Thermal performance of a solar hybrid dryer for Conilon coffee (*Coffea canephora*)

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Introduction

- Coffee is one of the products with highest costs in the drying process;
- Conventional methods of drying coffee is a relatively slow process that can lead to considerable losses of product quality, requiring extensive areas and long drying time and can be use energy sources;
- Several studies are being developed to improve and increase the efficiency of solar dryers;
- Design and development of an energy efficient hybrid solar-electric dryer (HSED) suitable for drying of organic Conilon coffee placed in the town of Seropédica, Rio de Janeiro, Brazil.

Material and Methods

- Laboratory of Rural Electrification and Alternative Energies

a)

b)

Figure 1. HSED a) Solar collector (SC), drying chamber (DC), photovoltaic panel and b) Conductive air channels

- Energy and drying efficiency - thermal performance of the HSED;
- Monitoring - Temperature and relative humidity of the drying and ambient air, solar radiation intensity and coffee weight;
- Drying time - 07:00 to 17:00 h, totalling 120 h of operation with an intermittent period (at night) of 14 h;
- Effective drying period - 60 h
- Intermittence - the exhaust system kept off and solar collector and drying chamber sealed.

Results

- Temp and RH - 38.3 °C and 60.6% outlet of the SC, 32.7 ºC and 72.2% outlet DC and 27.8 ºC and 74.5% ambient air.
- Maximum T - 53.8 SC, 41.6 ºC DC and 31.6 °C ambient air at 12:00 h.
- The solar collector and dryer chamber efficiency were 29.1 and 40.8%, respectively, while the overall dryer efficiency 43.2%.

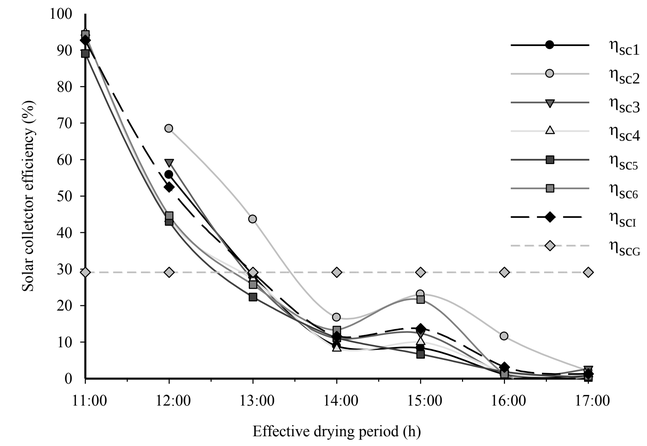

Figure 2. Thermal, instantaneous and global average efficiency of the solar collector throughout the drying period

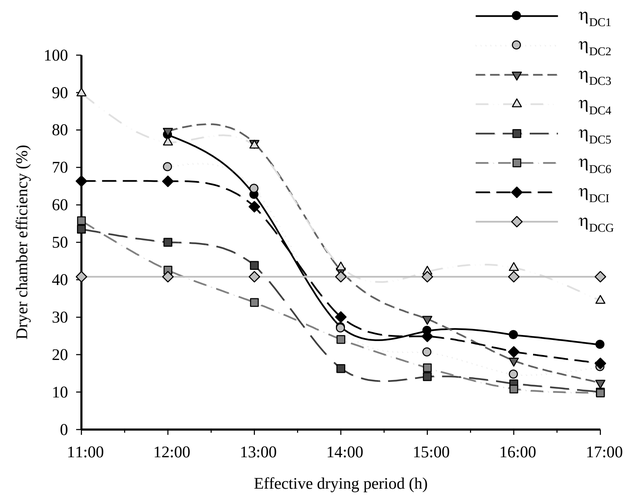

Figure 3. Thermal efficiency of the drying chamber of the hybrid solar-electric dryer over the drying period

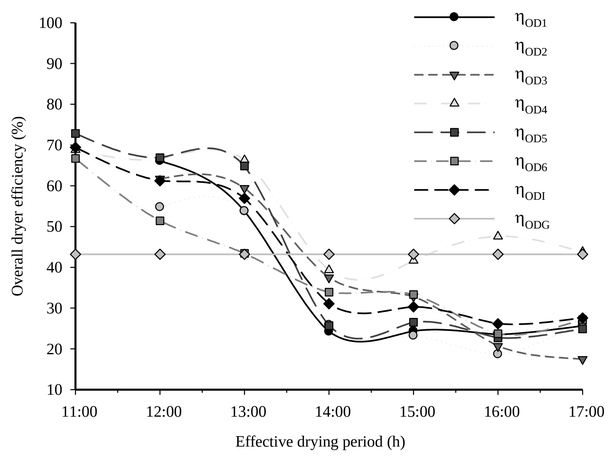

Figure 4. Overall thermal efficiency of the hybrid solar-electric dryer over the drying period.
(ηODn – Overall dryer efficiency; n – drying day; I - Instantaneous; G - Global).

Conclusions

- As most of the producers still use conventional drying methods, the data obtained in the present study allow us to say the hybrid solar electric dryer proved to be an economically viable and economical tool for processing coffee in small rural properties, and can be applied to other agricultural products.

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