Abstract:

An experimental and theoretical study has been done to investigate the thermal performance of different types of air solar collectors, in this study air solar collector with a dimensions of (120 cm x90 cm x12 cm) , was tested under climate condition of Baghdad city with a (43° tilt angel) by using the absorber plate (1.45 mm thickness, 115 cm height x 84 cm width), which was manufactured from iron painted with a black matt.

The experimental test deals with five types of absorber :-

(a) Conventional smooth flat plate absorber.

(b) Fins on the absorber .

(c) Corrugated absorber plate.

(d) Iron wire mesh on absorber.

(e) A matrix of porous media on absorber .

The studies have been performed on the three different values of mass flow rate (0.016 kg/s to 0.027 kg/s) for each type of collector and then the porosity for the collector type (e) was tested by changing the porosity of porous media .

The hourly and average efficiency of the collector were considered to compare the thermal performance of the air solar collectors.

In the theoretical part of the study, a typical air solar collector model has been performed to build a standard software for testing any type of air solar collectors with local weather data .

In the experimental study it can be seen by using some obstacle material to the air flow (fins, corrugated absorber plate, iron wire mesh porous media on the absorber) could be enhanced the efficiencies not less than 4 % for finned type and 8 % for corrugated and 25 % for mesh and 30 % for porous media comparing with flat plate (smooth) collector .

Theoretically, the results showed that the collector with high convention heat transfer coefficient porous media have high hourly efficiency about (η = 56 %) and iron wire mesh on absorber (η = 52 %). on the other side the minimum performance occurred in the flat plate absorber (η = 28 %).

Comparison of results reveals that the theoretical predictions agree reasonably well with experimental results. The difference between the theoretical and experimental efficiency in general was between (1─15 %).