Popular Scientific Summary of a Master's Thesis project at Lund University

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Bhutan, a land of breathtaking beauty nestled in the eastern Himalayas. It's where nature's wonders abound, but it also presents unique challenges when transporting goods, including agricultural products. The country's geography, with its narrow paths, poses obstacles to reaching markets on time. This situation leads to spoilage and reduced crop market value, ultimately affecting food availability for consumers and farmers' incomes.

Bhutanese farmers have been using traditional sun-drying techniques to preserve food items. This method involves spreading the food items out in the sun to dry, but this takes a long time and doesn't always work well. It also exposes food to contaminants, pests, and spoilage risks, which affect its quality and safety.

The University of Lund is collaborating with the Royal University of Bhutan and Bhutanese farmers to work on preservation of food techniques in the Himalayas region. The project aims to design a cost-effective solar-powered food dryer.

During ten-week experiments in Bhutan, a solar dryer was tested in the drying process of eggplant. The present solar dryer consists of several components: a heat exchanger, a box-shaped drying chamber, an absorber with a black metal plate to capture the sun's rays, and fans to circulate air. The absorbed radiation heats the surrounding air and raises the temperature inside the dryer, leading to moisture evaporation from the drying materials.

The project's primary objective was to analyze the thermal characteristics of the different components of the solar dryer. Different airflows were evaluated for their effect on the system's performance by changing the fan speed. During this study, a net was added to the absorber and the effects of adding a net were investigated. Throughout the experiments, temperature sensors were strategically placed, allowing measurements to be taken before and after each component in the dryer at different air flows.

It was discovered that increased airflow significantly accelerated the drying process by removing more moisture. Moreover, the study revealed a homogeneous drying process, which shows that after a certain time, all products have dried uniformly, so farmers do not have to shift the product around manually. As a result, the locals' workload is reduced. Because the weather was different during these tests, it is hard to compare how well solar dryer works with and without a net on the absorber. To compare absorber efficiency with and without net, it is necessary to test the design in a controlled environment in the future. Future research could also explore the effects of applying nets with varying orientations to the absorber's surface, providing further insights into the optimization of heat transfer in solar dryers.

This project in Bhutan served as an important step toward enhancing the performance of solar dryers, ultimately contributing to more efficient and sustainable drying practices in the region.