Abstract

NUMERICAL SIMULATION AND EXPERIMENTAL STUDY PERFORMANCE OF V-GROOVE SOLAR COLLECTOR ABSORBER WITH TRIANGLE OBSTACLE ADDITION ARRANGED IN ALIGNED

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Solar energy is one of alternative and renewable energy that produces no pollutants, it is very easy to obtain, innecpensive, and plentiful, especially for countries that are on the equator such as Indonesia. The use of solar energy can be applied into many things, one of them for drying with using a solar collector. To make a solar air heater more economical, then the thermal efficiency should be increased. One effort is to improve the heat transfer coefficient between absorber and fluid by increasing the convection heat transfer coefficient by creating turbulence in the heat transfer area. This can be achieved by providing a disorder of the airways below the absorber with obstacle addition.

With using the obstacle the turbulence will increase, but also pressure drop will increase. For that we need to find the spacing and the optimum size of the obstacle in numerical simulations using Gambit 2.2.30 and Fluent 6.2.16. From this modeling obtained the optimum size of the obstacle is M with the distance of 1e. Then, the experiments using this obstacle. Solar collector system used is a v-groove absorber collector with the addition of a triangular obstacle with zinc material. Data retrieval implemented with velocity variation of fluid by adjusting
the flow rate, from 0.5 m/s, 0.6 m/s, and 0.7 m/s with range of data retrieval time between 10.30 AM to 12.30 PM.

Cover glass and absorber temperatures, $U_L$ and $q_{loss}$ in solar collectors with an obstacle lower than solar collectors without any obstacle. Used Energy and efficiency of the solar collector with an obstacle greater than the solar collector without any obstacle. Highest useful energy of 42.14 Watt solar collectors on the obstacle which is achieved on July 2, 2011 at 11:50 with the fluid inlet velocity of 0.7 m/s. The highest efficiency solar collectors on the obstacle is 8.21% which is achieved on July 2, 2011 at 10:50 with the fluid inlet velocity of 0.7 m/s. The performance of the v-groove solar collector with the addition of an obstacle will be better than the v-groove solar collector without an additional obstacle.

Key words: solar collector, v-groove absorber, aligned triangular obstacle, the total heat transfer coefficient, useful energy, the efficiency of the collector.