Fresh Meat: New Biosensor Accurately and Efficiently Determines Meat Freshness

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Employing a porous graphene electrode with zinc oxide nanoparticles, biosensor identifies aging byproducts in meat.

The freshness of animal meat is an essential property determining its quality and safety. With advanced technology capable of preserving food for extended periods of time, meat can be shipped around the globe and consumed long after an animal dies. As global meat consumption rates increase, so too does the demand for effective measures for its age.

Despite the technological advances keeping meat fresh for as long as possible, certain aging processes are unavoidable. Adenosine triphosphate (ATP) is a molecule produced by breathing and responsible for providing energy to cells. When an animal stops breathing, ATP synthesis also stops, and the existing molecules decompose into acid, diminishing first flavor and then safety. Hypoxanthine (HXA) and xanthine are intermediate steps in this transition. Assessing their prevalence in meat indicates its freshness.

In AIP Advances, from AIP Publishing, researchers from the Vietnam Academy of Science and Technology, VNU University of Science, Hanoi University of Science and Technology, and the Russian Academy of Sciences developed a biosensor using graphene electrodes modified by zinc oxide nanoparticles to measure HXA. The team demonstrated the sensor's efficacy on pork meat.

While many HXA sensing methods currently exist, they can be costly and time-consuming and require specialists.

"In comparison to modern food-testing methods, like high-performance liquid

chromatography, gas chromatography, mass spectrometry, atomic and molecular spectroscopy, and nuclear magnetic resonance spectroscopy, biosensors like our sensor offer superior advantages in time, portability, high sensitivity, and selectivity," said author Ngo Thi Hong Le.

Biosensor determines meat freshness by detecting HXA in a solution sample derived from the meat.

The sensor is produced using a polyimide film, which is converted into porous graphene using a pulsed laser. The added zinc oxide nanoparticles attract the HXA molecules to the electrode surface. When HXA interacts with the electrode, it oxidizes and transfers its electrons, spiking the electrode's voltage. The linear relationship between HXA and voltage increase enables easy determination of HXA content.

To assess the sensor's ability, the researchers tested solutions with known quantities of HXA. After the outstanding performance, the researchers measured the biosensor's practicality using pork tenderloins purchased from a supermarket. The sensor performed with over 98% accuracy, favorable detection range, and low detection limit.

"In Vietnam, pork is the most consumed meat," said Le. "Therefore, pork quality monitoring is one of the important requirements in the food industry in our country, which is why we prioritized it."

More than just pork, any meat product can be evaluated by this biosensor.

Read the original article on American Institute of Physics.