Technology Offer

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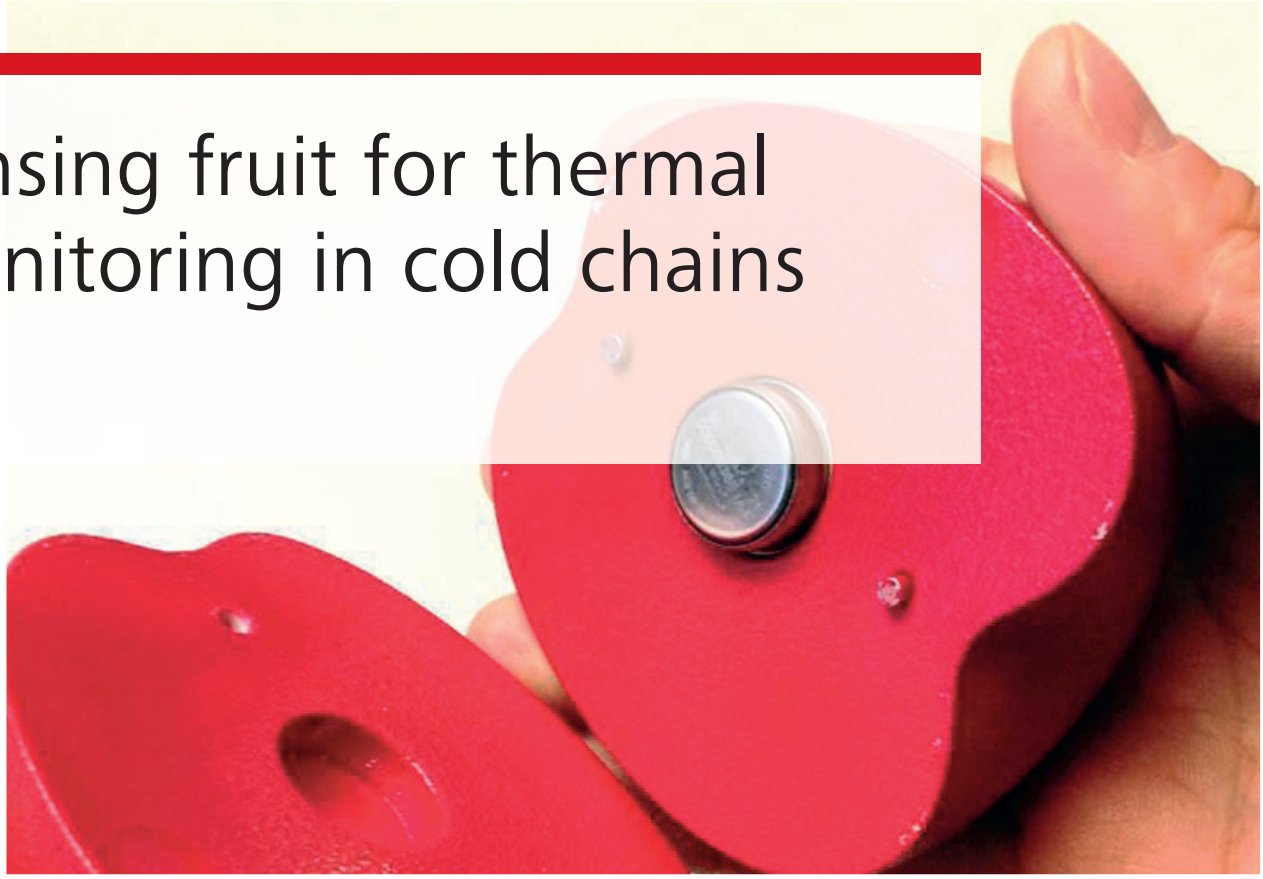
Materials Science and Technology

Sensing fruit for thermal monitoring in cold chains



Invention

An artificial fruit with integrated temperature sensors is designed to match the cooling behaviour of real fruit by using a biomimetic approach. Thereby, the thermal history of fresh produce can be monitored throughout the cold chain in a more realistic way than currently possible.

Background

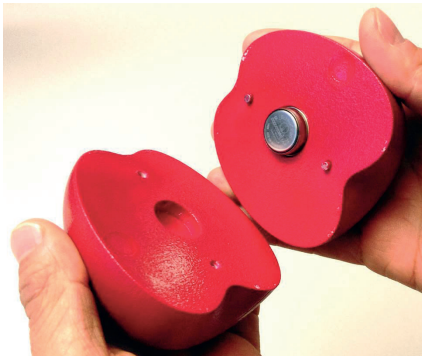
Monitoring the postharvest temperature history of fresh horticultural produce, such as fruits and vegetables, is essential since temperature is the single most important parameter affecting produce quality, deterioration and shelf life. Therefore, temperature is measured in different unit operations of the cold chain, including precooling, transport in refrigerated containers or trucks, and cold storage. The applied technologies include point probes, which wound the fruit and can only be inserted at easily-accessible locations in the cargo, or RFID tags, which measure air – not fruit – temperatures. Currently, no solution is available to track the fruit pulp temperature throughout the entire chain in commercial shipments, particularly at positions deep inside the cargo.

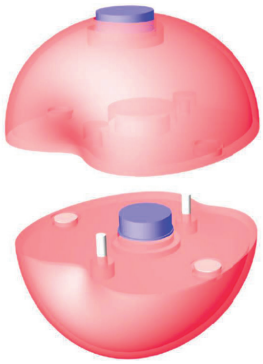
Advantages

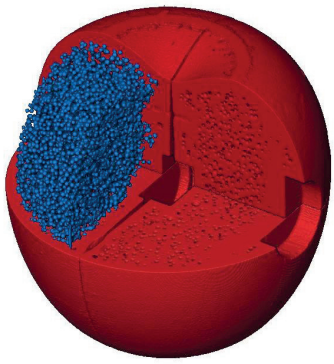
The sensing fruit reacts thermally similar to real horticultural produce since its shape, size, surface texture, color and internal composition are tuned to match those of the fruit species or even cultivar of interest. It can be packed directly with the fresh produce in a commercial setting, by which it can be placed easily at multiple positions in the cargo. Thereby, the sensing fruit accompanies the cargo throughout the entire cold-chain journey. The airflow or cooling behavior of surrounding produce are not affected as the sensing fruit is a stand-alone unit with self-powered, integrated, wireless sensors. This non-instrusive aspect provides the highest degree of realism of the measured temperatures, namely in the fruit core and at its surface. The sensing fruit and its built-in sensors have a lifespan of several years.

Applications

Exporters, importers, wholesalers or retailers can benefit from a better monitoring of the thermal history of their perishable goods with sensing fruits, including in their precooling facilities, cold stores and ripening facilities. They will be able to better pinpoint the location and reason for unexpected quality loss, which is essential for quality claims. Manufacturers of refrigerated containers can use the sensing fruit to better demonstrate the feasibility of new cooling hardware or control software to their customers. The food packaging industry will be able to verify faster the fruit cooling behaviour of novel packaging designs. Governmental organisations for cold-chain quality certification and control could allow the application of sensing fruits to help decide on the cargo quality after transport, or on the efficacy of cold disinfestation protocols. The sensing fruit can also be of use in preharvest applications to monitor the produce's thermal behaviour in greenhouses or orchards.







Ownership

Empa, Swiss Federal Laboratories for Materials Science and Technology, Überlandstrasse 129, CH-8600 Dübendorf; Patent pending

Keywords

Temperature monitoring, artificial fruit, fruit dummy, fruit simulator, cold chain, biomimetic

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