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EXPERIMENTAL ANALYSIS OF THE EFFECT ADDITION HEAT COVER IN DISTILLATION REACTOR

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Abstract. The process of separating two or more components in a liquid based on the boiling point of the substance is called distillation. Research on the distillation column or reactor has been carried out to improve the distillation system but is still discussing the reactions occur. Based on the second law of thermodynamics known as exergy analysis to obtain information about thermodynamic efficiency and locations of energy efficiency so that energy savings can be made. Distillation reactor as one of the main tools is very important points.
The addition of protective layer on the distillation reactor aims to reduce heat losses occur. Heat protection materials used in the form of jute and glass wool. The prototype of the distillation apparatus with this coating will be applied to the community as an appropriate technology. The combination of 3 cm jute on inside and then 3 cm glass wool gave the highest heat transfer value is 7864.21 watts.

Keywords : jute, glass wool, distillation. reactor.

1. INTRODUCTION

The process of separating two or more components of a substance based on their boiling points is called distillation. The reactor is the main component in the process of separating substances. The temperature is gradually increased to be able to evaporate the substance, the steam flows through the connecting pipe to the condenser. The phase change process from vapor to liquid occurs in the condenser.

Several studies discuss the reactions that occur in the reactor. The heat load Q as the x-axis and the carnot efficiency, 1 - T0/T as the y - axis are described using availability diagrams based on thermodynamic analysis [1-4]. The heat source path will always be higher than the heatsink path, the temperature at the heat source is always greater than the temperature at the heatsink, the distance between of two path is the energy lost [5-7]. Energy requirements and energy loss due to the distance are still an obstacle. Based on the exergy analysis, information about the efficiency of heat transfer and the location of heat loss can be obtained so that energy savings can be made [8-12]. This research has not provided a solution to overcome the problems that occur.

The distillation reactor is the main component in the separation step. Planning, manufacture and analysis of the reactor are the main concerns in every distillation process [13-16]. The energy used in the purification process has a greater percentage of the energy that can be obtained, which results in a purification efficiency of 11 % and technical efficiency of 20 % [17][18]. The energy needs of this research to produce distillates are still very large.

The temperature difference in the thermosyphon cover is affected by the heat - protective layer [19][20]. A decrease in temperature of 20^0 C on indoor floor tiles as the effect of adding carpet [8]. The addition of a heat protective layer in the reactor is expected to have an effect of the thermodynamic process. The distillation reactor which is the most important part of the system, is a major concern in energy efficiency efforts. Heat protection material from glass wool and jute because they are easy to find and maintain. The distillation apparatus is designed to be prototyped and implemented for rural communities which is the application of appropriate technology.

2. METHODS

2.1. Design

The process of making alcoholic beverages with raw materials for coconut or palm tree sap in the community still uses a traditional tools. The raw materials needed are 16 liters of palm sap to get 1 liter of alcoholic beverage, the heating time of the raw materials is about 3 to 4 hours. The heat transfer that occurs and the heat loss in the reactor results in a long production time.

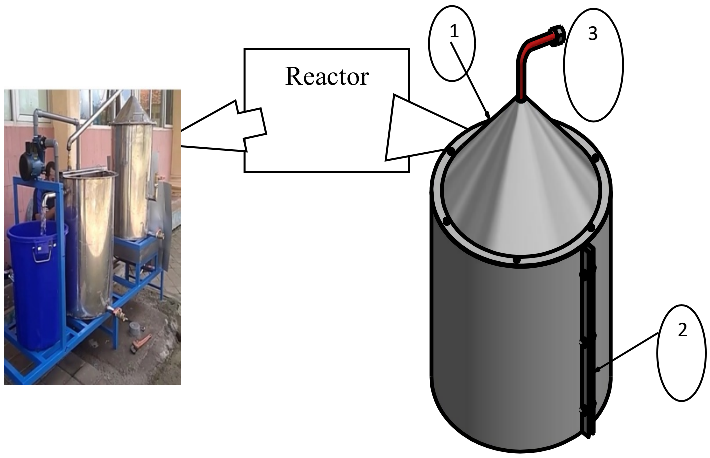

Figure 1. Distillation Tool

The addition of a protective layer on the distillation tube is made to retain heat. The addition of this layer is expected to increase the efficiency of production time. The heat protection layer reduces conduction and convection heat loss. The tube is closed to prevent any steam from escaping. The temperature is increased gradually by LPG burner to vaporize the substance. The steam flows through the connecting pipe and undergoes a phase change to liquid when it enters the spiral pipe in the condenser.

2.2. Research instrument

The fixed variables in the test are time and temperature used, while the independent variable is the heat transfer value. The test was carried out for 60 minutes for one process and data collection was carried out every 15 minutes. The test was carried out 5 times with the same reactor time and temperature in each process.

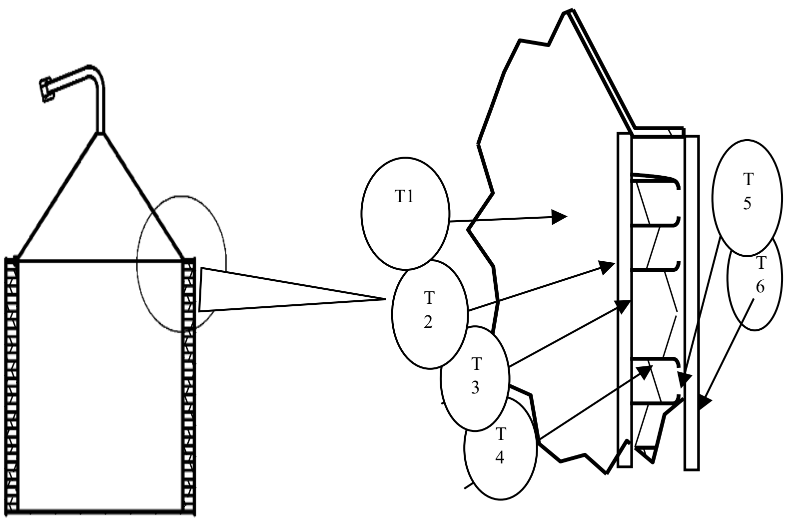

Figure 2. Location of data retrieval

3. RESULTS

3.1. *Result Of Data*

The materials used are glass wool and jute because they are easy to find and maintain. The heat protection layer is varied according to the research needs. The models is made like using only glass wool or jute and a combination of glass wool and jute. The thickness and variation of the heat protective layer material from 4 cm to 6 cm. The resulting data is as in Table 1.

Table 1 Result of experimental data

Time (min)	Heat Transfer							
	4cm Glasswol	4cm Jute	2 cm Glas swoll 2 cm jute	2 cm jute 2 cm Glas swoll	6cm Glass woll	6cm Jute	3 cm Glass woll 3 cm jute	3 cm jute 3 cm Glass woll
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
15	1130.54	1769.34	375431	3498.17	827.67	634.78	4231.19	4161.58
30	4327.30	3057.60	5129.38	4704.63	2136.92	877.36	5415.93	5337.00
45	8595.16	4433.69	6682.55	6498.53	6036.66	1628.66	7335.53	8189.64
60	7081.76	4532.79	9972.47	9149.16	8485.84	3303.01	10715.41	10916.46
75	6772.19	8657.05	9527.75	8854.45	7862.65	8546.09	10108.69	10238.27
90	5589.50	7850.73	9023.64	8808.16	6950.15	7147.84	9318.96	9410.06
105	4401.42	7167.30	8075.96	7832.10	5745.92	6488.28	8755.46	8921.82
120	3724.94	6633.02	7656.04	7343.44	4754.10	6166.77	7181.49	7947.37
135	3186.22	5683.89	6623.69	6366.34	3630.55	5339.09	6742.97	7224.95
150	2692.24	4941.31	5310.75	5389.66	2140.27	4835.31	5519.68	6295.00
Rate	4750.13	5472.67	71175.65	6844.46	4917.07	4496.72	7592.53	7864.21

The phenomenon of heat transfer that occurs is analyzed by graphical method. Descriptive method is used to describe the ability of the coating to withstand heat transfer. The phenomenon of heat transfer can be described as in Figure 3.

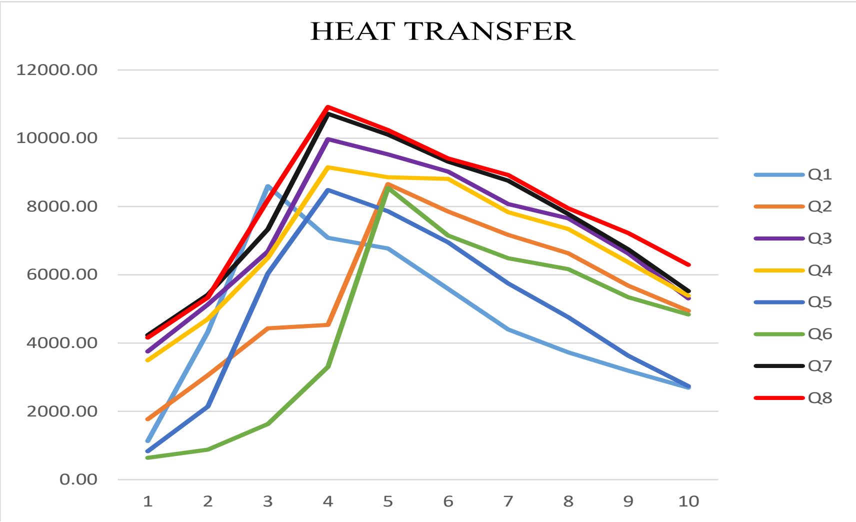

Figure 3 Heat transfer graph

The heat transfer that occurs due to the addition of a heat shield on the reactor can be seen in figure 3. Significant heat transfer occurs as a result of the addition a heat shield layer according by the variations made. Significant temperature differences as a result of layer variations affect to the heat transfer value. The smallest heat transfer value obtained from the heat protective layer only uses jute with a thickness of 6 cm is 4496.74 watts. Jute must have fibers that are not tight so that it affects to the heat transfer. The heat protection layer of glass wool with denser fibers is also not able to provide a good heat transfer value. The heat transfer value is 4917.07 watts with a layer thickness of 6 cm. The alloy of heat shielding material has a significant effect on its heat transfer value. The combination of 2 cm glass wool and 2 cm jute gives a value of 6844.46 watts where the inside uses jute and the outside uses glass wool. Alloys with the same thickness by swapping the inner side using glass wool and the outer side using jute provide a heat transfer value of 7175.65 watts. From the graph, it can be seen that the mixture of jute on the inside with a thickness of 3 cm and glass wool on the outside with a thickness of 3 cm gives the highest heat transfer value, which is 7864.21 watts (Q8).

4. CONCLUSION

1. The type of heat protection material affects the value of heat transfer occurs.
2. The alloy of the heat shield type can provide the best heat transfer value, which is 7864.21 watts

5. ACKNOWLEDGEMENT

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