Review of solar drying in the food industry and advanced solar drying techniques for sustainable food preservation

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Abstract

Solar drying is an environmentally friendly and energy efficient method used in the food industry to preserve agricultural products by removing moisture through solar energy. Different methods of solar drying are used depending on the type of food and production scale. The main techniques include open sun drying, direct solar drying, indirect solar drying, mixed-mode drying, and hybrid solar dryers. Open sun drying is the simplest and cheapest method, while indirect and hybrid systems provide better hygiene, temperature control, and product quality. Solar drying can be applied to a waste range of foods such as fruits, vegetables, grains, herbs, spices, fish, and meat products. Common examples include drying mangoes, bananas, tomatoes, chilies, onions, rice, and medicinal plants. At the industrial and business level, solar drying offers a sustainable alternative to conventional electric or fuel-based dryers. Food processing companies and small-scale farmers can use solar dryers to reduce post-harvest losses, increase shelf life, and improve product availability throughout the year. This work describes the importance of solar drying technology in the food industry and explains different methods of solar drying used for food preservation. It also discusses the applications of solar drying for fruits, vegetables, grains, fish, and other agricultural products, along with its benefits in reducing energy costs, improving food quality, and increasing shelf life. Furthermore, this research highlights the future development of solar drying systems through advanced technologies such as artificial intelligence, IoT, and smart control systems to achieve sustainable and efficient food processing solutions.

Keywords: solar drying, food preservation, solar dryer, renewable energy, agricultural products, hybrid solar drying.

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