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MODELLING AND SIMULATION OF PROCESSES BY SMART SENSING: A SOLAR DRYER FOR PLANT MATERIAL

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ABSTRACT Operation and decision making in most processing plants is guided by highly empirical recipes and rules which are too rigid to adapt the process to changes in the external or internal conditions. Such empirical rules often lead plants to operate far from optimal conditions, both in terms of operation cost and product quality. Considerable efforts have been made to develop several types of solar dryers around the globe, which properly designed may prove to be energy saving devices for drying processes. In this study, a small wood dryer has been used for modelling. The drying rate expressed as -dX/dt=f/X (where *X* is DB wood moisture content), allows to identify two different kinetics; 1) for high *X* values (X 65% to 30%) or fibre saturation point (FSP); and 2) for *X* values under FSP, in which diffusion is the mechanism that governs a decreasing drying rate at this stage. A complex drying rate model developed in this work allows the determination of the wood and convective mass transfer at wood-air interface. Validation and application to fruit and plant drying cycles is being carried out. The implementation of three different proposed models is used as the software for a "smart" sensor system, which is based on *Sensirion* sensors (for temperature and relative humidity in the air) and thermocouples for timber temperature.

Keywords: Solar dryers; wood and convective mass transfer; sensor system; Sensirion sensors; thermocouples.