Abstracts

Ventilation by solar chimney is one of the effective passive methods to help reduces energy consumption in air conditioning systems. Previous research finds the solar heat collected in the solar chimney increases ventilation rate and air velocity in the occupied room and produces thermal comfort condition to the occupants, especially in row houses.

This research focuses on the efficiency of ventilation of the solar chimney as a result of various heat gains. The experiment is carried out in a controlled room. The experimental model is 2 meters wide, 2 meters long, and 2.4 meters high, with an air inlet of 0.15 meters high at the bottom of the box, and with the solar chimney of 0.2 meters wide, 2 meters long, and 1.9 meters high on the top of the box. Installed within the solar chimney are mirrors and black-sprayed aluminum, to help keep as much heat in the chimney as possible in order to maximize the buoyancy effect. The model is provided with the heat similar to natural solar intensity at the rates of 300-800 watts per square meter.

The results are then compared with the mathematical model that predicts the air flow rate as a result of various heat gains. It is discovered that the flow rate varies according to the intensity of solar radiation. The lowest air flow rate is 0.03 m^3/s at the heat radiation of 300 watts per square meter, and the highest air flow rate is 0.11 m^3/s at the heat radiation of 800 watts per square meter. It is also found that every 100 watts per meter of heat radiation given to the chimney will increase the air flow rate by 0.01 m^3/s. The results from the mathematic model are slightly higher than those from the experimental model but share the same trend. The results obtained from this research lead to the design guidelines of row houses located in hot-humid climate and knowledge applicable to various global climates.