Developing a Prototype of an Efficient Solar-Energy Paddy Rice Dryer for Post-Harvest Applications

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Abstract

Rice drying is a pivotal post-harvest process, particularly due to the essential role of rice as a staple food in Southeast Asia. Traditional drying techniques, which largely rely on natural sunlight, are fraught with challenges, including inconsistent drying times and suboptimal humidity levels, thereby compromising the quality of rice. To tackle these challenges, we have developed an innovative, eco-friendly prototype: an efficient solar-energy paddy rice dryer. This avant-garde system incorporates an automatic control mechanism that ensures optimal drying conditions, thus improving the efficiency and effectiveness of the rice drying process. In the development of this solar-energy paddy rice dryer, we equipped it with relative humidity and temperature sensors to sustain ideal drying conditions and integrated alerts to the Blynk app for remote monitoring and control. Additionally, the prototype features a unique solution for insufficient light conditions: a top-mounted mirror controlled by a light intensity sensor to maximize light exposure and ensure efficient drying. Our findings indicate that this machine consistently maintains stable and precise humidity and temperature levels. Furthermore, the prototype demonstrates superior milling quality over traditional drying methods, with a higher yield rate of 34.90% compared to 33.90% achieved through pavement drying. These results highlight the prototype's capacity to enhance rice quality while reducing drying time from, traditionally, 4 days to, novel, 2 days and promoting environmental sustainability. By conserving electricity and leveraging renewable energy sources, our solar-energy paddy rice dryer contributes to global efforts aimed at reducing carbon footprints and addressing climate change.

Keywords: Milling Quality, Pavement Drying, Solar-Energy