Solar oven for intertropical zones: Optogeometrical design

O.A. Jaramillo a,*, G. Huelsz a, G. Hernández-Luna a, J. A. del Río a, R. Acosta b, L. G. Arriaga c

a Centro de Investigación en Energía, Universidad Nacional Autónoma de México, Priv. Xochicalco S/N, Col. Centro, Temixco, Morelos 62580, Mexico
b Universidad de Quintana Roo, Boulevard Bahía s/n Esq. I. Cononfort, Chetumal Quintana Roo 77019, Mexico
c Instituto de Investigaciones Eléctricas, Av. Reforma 113, Col. Palmira, Cuernavaca, Morelos 62490, Mexico

Received 14 September 2006; accepted 29 April 2007
Available online 18 June 2007

Abstract

In this paper, a novel design of a solar oven for the intertropical zones is presented. The oven box has seven faces instead of the six faces of most common designs reported in the literature, two of them are alternatively used as bases. This oven has four fixed mirrors to concentrate solar energy. The main advantage of this novel design is that the oven needs only four simple movements in order to obtain an adequate solar concentration throughout the year. This feature has been possible due to the optogeometrical design that is presented. A simple theoretical model of the oven concentration is developed. According to the model, the concentration achieved by the oven at noon is greater than 1.95 for all days of the year. In order to analyze the optical performance of the solar cooker, an experimental evaluation was conducted by using a scale model of the solar cooker and a heliodon.

© 2007 Elsevier Ltd. All rights reserved.

Keywords: Solar box cooker; Intertropical zones; Geometry; Concentration

* Corresponding author. Tel.: +52 555 622 9835; fax: +52 777 325 0018.
E-mail address: ojas@cie.unam.mx (O.A. Jaramillo).

0196-8904/$ - see front matter © 2007 Elsevier Ltd. All rights reserved.
doi:10.1016/j.enconman.2007.04.021