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Singapore

NTU researchers lead development of AI-powered 'electronic nose' to sniff out meat freshness, reduce food waste

An international team led by Nanyang Technological University's Professor Chen Xiao Dong (left) has invented an artificial olfactory system that mimics the mammalian nose to assess the freshness of meat accurately. (Photo: NTU)

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SINGAPORE: Scientists from the Nanyang Technological University (NTU) have led an international team to invent an "electronic nose" that assesses the freshness of meat with 98.5 per cent accuracy.

The invention could help to reduce food wastage by confirming whether meat is fit for consumption more accurately than a "best before" label can, the research team said in a news release on Tuesday (Nov 10).

The electronic nose comprises two elements that mimic the way a mammal's nose recognises fresh or rotting meat.

A coloured "barcode" made of chitosan, a type of natural sugar, is loaded with different dyes and acts as a set of receptors for the gases produced by decaying meat.

The dyes change colour in response to the different types and concentrations of gases, producing a unique combination of colours that serves as a "scent fingerprint" for the state of any meat, said NTU.
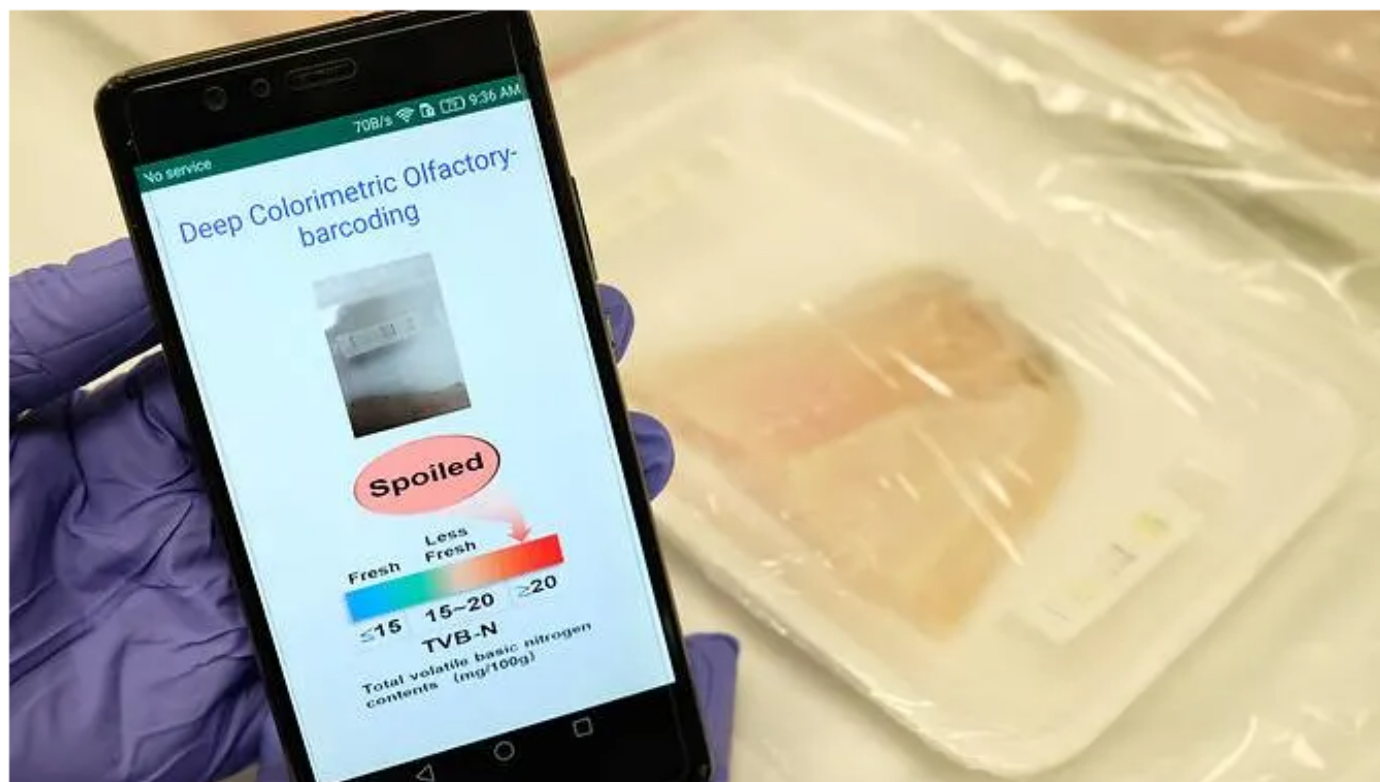

The electronic nose comprises a "barcode" that changes colour due to reactions with gases emitted by the decaying meat. (Photo: NTU)

For example, a yellow dye in the barcode changes to blue as it reacts to bioamines produced by decaying meat. Its colour intensity changes with an increasing concentration of bioamines as the meat decays further, the university explained.

The research team developed a classification system – fresh, less fresh or spoiled – using an international standard that determines meat freshness, NTU said.

The second part of the electronic nose is a barcode "reader", which uses artificial intelligence (AI) to interpret the combination of colours on the barcode.

To make the electronic nose portable, the reader is integrated into a smartphone application that can yield results in 30 seconds, NTU said.

The electronic nose comprises a barcode "reader" in the form of a smartphone application powered by artificial intelligence. (Photo: NTU)

The NTU research team, which collaborated with scientists from China's Jiangnan University and Australia's Monash University, trained the AI algorithm to pick out patterns using more than 3,400 images of barcodes glued to the packaging film of chicken, fish and beef.

Subsequent tests of the electronic nose revealed an overall 98.5 per cent accuracy rate – 100 per cent accuracy in identifying spoiled meats, and 96 to 99 per cent accuracy for fresh and less fresh meats.

While electronic noses have been extensively researched, there have been bottlenecks to commercialisation due to issues with accurately detecting and identifying odour, said director of NTU's Innovative Centre for Flexible Devices Professor Chen Xiaodong.

The NTU invention offered "both a robust sensor setup and a data analysis method that can accurately predict scent fingerprints", he said.

"Our proof-of-concept artificial olfactory system, which we tested in real-life scenarios, can be easily integrated into packaging materials and yields results in a short time without the bulky wiring used for electrical signal

collection in some e-noses that were developed recently," said Prof Chen.

"These barcodes help consumers to save money by ensuring that they do not discard products that are still fit for consumption, which also helps the environment.

"The biodegradable and non-toxic nature of the barcodes also means they could be safely applied in all parts of the food supply chain to ensure food freshness."

A patent has been filed for the invention and the team is working with a Singapore agribusiness company to extend the concept to other types of perishables, NTU said.

Source: CNA/dv(hs)

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