Solar ray collector

OBJECTIVE:

1. To determine the efficiency of the solar ray collector under various experimental conditions. Illumination with a halogen lamp. Water temperature? 20°C.

- a) Complete collector
- b) Collector without glass plate

2. Illumination with a halogen lamp. Water temperature? 60°C.

- a) Complete collector
- b) Complete collector, a cold jet of air impinges
- c) Collector without glass plate
- d) Collector without glass plate, a cold jet of air impinges

INTRODUCTION: Solar ray collectors transform solar radiation into heat and transfer that heat to water. Then solar heat can be used for heating water, to back up heating systems. The heart of a solar collector is the absorber, which is usually composed of several narrow metal strips. The carrier fluid for heat transfer flows through a heat-carrying pipe, which is connected to the absorber strip. In plate-type absorbers, two sheets are sandwiched together allowing the medium to flow between the two sheets. Absorbers are typically made of copper or aluminum.

Theoretically, solar collectors transform solar radiation into heat and transfer that heat to a medium (water, solar fluid, or air). Then solar heat can be used for heating water, to back up heating systems. The efficiency of a solar collector is defined as the quotient of usable thermal energy versus received solar energy. Absorbers are usually black, as dark surfaces demonstrate a

particularly high degree of light absorption. The level of absorption indicates the amount of solar radiation being absorbed which means not being reflected. As the absorber warms up to a temperature higher than the ambient temperature, it gives off a great part of the accumulated solar energy in form of heat rays. The experiment we can observe that the temperature increases for collectors with glass is lesser than the collector without a glass. This is because for the condition without a glass plate, the light emitted from the halogen lamp not being reflected. Thus the light is emitted directed to the solar ray collector and gives their full efficiency without any disturbance or obstacles.

In another scenario, a collector with the glass plate, the light that emitted from the halogen lamp is being reflected by the glass plate and also reduced the heat that crosses from the glass to the solar collector and hence reduced their efficiency. When the glass is placed, the maximum efficiency recorded was 0. 23 and when the glass is not used the maximum efficiency reached 0. 29. Efficiency indicates how well an energy conversion or transfer process is accomplished. We can say that when we use heated water around 60 C, we can see that PN becomes constant zero at the end of the time for natural air with glass. This is because the inlet and outlet temperature have become the same. So we can say that there is no useful power in the system. For the experiment that using the blower, the useful power and efficiency of the absorber for the blower without a glass plate is higher than the blower with a glass plate. This is because the air from the blower relieves the heat from the surface of the absorber thus directly reducing the effectiveness of the

absorber significantly. There are several errors that occurred while we doing the experiment.

First is as parallax errors, for instance, the reading of the thermometer not taken precisely. Thus it might be given a slight error in the data. If the parallax errors occurred, it might influence the results and calculations that we got. Secondly is to get the temperature of water at 60 Celsius°C and sometimes the temperature drop and affected the heat exchanger. Besides, we are having difficulty in order to maintain the flow rate of 100 cm3/min, because it sometimes goes down and up. Thus we have to check it frequently and its quite disturbing because we also need to take the measurement for every minutes for 15 minutes. Moreover, the thermometer is not precise because its scale is only 0. 5. Thus it is very difficult to get the correct measurement.

CONCLUSION: In conclusion, we can say that this experiment has achieved its objectives since we can determine the efficiency of the solar ray collector under various experimental conditions. In this experiment, we can say that, the greater the heat losses of the absorber the higher its temperature. Although there a lack of technique in handling the apparatus, we managed to complete the experiment with the guide of the instructor.