

Fresh Quality Chain Model Helps to Analyze Shelf-life of Minimally Processed Products



IFPA Associate Member: Agrotechnology & Food Innovations Wageningen UR, The Netherlands

The Fresh Quality Chain Model reveals opportunities to extend the shelf-life of fresh-cut vegetables. With this model, Agrotechnology & Food Innovations Wageningen (A&FI Wageningen) gained insight into the role of condensation and micro-perforations in quality decay of minimally processed vegetables.

For fresh-cut vegetables, product quality is a major selling point toward retail. This is also true for Groentehof as a major Dutch processor of minimally processed fruits and vegetables. Based on the fact that modified atmosphere (MA) packaged endive kept under optimal conditions remains fresh considerably longer than under supply chain conditions, the company was interested in finding and evaluating points for improvement. Groentehof initiated a project together with their supply chain partners, farmers and retail and with Carrier in providing cooling facilities for stores. A&FI Wageningen, an expertise center for food processing and modeling, assisted participants by performing several conditioned experiments and developed the Fresh Quality Chain Model. Initially, Groentehof was especially interested in the effect condensed water has on the quality decay. It was suspected that short but high temperature peaks of around 20°C caused condensation of water, which then formed a trigger for further quality reduction.



ified Atmosphere Packaging) Model. The MAP Model is based on physical processes within the package, such as heat transfer, gas exchange, etc. This scientific model was extended with quality attributes as measured in the supply chain and processes relevant to condensation. The model was extended with a user-friendly interface, enabling Groentehof to perform scenario analyses themselves.

Role of the Model

During the project, the FQC Model became the pivot between lab experiments and the actual chain conditions. Experimental data were used to fit the model, which then predicted outcomes for a certain scenario, for example, the effects of a shorter supply chain on the product quality and the shelf life. These calculated results

were then tested under real chain conditions, giving feedback to the model once again. The model also became the central place for collecting all data and knowledge obtained over the years. Furthermore, the model

enables the supply chain partners to elaborate ideas and to analyze possible improvements.

Observations for the Groentehof Supply Chain

The FQC Model revealed that short but high temperature peaks have little influence on shelf life. Also, only very small amounts of condensate due to temperature peaks were predicted by

the model. Hence, condensate due to temperature peaks could not be a main trigger for quality decay. The advice is thus to keep the product as cool as possible, despite short and high temperature peaks in the supply chain.

In addition to the role of condensation, the influence of the atmospheric gas composition was investigated. The impact of different gas-permeability characteristics of the packaging on the shelf life of fresh-cut endive was quantified and modeled. It became clear that the specific packaging characteristics have a great influence on the shelf life of cut endive. This is especially the case when inevitable short temperature peaks occur in the supply chain. If the product's environment becomes anaerobic, then its shelf life decreases dramatically.

Model Yourself

One has to keep in mind that the whole process of refining the model and collecting relevant product-specific parameters is as important as the final results of the scenario analyses. A prerequisite for the approach followed is an open-minded approach toward models. The most important advantage of the FQC Model is that it enables the evaluation of several scenarios prior to testing them in production and the chain.

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Description of the Model

The basis for the Fresh Quality Chain (FQC) Model is the MAP (Mod-

