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DYNAMIC SIMULATION OF CA COOL STORAGE SYSTEMS FOR PIP FRUITS

H.B. Nahor[1]; N. Scheerlinck[1]; P. Verboven[1]; J.F. Van Impe[2]; B.M. Nicolaï[1]
[1]Flanders Center/ Laboratory of Postharvest Technology, Department of Agro-Engineering and - Economics, Katholieke Universiteit Leuven, W. de Croylaan 42, B-3001 Leuven, Belgium.
Tel: +32-16-32.26.68 - Fax: +32-16-32.29.55
E-mail: nahor.haddish@agr.kuleuven.ac.be
[2]BioTec-Bioprocess Technology and Control, Department of Chemical Engineering, Katholieke Universiteit Leuven, W. de Croylaan 46, B-3001 Leuven, Belgium.

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Abstract

Nowadays, pip fruits are stored in controlled atmosphere cool rooms for a relatively longer period of time. In order to meet the demands of the consumer for quality of the products after this period, the environment where they are stored should be appropriately and carefully controlled. For effective design and optimization of the involved processes the use of predictive models and computer simulation is essential; not only of the cooled space but also that of the involved mechanical plants such as the refrigeration and gas handling unit and the interaction between these units.

In this paper a model for simulation of dynamic processes in controlled atmosphere cool room storage systems is presented. The model consists of three interacting sub-models, which allow the prediction of transient behavior of the processes in the three units, namely, the cool room, the refrigeration system and the gas-handling unit. Several modules representing each of the components in these units were developed based on energy and mass balances. The modules were then arranged to form the sub-models and in turn, the global CA cool storage system model was formulated by interconnecting the sub-models. The modules are implemented in a computational environment, (EcosimPro) which can handle continuous and discrete events. Moreover, the software allows graphical modeling using modules generated schematically. The modules can be customized by editing the attributes of the model and can be connected to pertinent components to form the desired model.

Simulation of several cool rooms (CA) loaded with different products is possible by using the model, which enables to predict the actual total load imposed on the refrigeration plant and the gas-handling unit. Due to the modular and object-oriented approach greater flexibility with respect to model modification and reusability is achieved. Further, tuning of control parameters can be carried out using the model to improve performance of the cool rooms. In this work the model predictions were compared with experimental results for an empty as well as loaded cool room. The model can be used as a tool for design and energy prediction of CA cool storage systems.