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Performance evaluation of an Inflatable Solar Dryer for maize and the effect on product quality compared with traditional sun drying

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Introduction

- Maize in Uganda, an important staple food, is often harvested during rainy season.
- Inflatable solar drying has proven to be an effective alternative to traditional open sun drying for drying crops in the tropic and subtropics regions.
- The objective of this study was to evaluate the performance of an inflatable solar dryer (ISD) for maize drying and its effect on product quality compared to open sun drying (OSD).

Material and Methods

- Three batches of maize were dried using an ISD (SBD 50, GrainPro Inc., the Philippines) in Gombe, Wakiso District, Central Uganda.
- ISD is a mobile collapsible dryer design with a length and width of 26 and 2 m, respectively.

Fig 1. Inflatable Solar Dryer with nominal capacity of 1000 kg maize.

- ISD is made of UV stable transparent polyethylene film for the upper part and a black PVC film for the bottom part, which are connected with a zipper.
- Two 12V DC ventilators were installed at the inlet of the ISD and were powered by 2 x 100-W_{peak} solar panels & 75-Ah solar battery.

Results

- The safe storage moisture content was achieved in 2 days using both drying methods.
- The maximum temperature reached in the dryer was 67.5ºC with a relative humidity of 14.2%
- No substantial difference in drying time was detected between the drying treatments.
- Batch 3 maize had been stored for a long period at moisture content of 15.42% before treatment.
- An slight increase in moisture content was noticed on the third day as the humidity increased in the night.
- Batch 3 with relatively lower moisture was dried in 2 days.

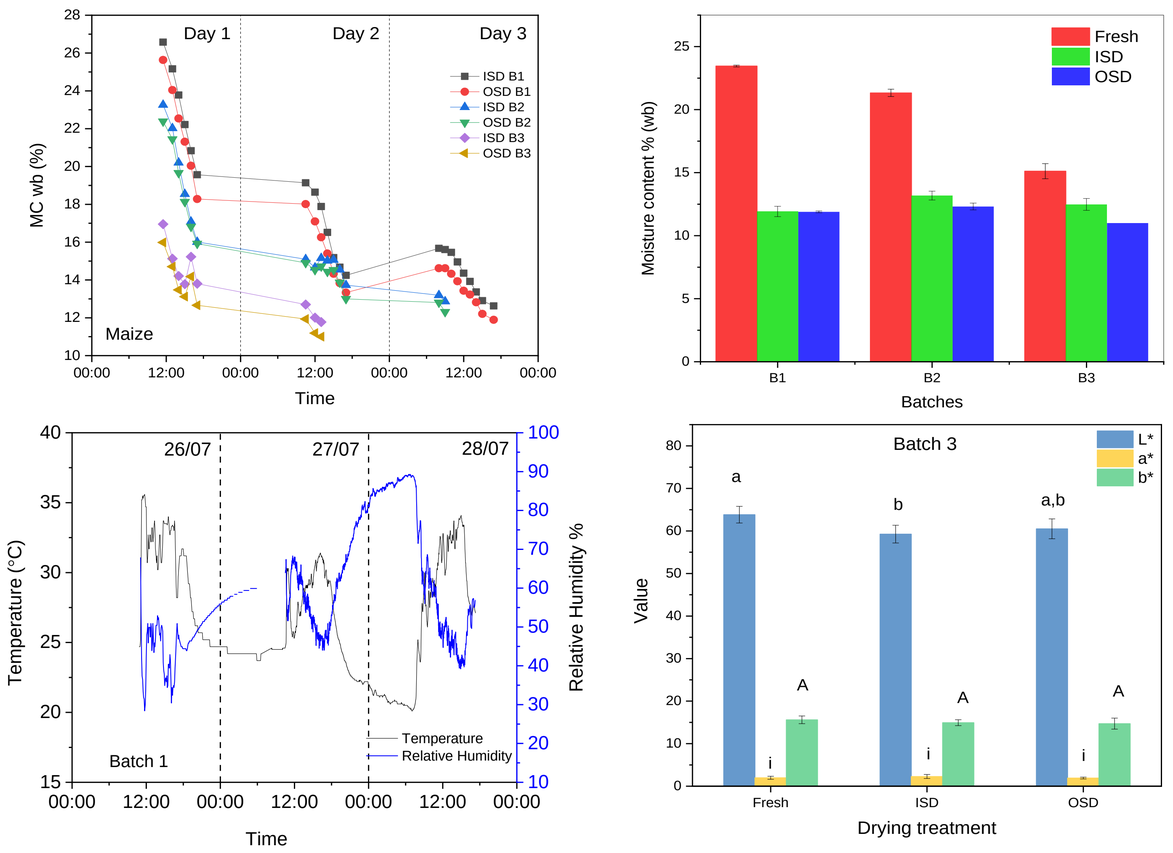

Fig 2. Drying curves (top left), final moisture content graphs (top right), temperature/relative humidity plots (bottom left) and colour plots (bottom right).

- Batch 1 and 2 showed an aflatoxin contamination lower than the standard limits while in batch 3, contamination was manifold higher.

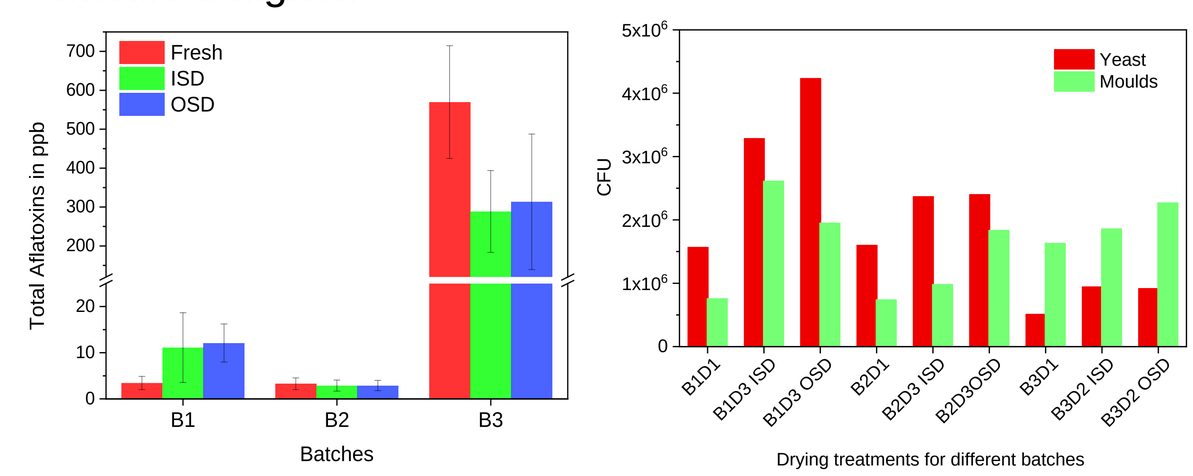

Fig 3. Total aflatoxins content (left) and yeast and moulds colony count (right, B1D1 stand for Batch 1, Day 1).

- The high initial moisture content in batch 3 explains the high contamination in aflatoxins compared to other batches.
- Yeast and molds varied with treatments and time.

Conclusions

- Application of ISD showed a great potential to dry maize and preserve the quality during hot rainy season and fluctuating weather condition.
- A rapid and non-destructive method to determine the quality of maize should be developed for early detection of the contamination along the whole value chain.

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