**Performance Analysis of a Double Pass Solar Air Thermal Collector with Porous Media Using Lava Rock**

## ABSTRACT

This paper investigates double-pass solar air thermal collectors with lava rock as the porous media. The addition of lava rock serves as short-term sensible thermal storage for a solar drying system. It also enhances the convective heat transfer rate to the airflow due to an increased heat transfer area and increased turbulence in the air channel. A mathematical model was developed based on energy balance equations and was numerically solved in MATLAB. The collector's thermal performance was studied at various levels of solar intensity and at different wind speeds for different design parameters: collector size, air mass flow rate, and lava rock volume. From the study, the optimum efficiencies that were obtained in the range between the intensities of 500 W/m2 and 800 W/$m^2$ were 62% to 64%, respectively, with an optimum flow rate of 0.035 kg/s. The optimum porosity of about 89% was selected for the collector by considering the pressure drop and thermal efficiency. An optimal temperature output range between 41.7 °C and 48.3 °C could be achieved and was suitable for agricultural and food drying applications. Meanwhile, compared to conventional DPSAHs, the average percentage increase in the output temperature of the DPSAH with lava rock was found to be higher by 17.5%.