Online detection technology research on agricultural product quality deterioration

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ABSTRACT: According to agricultural products logistics links prone to deterioration of the quality, and the outstanding is-sues of lacking of monitoring technology and equipment, for the fruits, vegetables, meat and aquatic products distribution process, the quality of agricultural products of fission online detection technology and equipment were studied. This article focuses on the technique difficulties and problems of agricultural products quality fission online detection to analyze. The construction of nondestructive testing technology and equipment of the new system suitable for China's agricultural products quality are discussed and the technical analysis, this research will improve our logistics management level of agricultural products and agricultural products logistics efficiency, effectively avoid the massive rot damage events.

KEYWORD: Quality deterioration; Online detection

1 RESEARCH NEED ANALYSIS

"The food is what matters to the people, food safety is pivotal." Food safety is related to people's livelihood. The quality and safety of agricultural products directly determine the quality and safety of food, directly related to the daily life of every one of us, and related to the people's health and even life. As China's economy continues to grow rapidly, consumer demand for quality and safety of agricultural products is getting higher and higher.

It is worth pointing out that, along with the expansion of the scale of agricultural industry, technology progress and transport development, agricultural product logistics, especially of cold chain logistics process controlled environment is more and more strong, a lot of fresh agricultural products from the origin has been in refrigerator car, cold storage in a controlled environment. Therefore, as soon as possible to detect the quality of agricultural products in the logistics, it is important to have an early warning in the occurrence of the phenomenon of corruption. (1) Effective detection and warning can provide the feedback information to control the process of logistics environment, such as adding large ventilation in will deteriorate, reducing temperature and other measures, so as to reduce or avoid agricultural corruption, reduce economic losses. (2) Real-time monitoring of quality deterioration state measurement is helpful to the whole planning to develop the logistics of agricultural products, such as the part of the product quality deterioration when the re plan-

ning of the logistics chain, will not happen early corruption of agricultural products in the consumer link, to nip in the bud. (3) Due to deterioration of the quality of agricultural products in the role of microorganisms, corruption has very strong infectivity, monitoring state of deterioration the part can detect the deterioration of agricultural products, which will be part of the corruption as soon as possible goods handling, to avoid its impact on other fresh agricultural products. (4) real-time detection of quality deterioration is to protect the interests of consumers, improve the safety level of agricultural products With the development of society, the modern logistics has gradually become transparent, so that consumers can understand the whole process of food "from farm to table", and it is the inevitable trend of the development of agricultural products logistics.

2 THE MAIN TECHNICAL DIFFICULTIES AND PROBLEMS ANALYSIS

Cold chain logistics is mainly used in the majority of fresh agricultural products, especially meat and aquatic products, its transport and storage at low temperature. The study of agricultural products quality inferior variable monitors need long-term work in low temperature and vibration environment, how to design the reasonable sensor parts structure and monitoring system to meet the environmental adaptability is one of the technical difficulties in this study. The study to avoid using is greatly affected by

temperature, power consumption of a semiconductor sensor using electrochemical sensing technology and optical sensing technology to define measurements to quantify the deterioration of gas, and application of industrial and automotive grade devices realize the environmental adaptability of the sensors and the monitoring system requirements.

The goal of this study is not only localized in the international cutting-edge technology breakthrough, more important is to rely on the technology to provide support for the logistics of agricultural products, to solve practical problems in production and life, commercial electronic nose commonly used in the industry, spectrum analyzer and other expensive instruments are difficult to serve in the actual production. Therefore, how to lower cost implementation of technology products is one of the key and the difficulty of this research. This research carried out in the key consideration of implementation issues, such as: Optimization of fingerprint for the quality deterioration of agricultural products, in order to realize the identification of deterioration with the least sensor unit. For the oxidation of reducing gas, using the redox gas sensing, using non dispersive infrared sensing method to achieve the steady-state gas sensing, and avoid the use of light and other high cost solutions.

Fast acquiring, separating and dynamic sequences image fusing fruit appearance quality detection of moving target. By experiments design, data analysis and technical improve to solve the verification test. Build the fruit external quality comprehensive detection method and the detection model. Through image processing, feature extraction, mathematical modeling, model calibration solution.

Based on the advantages of specific bacterial surface biochemical characteristics and immune magnetic beads are complex background on four or more tested pathogens, selective fast pretreatment and enrichment of samples, the samples were purified and separated. Detection of four or more pathogens simultaneously based on immune fluorescence quantum dot labeling, to improve the detection sensitivity and speed, reduce the amount of samples, thereby reducing the cost of detection. Combined with immune nanometer magnetic bead separation technology and immune fluorescent quantum dot markers to develop a portable detecting instrument and complete the above four kinds of pathogenic bacteria for the simultaneous separation and detection. The micro nano magnetic spheres with insulation characteristics are used as the carrier of the impedance signal. The detection sensitivity of small molecule compounds is enhanced by the volume effect of micro nano magnetic spheres. Using the directional movement of micro nano magnetic spheres in the magnetic field to reduce the steric effect of micro nano magnetic spheres, and to improve the rate of immune response, so as to achieve the purpose of reducing the detection time and realizing the fast detection of the field.

The application of technological achievements and demonstration of industrialization. Through the relevant circulation enterprises of the research shows that enterprises are subject to personnel, technology, information and other factors, agricultural products circulation quality online detection technology and equipment is relatively short, For the relevant new technologies, the new means of understanding is low, the ability to accept and digest absorption is poor, In this regard, China has not yet more mature, effective mode of operation. Therefore, facing to the basic unit, the research and establishment can improve the research results demonstration and promotion efficiency, and enhance the radiation effect of the method and the way, is also one of the difficult problems that need to be solved.

3 CONSTRUCTION OF THE NEW SYSTEM OF QUALITY NONDESTRUCTIVE TESTING TECHNOLOGY AND EQUIPMENT FOR AGRICULTURAL PRODUCTS

3.1 *Construction and research content*

(1)Construction of the database for the quality identification of agricultural products

Study vegetables, fruit, meat, aquatic products in different environmental parameters in the process of logistics nutritional quality, health quality, safety and odor, surface defect, microbial variation construct discriminant database of agricultural products of different levels of quality. Construct agricultural products quality level and the fresh degree of odor, near infrared spectral discriminant model and shelf life prediction model. Using principal component analysis, linear discriminant analysis, cluster analysis, statistical process quality control, artificial neural network pattern recognition were multi pattern quality grade qualitative discrimination, the smell was developed using partial least squares, near infrared spectroscopy, surface defects and quality index of quantitative relationship.

(2) Research and development of high sensitive sensing technology and sensor for quality deterioration of agricultural products

Based on the relation between agricultural product quality deterioration and spoilage gas, screening and optimization is applied to vegetables, fruit, meat, aquatic product quality deterioration variable process of gas sensors, electrochemical sensing techniques for study of hydrogen sulfide, ammonia and other gases, optimize selection ion selective gas sensitive electrode, electrode in weak signal conditioning and acquisition, through the study of real-time calibration mode measurement baseline noise reduction; the study of ethanol, ethylene and other gases non dispersive infrared sensing technology

construct multiple reflection optical system to improve the optical path, the optimal selection for links in a variety of gas flow in the cold chain physical sensitive bands, to establish the absorbance and the concentration of gas quantitative measurement model.

(3) Development of the monitoring system for the quality deterioration of agricultural products (simple electronic nose)

In the sensing devices developed on the basis of, integrated ammonia, hydrogen sulfide, ethylene, ethanol and other gas sensor, construction of agricultural products cold chain logistics in deterioration of the quality of integrated monitoring equipment. In the process of integration of sensor array signal acquisition, timing synchronization, high speed signal deal with the problem, developed in logistics car (or cold) vehicle mounted monitoring equipment installation, for the delivery of several gases in the process of simultaneously continuous online monitoring and early warning. Low power design of multiple sensor integration which can be innovate to a portable monitoring equipment, at any time in the transportation of deteriorated gas monitoring.

(4) Research and equipment development of typical fruit surface defect fast on line nondestructive testing technology

Study on the typical fruit surface defect on-line nondestructive study of typical fruit damage detection technology and equipment research and development of insect pest, optical response characteristics such as decay of surface defects, the comprehensive utilization of high / multi spectral image technology, fluorescence technique and structure of optical encoding technology, determine the best image acquisition band, breakthrough high speed, high precision detection of dynamic image sequence fusion, feature extraction and 3D information acquisition and other core technology, set up the fruit surface defect, fruit stem calyx and fast recognition method; development of water transport, fruit grading device turning and unloading integration, realize the fruit automatic orientation and tidy, orderly, high speed online arrangement; rapid development of typical fruit surface defect nondestructive on-line the detection and classification of automatic production line.

(5) Research and development of equipment rapid detection method of multiple pathogenic bacteria and mycotoxins

To match the impedance spectrum for Salmonella bacteria, golden yellow staphylococcus aureus and other common food borne pathogenic bacteria and study based on flagella, lipopolysaccharide molecules monoclonal antibody immune response characteristics, selected with high specificity and sensitivity of antibody preparation of bio sensing material, the development of multiple pathogenic bacteria fluorescent biosensor detection instruments. In the

OTA, Zea, don and other fungi mycin, using different coupling than the mark to the micro nano magnetic ball surface, the micro nano magnetic ball impedance characteristics and surface antigen marker density, particle size, magnetic field intensity on the detection performance. Developing immune sensor portable impedance measurement instrument can achieve the mildew fungus rapid detection.

(6) Integrated model of online detection technology for quality deterioration in the process of agricultural products logistics

In the research on the basis of the fruits and vegetables, meat, aquatic products logistics in the process of deterioration of the quality detection of key technology and equipment integration, assembly, and innovation, supporting technology and equipment selection results. Key, establish demonstration platform of logistics enterprises, to promote the application of model in a typical cold chain logistics links, constructs the model of Pyramid network, through demonstration radiation effect within the industry, guarantee quality and safety of agricultural products cold chain logistics. In the demonstration process, focusing on the equipment of easy operation, accuracy, stability, accessibility, and quality deterioration of major event early warning capability for long-term testing and evaluation, research and technology the cold chain logistics transportation efficiency, improve the quality and safety of agricultural products. In the process of demonstration and application of continuous optimization and improvement of technology and products for large-scale industry To lay the technical foundation for application.

3.2 *innovation point*

(1) This study closely tracking the international frontier，break agricultural product deterioration in the process of produced gas electrochemical sensing technology, non dispersive infrared sensing technology, and thus the development of vehicle type, hand-held agricultural products quality inferior change monitoring system. This study developed technology products will achieve better agricultural products cold chain logistics in the process of deterioration of continuous monitoring and rapid alert. Compared with the conventional sampling analysis method and the study method has fast response, high efficiency, low cost advantage, after the demonstration and extension can be instead of the conventional method, and belongs to the technology innovation.

(2) In this study, give full consideration to the product technology application in practical problems. This study will analyze and solve product for cold chain logistics process adaptability to low temperature, electromagnetic compatibility, early warning ability by the fingerprint database and pattern recognition methods to improve the equipment. For

logistics information acquisition environment, in the equipment at a low cost, low power consumption to carry out a lot of work, so that the equipment is suitable for a large number of promotion, and effectively improve the efficiency of the logistics of agricultural products cold chain, belonging to the application method of innovation.

(3) Based on the specific characteristics of a bacterial surface and nano immune magnetic beads advantages of various kinds of measured pathogens under complex background of multivariate sample pretreatment and enrichment, which in order to achieve efficient purification and separation of the sample. Based on immune fluorescent quantum dot marking also quick detection of multiple pathogens to achieve improve the detection sensitivity and speed, reduce the amount of samples, so as to reduce test cost. Combined with immune nanometer magnetic bead separation technology and immune fluorescence quantum point detection technology research and development of portable instrument, to complete against various pathogenic bacteria in food, fast, multivariate testing.

(4) The surface with insulation characteristics of micro / nano magnetic ball as impedance signal amplification carrier, using micro / nano magnetic ball volume effect to enhance immune impedance method of small molecule compounds detection sensitivity, using micro nano magnetic beads in magnetic field directional movement, reduce micro nano magnetic ball of air between the steric effect, improve the immunological reaction rate, so as to achieve to reduce the detection time, achieve the purpose of rapid detection on the spot.

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