EFFICIENCY OF A COMPOUND PARABOLIC CONCENTRATOR KITCHEN IN IZTAPALAPA, MEXICO CITY.

E. Barrera Calva[1] , E. Rincón Mejía [2], E. Antaño Díaz[1], Verónica Frías[1], J. Hernández[3] Federico González[1], Ricardo Rosas[1]

[1]Autonomous Metropolitan University
[2]Automomous University of Mexico City
[3]Solar Module

Casa abierta al tiempo

CONSOLFOOD 2018
Advances in Solar Thermal Food Processing

RED MUJERES EN ENERGÍA RENOVABLE Y EFICIENCIA ENERGÉTICA

UAlg ISE
UNIVERSIDADE DO ALGARVE
INSTITUTO SUPERIOR DE ENGENHARIA

Abstract

A Tolokatzin variant composite parabolic concentrating solar cooker is built, a thermal analysis is carried out, the axial, radial temperature profiles inside and outside the tube are obtained at different times of the day and its thermal performance with food inside to demonstrate its capacity to mitigate greenhouse gases and the benefits that would be obtained from being implemented at the city level, as well as at the national level.

Proposal

Taking into account the high concentrations of pollutants that exist in the air in a city as populated as Mexico (8.918 million inhabitants) and the health problems that are there, it is necessary to attack the problem. A very good strategy to breathe a cleaner air in cooking food that uses solar energy.

Description

An effective area kitchen of 0.791 m^2 is built, with a Polished Stainless Steel Absorber tube with a black coating of electrodeposited black Cobalt with an outer diameter of 0.11 meters, the reflector material is polished steel sheet mirror, the clear glass cover and as polyurethane foam insulation.

Experimentation and measurements

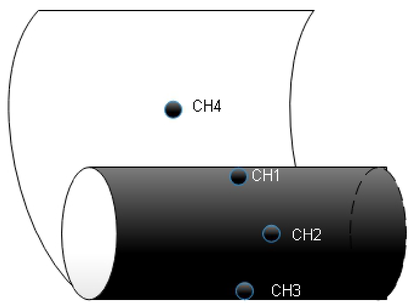

Figure 1. Thermocouples placed radially and another on the surface

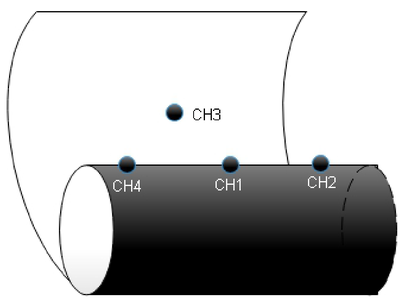

Figure 2. Axial temperature measurement

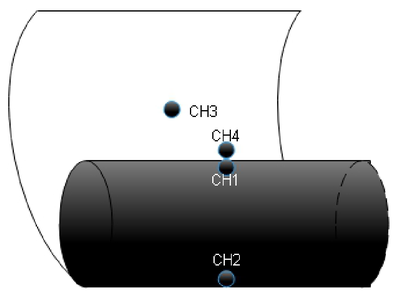

Figure 3. Temperature inside and outside the absorber tube

Figure 4. Some dishes, a user of the solar cooker, absorber tube and solar cooker

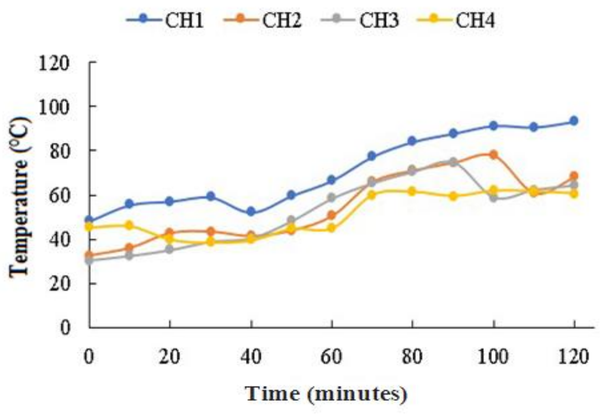

Figure 5. Temperature against time for different regions of the absorber.

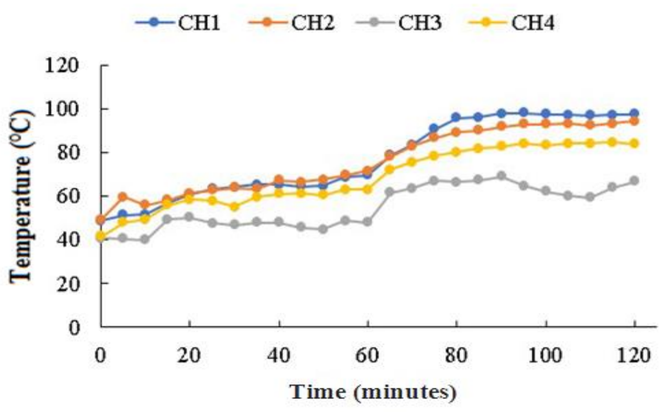

Figure 6. Temperature profile axially in the absorber tube

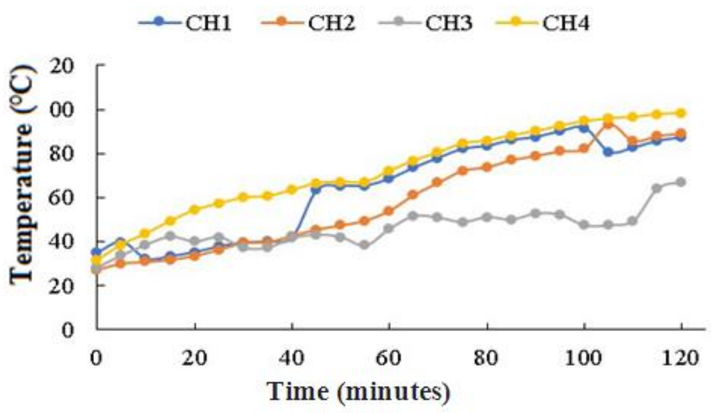

Figure 7. Profile of temperatures inside and outside the absorber tube

Methodology

- Design
- Building
- Instrumentation
- Experimentation
- Measurement
- Analysis
- Conclusions

Measurement of the radial, axial temperature inside and outside the absorber tube.

Thermal Profile & Efficiency

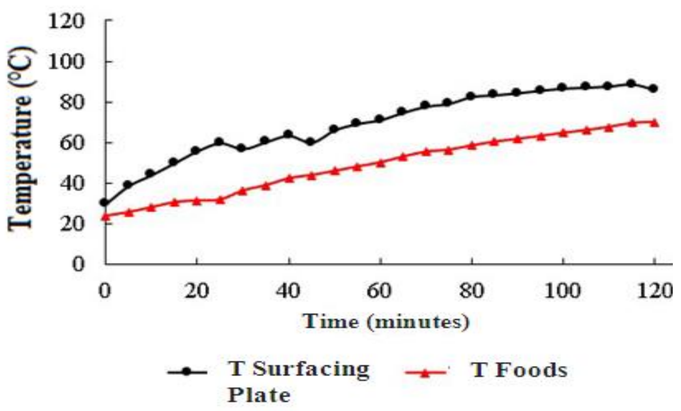

Figure 8. Profile of temperatures on August 14

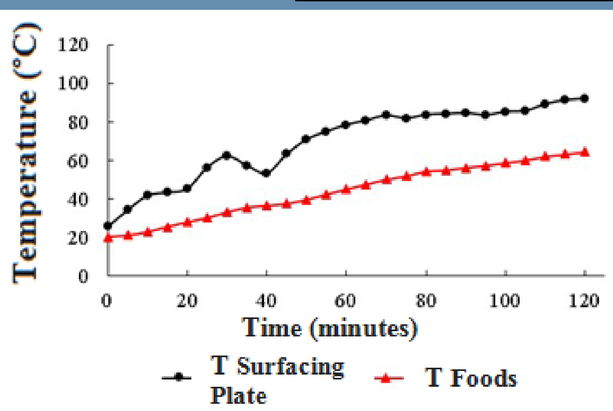

Figure 9. Profile of temperatures on August 18

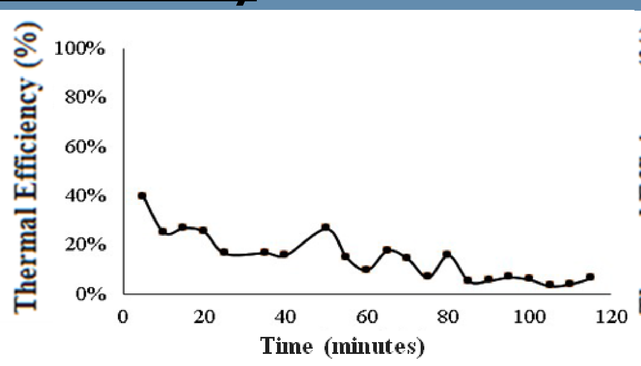

Figure 10. Thermal efficiency versus time for August 14

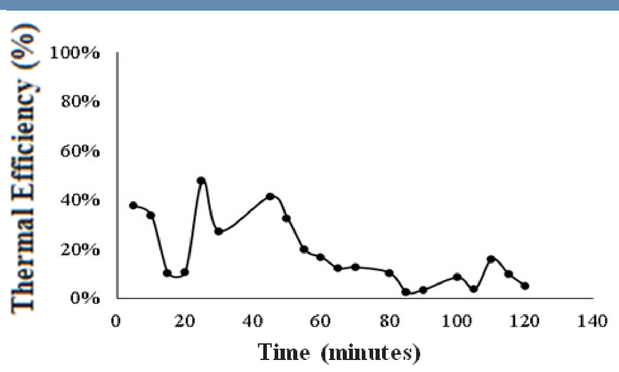

Figure 11. Thermal efficiency versus time for August 18

Thermal Profile and Thermal Efficiency, with food.

Conclusions

By placing in the sun a solar cooker with food on August 18 in Mexico City, with a level of insolation of the order of 5.3 kWh/m^2, that leads to a thermal efficiency of the order of 17.88%. Assuming that the solar cooker is used in a day at least 3 hours in the home, the heat used is 1.96 MJ, which represents the energy displaced by fossil fuels, which represents savings in one day. Taking into account its useful life of 15 years, the energy saving could reach 10.71 GJ unitarily. The scope and impact that this solar technology could have is the reduction of 1.43 MtCO2 nationwide.

References

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