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NANOTECHNOLOGY IN DETECTING CONTAMINATION AND SPOILAGE OF FOOD

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Abstract

The world faces a number of major challenges such as water shortages, food, and public health issues. Nanomaterials with dimensions from 1-100 nm have significant changes in their optical, magnetic, electrical, chemical and physical properties**.** These facts have been known for some time but have recently been invested in finding solutions to food problems and employing them to monitor the safety and validity of the packaged food product**.** Sensors made of nano-size granules are the simplest and most inexpensive species to detect the status and safety of a packaged food product**.** It is done as well use these simple sensors detect any changes that may occur to foods stored in containers for refrigerating food and food, as well as in the places of display and outlets of sale and distribution. The idea of the work of this category of sensors is based on the discovery of bacterial and microbial activity on the gradual gradual change in the colors of their granules**.** Because of what it enjoys granules that form sensors with a large surface area make it highly sensitive sensors that operate at the lowest bacterial or microbial concentrations.

Key words: Nanomaterials, contamination, food, Sensors, refrigerating

Introduction

The likelihood of food contamination in contemporary times has increased because of the rapid globalization of food production and trade. Some outbreaks of food-borne disease outbreaks and the global rate of food borne infection are difficult to estimate, but in 2000, about 2.1 million people died from salmonella. Many of these diseases are attributed to contamination of drinking water and food (Smith & Diack, 2005).

It is reported that about 30% of the total population of the industrialized countries themselves suffer from food borne infection every year. Where the rate of bacterial infection through food is estimated at 76 million cases annually, receiving treatment in hospitals about 325,000 cases, in addition to about 5,000 deaths. In particular, however, developing countries suffer more from the risk of food borne disease due to the widespread spread of diseases, including those caused by Salmonella. Here, we note that food borne diseases cause serious and severe harm to society. In 1994, Salmonella infection was reported due to contaminated ice cream in the United States, resulting in 224,000 individuals being infected. In 1998, there was an outbreak of hepatitis A in China, which resulted from contaminated molluscs, resulting in 300,000 people being infected. (Mead *et al.*, 1999). Food contamination creates widespread social and economic pressure on communities that are vulnerable to invasion or outbreaks. Medical costs and production losses for diseases caused by nurses in the United States during 1997 were estimated at US $ 35 billion (Smith & Diack, 2005).

Due to the importance of Salmonella bacteria and their ability to cause disease, recent studies have sought to develop routine monitoring systems for food and the environment to detect them while relying on being accurate, sensitive and fast. There are many methods of detecting food borne and pathogenic bacteria in humans (Pitcher and Fry, 2000). These methods intersect in

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seeking quick results and differ in isolation and differentiation (Stevens and Jaykus, 2004). The diagnostic tests that use antibodies to identify microorganisms during their synthesis are used. These tests are sensitive and can often be completed within a few hours, but usually the development of organisms is first required in the irradiation for 48-24 hours to reach the required test preparation of 106 cells/ml (Siragusa *et al.*, 1995). Microbiology was used by the Analytical Profile Index (API) (Lazcka *et al.*, 2006; Leonard *et al.*, 2003). The API technique is used to detect bacteria belonging to the Enterobacteriaceae family, including Salmonella, Six species of *S. arizonae, S. choleraesuis, S.gallinarum, S. paratyphi, S. pullorum, S. typhi*, as well as other species that cannot be identified with Salmonella spp. (Gillespie *et al.* 2005). Although conventional methods have long been detected (Lazcka *et al.*, 2006), research is ongoing Modern, faster, and more accurate methods have been developed. Researchers have been able to use the Polymerase Chain Reaction (PCR) technique to detect the presence or absence of Salmonella in a given product within hours, and have been able to determine their identity and type.

The PCR technique requires primers to correspond to the types of bacteria to be detected (Touron *et al.*, 2005). It depends on the amplification of a specific piece of genetic material. It was used in the mid-1980s and requires a short duration of 24, And it does not require pre-enrichment (Lazcka *et al.*, 2006). The PCR technique cannot be used to detect the actual number of live bacteria because it depends on the genetic material (Yaron and Matthews, 2002).

Much has been developed on this technique to obtain accurate results for as little as possible in the detection of salmonella bacteria (Knight *et al.*, 1990). It requires a number of salmonella bacteria between 410- 310 mm/, Fontaine *et al.*, 1980. Greenwood and his colleagues recommended in 1983) the introduction of PCR technology in the detection and adoption of Salmonella-derived bacteria in food as a fast and reliable method of analysis that replaces traditional methods of detection. Vitek 2 Compact is a rapid detection system for bacteria, viruses and yeast. It is a sophisticated global system for the detection of bacterial tests in an ideal manner. It diagnoses all bacteria that contaminate food and detect viruses and yeast in quick and simple steps. Which diagnoses the bacteria with a duration of 2-8 hours and is a quick detection method compared to conventional methods (Stefaniuk *et al.*, 2006).

The Pulse Field Gel Electrophoresis (PFGE) technique, which is based on DNA fingerprinting of food-borne pathogens using the PFGE device and using specific protocols and equipment for each germ, was also introduced directly into the Pulse Net network. Where the network identifies the patterns of the microbial DNA and identifies the relevant fingerprints and then takes action to reduce and control the spread of food borne infections when they occur (Halpin *et al.*, 2010).

In 2013, Khamis and his colleagues discovered Lysteria monocytogenes in imported cheese using Clear view technique, a rapid method that relies on antibody reactions to the bacterial toxin. Fig. 1 shows a clear view. C is the control and T-nets for model placement. S is to read the result. In 2003, the method of Clear view was taken by taking the young colony and placing it in the water bath at 41°C for 21 minutes to break down the bacteria and remove its poison. The bacterial toxin then moved to the S window in several clear views containing the antibodies. T, this means that the result is positive, indicating the presence of bacterial poison, and researchers were able to obtain and detect these bacteria within three days depending on the interactions of the antibodies contained in this kit, compared to the traditional method that depends on biochemical tests.

Fig. 1: Clear view kit for diagnosis of Listeria bacteria (Longhi *et al.*, 2003)

Nanoparticle (NP), especially nanoparticles, is widely used in research. It is used in diagnosis and treatment and has been used to detect bacteria in foods because of their unique properties of small size, large area of ??size and stability, available in different sizes and shapes, Exceptionally, nanomaterials used in this field include the most common nanomaterials of gold, silver, titanium oxide and iron particles (Ansary *et al.*, 2009).

GNP has been introduced in biotechnology over the past four decades (Bendayan, 2001) and has been used for various applications. GNP has been used to detect DNA (Penn *et al.*, 2003) and connect genes (Connor,

2009), and facilitate the small size of nano- Their entry into different cells forms one of the greatest difficulties and using these nanoparticles facilitates the delivery of treatment to specific tissues.

The use of biologic nanosensors in the detection of microorganisms

The detection of microorganisms can be achieved by means of microbiological and molecular biochemistry. Modern advances in nanotechnology have enabled the detection of microorganisms using nanoparticles with nucleotides that complement the gene of the microorganism.

In a study in which gold nanoparticles were used with para-phenyleneethynylene and the formation of a compound (para-phenyleneethynylene), which determined the effectiveness of both positive and negative chromosomes based on the different response of both species (Phillips *et al.*, 2008). NP can be combined with appropriate antibodies and use marks on the presence of specific molecules or microbes.

GNP was used to detect the presence of Staphylococcus aureus after it was associated with specialized antimicrobial agents to reduce microbial pathogens (Lin *et al.*, 2008). Chromatography using GNP was also developed with antibiotics and ß-lactam *(Liu et al.,* 2007).

Nanosensors

Healthy, non-polluting healthy food is an urgent necessity. Consumers can directly distinguish fresh products such as meat if they are spoiled by their flavor or color. However, in the case of coated products, packaging materials impede the characterization of the product. The validity date is based on a set of ideal assumptions made during product transfer and storage.

For example, a carton containing the milk contains a date of validity of two weeks, but it is assumed that the milk was stored for a period in a temperature higher than the optimum temperature during its transfer. The date of validity is no longer applicable. Therefore, modern solutions must be used to detect its non-consumption. Capable of detecting gases, chemical contaminants and pathogens, responding to any changes in environmental conditions and thus useful in quality control, improving food safety and ensuring that consumer buy fresh products.

Sensors made of nano-size granules are the simplest and most inexpensive species to detect the status and safety of a packaged food product. These simple sensors are also used to detect any changes that may occur to food stored in containers for refrigerating food and foodstuffs, as well as in the places of supply, distribution and distribution. Recently, intelligent ink containing nanoparticles has been developed (TiO_2 is sensitive to oxygen and very sensitive to ultraviolet radiation). The color of the ink changes when the oxygen runs out of the food packaging. thus the consumer is warned about food corruption and will lose its validity for human consumption in a short time.

The nanoscale sensors have been used extensively in the field of biological and health technologies and have been applied extensively in diagnostic tests. This technique allows precise, sensitive and rapid analysis of a number of biological products, including enzymes, antibiotics, vitamins, glucose and other important molecules-the chemical found in the organism But they are not normally produced or expected to be present-such as manufactured organic compounds (Grieshaber *et al.*, 2008).

Biological sensors are divided into thermocouples, electrochemical and optical, 1991; (Goepel Sethi, 1994). Electrochemical sensors are most important for their high sensitivity, small size and easily integrated with the Warsinke *et al.* (2000).

Nanomaterials have attracted wide attention because of their electronic properties, which depend on the size and shape of nanoparticles (El-Deab & Ohsaka, 2002). The efficiency of electrochemical and electronic oxidation properties has led researchers to use them in technological applications, particularly nanoparticles, The sensor, which is due to the increase of electronic signal when the biological components resulting on the surface of nanoparticles, as the fluctuation of electrons in the nanoparticles of noble metals has a spectrum absorption Extending to the surrounding medium (Chen *et al.*, 2005) fig. 2.

The ratio of the change between absorption to change with the mean ambient refractive index gives sensitivity to the sensor, which is dependent on the ambient mean refractive index and the bonding methods used to connect the minutes to the supporting surface (Al Dah, 2007). On the other hand, silver, platinum, palladium, copper and cobalt, Sensor Development (Salimi, 2009).

The idea of the work of this category of sensors is based on the discovery of bacterial and microbial activity on the gradual gradual change in the colors of their granules. Because the granules of the sensors form large surfaces, this makes them highly sensitive sensors at the lowest bacterial or microbial concentrations. Nanoparticle granules are added to other super-soft granules that resist bacterial activity and oxidation resistance, increasing the

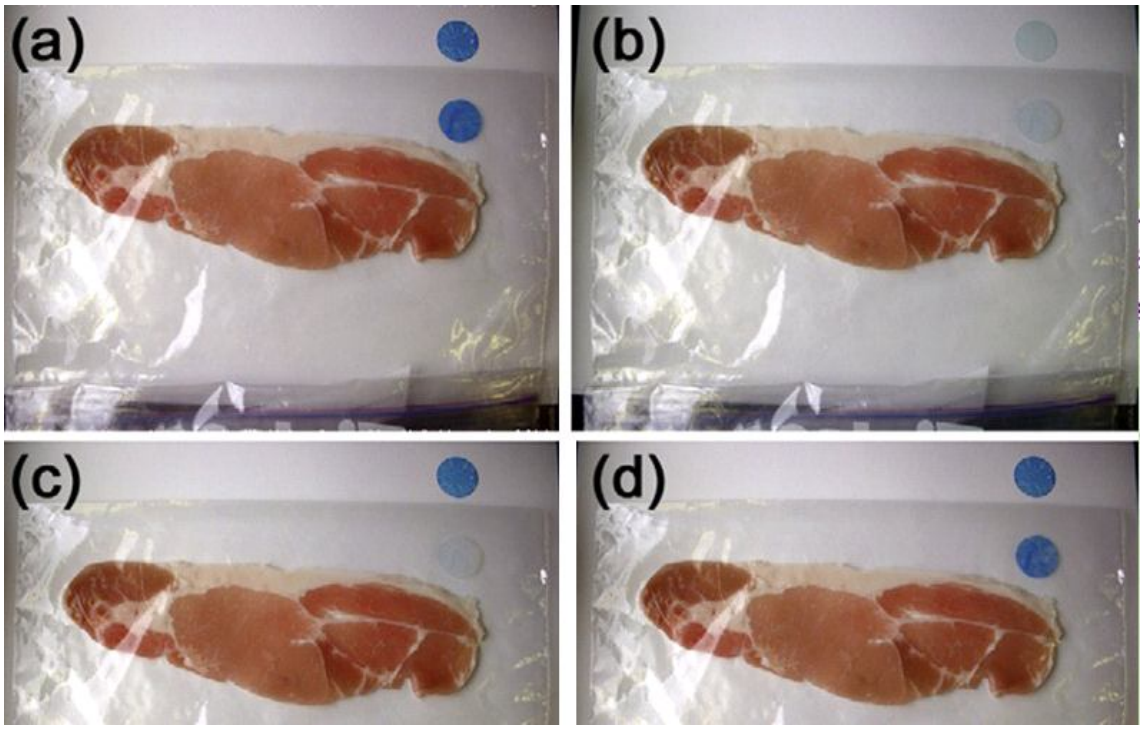

Fig. 2: Shows the change of ink color when the oxygen runs out inside the food package

shelf life of food products and keeping them on the shelves of outlets without damage.

Detection of microorganisms can be achieved by means of microbiological and molecular biochemistry. Modern advances in nanotechnology have enabled the detection of microorganisms using nanoparticles with the nucleotides of the microorganisms of the microorganism.

In a study in which gold nanoparticles were used with para-phenyleneethynylene and the formation of a compound (para-phenyleneethynylene), which determined the effectiveness of both positive and negative chromosomes based on the different response of both species (Phillips *et al.*, 2008). Nanoparticles can be combined with appropriate antibodies and used to mark the presence of specific molecules or microbes.

The nanoparticle particles were used to detect the presence of Staphylococcus aureus after being linked with the specialized antibodies to reduce microbial pathogens (Lin *et al.*, 2008). Chromatography using GNP was also developed with antibiotics and ß-lactam (Lui *et al.,* 2007).

Other types of biosensors are made up of carbon nanotubes. Inhalation of gaseous vapors resulting from food damage inside the packaging changes the electrical conductivity of these ultra-sensitive tubes, which are translated into electronic signals amplified to be picked up by hand-held or central receivers, Including these working in quality control and food safety units.

In a study carried out by Al-Hadedee (2016) in the preparation of a nanoscale biochemistry of chemical-encrusted gold nanoparticles coated with polyethylene clycol and associated with antibodies assigned to the association of food poisoning bacteria Salmonella typhimureum. Fig. 3.

The presence of *S. typhimurium* was detected by chromatic changes of samples after laser irradiation for 10 minutes with a complex (GNP + PEG + Mb) recorded after a bacterial attachment. The GNP, GNP + PEG, and GNP + PEG + Mb were recorded in the diets (meat and cheese) to detect and remove the bacteria. It was observed that the color of the meat and cheese sample added to it (GNP + PEG + Mb) was recorded when *S.typhimureum*. Fig. 4.

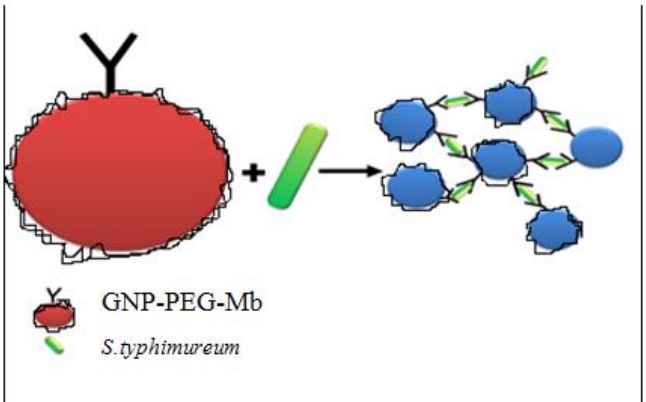

Fig. 3: Shows the association of *S.typhimureum* with the nanotubes (GNP-PEG-Mb) (Ali *et al.*, 2014)

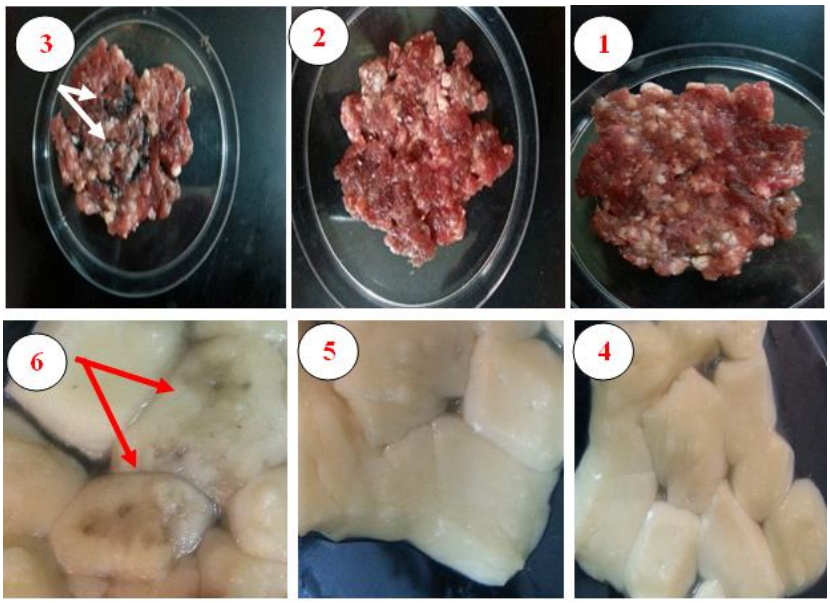

Fig. 4: Color change in meat and cheese sample due to *S.typhimureum* bacteria. Fig. (4-2): Add meat sample to GNP + PEG prepared in the B method after irradiation. Fig. (4- 3): Add the meat sample to the GNP + PEG + M complex prepared in the B method after irradiation. Fig. (4- 4): Cheese added with GNP was prepared after B irradiation. Fig. (4- 5): Sample cheese added with GnP + PEG prepared in B method after irradiation Fig. (4- 6): Sample added cheese prepared by GNP + PEG + M complex by method B after radiation.

Detection of Melamine by nanomaterials:

Melamine is a white chemical compound used in the manufacture of plastics or as an additive in the manufacture of some industrial fertilizers. It is also allowed in packaging of food products and packaging materials, allowing for a leakage of products to the products defined by the European standards of no more than 2.5 parts per million .

But some animal feed producers have since 2006 added some animal food products, and in recent years have added them to artificial milk to raise nitrogen in the results of the analysis, so that the production is marketed as protein-rich milk.

Because of increasing the risk of the toxicity by the proportion of melamine in the food and its interaction with Sanyorik acid, which is found in milk and some other food products as a sterile material, insoluble crystals are formed in the kidneys, leading to poisoning or other serious diseases, The World Health Organization has reduced the maximum amount that the body can accept from melamine from half a milligram per kilogram of body weight to 0.2 milligrams.

Melamin is a defect used to amplify the content of proteins in food because it is rich in nitrogen. The nanoparticles have the ability to detect the presence of milk in raw milk and infant milk with a concentration of less than 2.5. These particles are initially associated with sodium acid and thus selectively bind to the skin by means of the hydrogen bonds, Red to Blue. Fayaz et al (2009)

This is explained as follows:

The cyanoric acid is the result of the dream of the skin and close to its structure. It was initially associated with the nano-gold bodies to see if the three amino groups or the three internal nitrogen atoms within the ring in the structure of the blue are the cause of the blue color, since the cyanoric acid contains in its structure only the three nitrogen atoms It was found that the bodies did not change color when combined with the Sanyuric acid. Evidence that the three amino groups in the melanin are responsible for the change of color, which is the gold atoms around which the negative citrate and the three AuNP in the NH are combined with the melamine The citrate electrodes will combine with the amine groups 2, which will combine the golden bodies of each other with a color change from red to blue (the evidence of the presence of melanin).

In another method of detection, we take the milk samples and add a series of ions fig. 5.

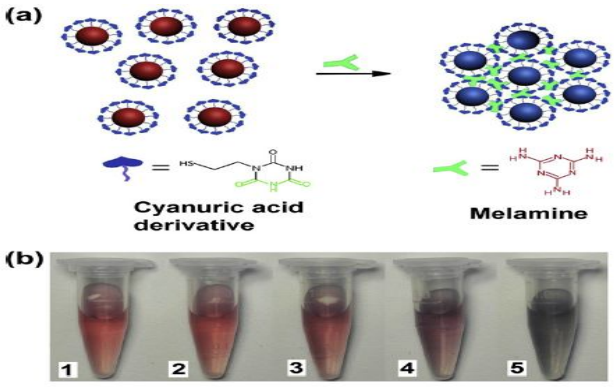

Fig. 5: Detection of Melamine by nanomaterials:

Gold with Reagent Reference:

- In the case of the sample contains the media: will be linked to the reference and will not form gold bodies

  Nanotechnology
- The sample does not contain the media: Gold ions will combine with the reagent and form objects

  Red gold nanoparticles (Cao.*et al.*, 2010).

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