

CRITICAL TEMPERATURE INDICATORS

BACKGROUND

Time/Temperature Indicator products are methods of informing users of the temperature exposure history of a product. They are used to ensure cold storage of perishable goods, to track ripening or aging of food products and to provide consumers with valuable information about the goods that they buy.

Prolonged or momentary exposure to extreme or elevated temperature can force ripening of fruit, cause dangerous spoilage of foods such as seafood, and inactivate pharmaceuticals, vaccines or chemical mixtures. In some scenarios, such as heating pre-prepared food, it is essential to know that a critical temperature has been exceeded.

Examples of such products include 3M™'s MonitorMark™, Temptime's HEATmarker® or Fresh Check®, and Ciba Chemicals' OnVu™. These are typically sold to manufacturers of products or those involved in early-stage packaging or distribution. They take the form of small to medium sized pre-printed stickers or labels, and may be activated by a variety of mechanical or other processes – such as exposure to UV light. Colour change on the visible label will usually indicate freshness, temperature history, or likelihood of spoilage.

These existing products typically sell for around \$US1.50 to several US dollars per label.

In response to a perceived need for a low-cost and customisable means to track critical temperature history, researchers from The Australian National University (ANU) developed the technology to print an inexpensive Critical Temperature Indicator (CTI). The CTI is delivered as a wax-based ink through a specialised inkjet print head, to an adhesive device, an existing label, or directly to packaging material.

The process would be sold to manufacturers and packagers as an integrated print head system, with specialised wax-based inks to be supplied as a consumable. The cost to the user would be in the order of one US cent per item printed.

APPLICATIONS

This technology can be used to indicate whether the product has exceeded a critical temperature. For example, ink mixtures could be developed to detect:

- inactivation of vaccines and pharmaceuticals
- denaturing of chemical compounds with cold storage requirements
- potential spoilage of perishable food
- excessive heat causing over ripening of fruit
- burnout of individual electronic components
- sufficient heating of pre-prepared meals.

Many more applications may be available. Whenever information regarding temperature history is needed, this product may be adapted to suit.



ADVANTAGES

The technology can be used at a fraction of the cost of existing products in this space. As a result, it may be more appealing for packagers or manufacturers to apply a label to many more items; for example applying a critical temperature label to individual bottles of pills or ampoules of vaccine, rather than one adhesive label to an entire carton containing many items. This also makes the technology appealing to mark large numbers of individual electronic components, which may be used to detect failure in some applications.

It is also highly customisable, both in terms of the imagery displayed and the temperature at which it activates. Customisation of the image may allow the product to be incorporated into other supply-chain technologies, such as bar-code scanners. That is, a valid bar-code may become blurred and hence unreadable above the critical temperature.

THE TECHNOLOGY & FURTHER DEVELOPMENT

The CTI technology has been developed to proof-of-concept level at critical temperatures of 25°C and 50°C using food grade inks. It is anticipated that by adjusting the mixture of waxes, indicators could be set to any critical temperature – from below freezing to above the boiling point of water.

Further development of this technology may increase the resolution of the images, the depth of colour and control of the critical time exposure over a critical temperature required to affect a change in the image. Current understanding indicates that the potential of this technology is only limited by the range of waxes and dyes that may be available for experimentation.

National phase patent applications regarding this technology have been submitted in Australia, the US, China, India, Japan and Europe.

BUSINESS OPPORTUNITY

ANU is seeking interested parties who may be involved in packaging, print technology, chemical development or related fields to take a license to further develop and exploit the CTI technology.

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