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Full Length Research Paper

The design and proposal of a thermodynamic drying system for the dehydration of Rosell (*Hibiscus Sabdariffa*) and other agro-industrial products

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Abstract

The proposed solar thermodynamic drying system reduces the traditional dehydration process of Rosell used in the western region of Mexico, from approximately 4 days to 4 h. In addition to the 95% reduction in process time, this system also maintains the Jamaica's nutritional content, especially that of ascorbic acid (vitamin C). The proposed drying system is based on current operating conditions in Colima, Mexico as well as on three quantifiable control variables of Jamaica: product weight, product humidity, and product drying temperature. The

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product control variables were quantified and defined during the project as: Initial weight (1.0 kg of fresh product), final weight (0.152 kg of dry solid), initial humidity (84.8%), final humidity (14.3%) and dry temperature (48 to 68º C). Based on these control variables, the proposed system operates a continuously moving band at a constant speed. As the Roselle moves along the band through the system's drying chamber, it is dehydrated by heated air. Initially, the system uses solar energy to heat fluid (water or thermal oil). The heat generated is transferred from fluid to surrounding air via a forced convection process. By greatly diminishing drying time and controlling humidity, the system affords considerable control over optimal end-product quality (protection from pollutants and destructive microbial activity). The proposed system's settings can be easily adjusted to accommodate other products as well, making it even more commercially viable for agro-industrial producers. The drying process eliminates the water or humidity content of the calyxes yet maintains the nutritional properties specifically, the ascorbic acid content. A low cost and durability of the system is considered in the design.

Key words: Low Cost Solar, Dehydration drying System, Roselle, Thermodynamics System, Agro-Products, Dehydration, Colima, Mexico.
