliance with exhaust water AC circulation system

After ensuring that the cooling duct pipe and heating room are clean, the tool is appropriately and properly connected. Then the tub is filled with AC wastewater from the reservoir by measuring to determine the initial volume, and then the water pump is turned on so that the water is pushed into the hose leading to the drain. Heating chamber (Steam) and cooling chamber (Condensor) until it flows back into the reservoir and then ensures no leaks.

The experiment in this study was designed to obtain data on the amount of AC waste water used during the extraction process, the impact of using AC waste water on the cooling pipe, and the impact of using AC wastewater on the heater plate and heating room (Steam). The experiment was carried out by:

a. To obtain data on the amount of AC wastewater used during the extraction process. The tool (Soxhlet) is turned on for the extraction experiment for 3 or 4 hours, periodically checking the thermometer as a water temperature indicator. Suppose there is an increase in water temperature. In that case, the effort to stabilize the water temperature is by inserting the Cool pack into the water bath to stabilize the temperature by room temperature. After the extraction experiment was completed, the Soxhlet was turned off and then measured the AC waste water, which was used to obtain data on the reduction (shrinkage) of water used in heating in the heating room (Steam). This experiment was repeated several times for the extraction process.
b. The impact of air conditioning wastewater on the cooling pipe. The tool (Soxhlet) is turned on for the extraction experiment for 3 or 4 hours; after the extraction process is complete, the Soxhlet and the water pump are turned off but make sure the water in the cooling pipe does not come out (still soaking) the cooling tube. This experiment was repeated several times for the extraction process.

The impact of air conditioning wastewater on the heating plate (heater) and the heating room (steam). The tool (Soxhlet) is turned on for the extraction experiment for 3 or 4 hours. After the extraction process is complete, the Soxhlet and the water pump are turned off, but it is ensured that the water in the heating chamber (Steam) does not come out (still soaking) the heating plate (Heater). This experiment was carried out several times. Repetitions for the extraction process.

3. Result And Discussion

After testing, it is continued with observations which include:

a. Amount of AC wastewater used during the extraction process.
b. Condition of the cooling pipe, is there any sediment and signs? Moss growth?
c. Conditions in the heating room (steam) and the heating plate (heater), whether the water is cloudy and there are deposits in the heating chamber (steam), and there are signs of crusting on the heating plate (heater)?

From the observations obtained the following data:
a. Amount of AC wastewater used during the extraction trial is as much as 20.15 liters.
b. The cooling pipe on the Soxhlet device looks clean and doesn't grow moss and dirt deposits.
c. The heating chamber and heating plate are clean. There are no deposits attached and no signs of rust.

The extraction trial process took 3 hours (according to the shortest time in the extraction process), that is, according to the capacity of the tub chamber volume was 20 liters, in the first 1 hour trial, the water volume was still constant, and the temperature was relatively stable. Still, starting from more than The first 1 hour, the water began to look a little less, this was because some of the water went into the steam heater to heat the hot steam as a fat flask heater to boil the extraction solvent, so that the volume of water decreased during the trial process (3 hours) which was 150 ml. Furthermore, the water temperature in the reservoir has increased several degrees from room temperature. This is because the water flowing in the cooling pipe above the extraction flask is in contact with hot air from the solvent vapor, so the longer it is in connection with the hot steam, the water temperature increases. Because the function of the AC wastewater here is not only as a steam feeder but also as a coolant, so that cooling runs well and efficiently, the water temperature must be kept cold stable. In implementing this test, we applied it by giving ice cubes to the water reservoir and cooling and increasing the volume of water that is decreasing. With the general method, when the tool is operated, the water flow rate used is generally 2.4 liters/minute, so if the device is tested and worked for 3 hours, it consumes 432 liters of water.

The cooling pipe on the Soxhlet apparatus is made of glass that forms a spiral circle inside a glass tube, with a spiral diameter of about 5 mm and a cooling glass tube diameter of about 5 cm and a pipe hole of about 2.5 mm in diameter, with helical pipe conditions in such a complicated way that it can be it is said that this cooling pipe is a tool that is very vulnerable to breakage, easy to get dirty and difficult to clean, so it needs special attention in its operation and maintenance, for that, it is necessary to use clean water with low ions and low hardness. With the use of AC wastewater during the trial process up to several months after the trial, the cooling pipe still looks clean. There is no growth of moss and deposits attached to the pipe surface.

The heating chamber in the Soxhlet device is a place to produce steam which is then flowed to heat the fat cup so that the solvent evaporates. Inside the heating room, there are a pair of heating plates (heater), a couple of containers that carry electricity when filled with water then a healing process occurs. If the water used for heating contains minerals, there will be movement on the surface of the plate, and the longer the buildup occurs, it will interfere with the tool's performance. In trials using AC wastewater that is low in ions and free from minerals, the heating chamber and heating plate appear clean. There are no signs of rust, and no deposits occur.

4. Conclusion

From the research results above, it can be concluded that with the circulation method, the efficiency of saving the use of clean water is 410.5 during the operation of the tool with a time of 3 hours. There is no growth of moss and deposits adhering to the surface of the pipe, and the cooling line still looks clean. There are no signs of rust and no assurances on the heating plate so that the tool's performance can be maintained.

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