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NANOTECHNOLOGY IN FOODS, MAINTAINING THEIR INTEGRITY AND INCREASING THE DURATION OF THEIR CONSERVATION

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Abstract

Food is the first need for humans and uses modern techniques to develop it and ensure its safety. Among the modern techniques that have become widespread, although there are some reservations are the Nano foods unknown to the majority of people, although it began to emerge. Nanotechnology is the science that deals with the study and treatment of the material on the atomic and molecular scale. Nanotechnology is interested in the development of new techniques and means measured in nanometers, which are a fraction of a million.

The technology has many applications in a variety of areas, including food applications such as: food processing, food preservation systems, application of nanotechnology in the fields of production, processing, packaging, safety and packaging of food.

It improves the mechanical and chemical properties of packaging materials, makes them strong, resistant to heat and environmental conditions, develops active anti-microbial and fungal surfaces and detects any biological or chemical changes. A group of companies and institutions are developing smart packaging systems, such as those that use gas-sensitive sensors and change their color when food is spoiled and gases are released. Others use nanotubes that reduce oxygen intake and maintain product moisture. There are sensors to detect contamination of food products at the same time.

Key words : Nanotechnology, food conservation system, gas sensitive sensors, molecular scale, chemical properties.

Introduction

All foods, in general, contain nanoparticles. For example, milk contains the casein protein, which is found on a nanometer, and the meat contains protein threads with a diameter of less than 100 nanometers. The arrangement of these particles and the change of structure affects the strength and specifications of milk and meat. Nanotechnology has a current or future role in several areas of food, from agriculture, manufacturing, product handling, and attention to the nutritional aspects of Suresh and Digvir (2009).

Global sales of nanotechnology products in the food and beverage packaging sector rose in the United States from $ 150 million in 2002 to $ 860 million in 2004 and then to $ 20.4 million in 2010 Consultancy, 2004. Helmut Kaiser.

According to the report, the applications are mainly to improve food packaging and improve the food additive in the market where the total market value is estimated at US $ 5.8 billion in 2012 (food processing is US $ 1303 million, food component is US $ 1475 million, food safety is US $ 97 million) US $ 2.93 billion (Cientifica, 2006) More than 200 companies actively participate in research and development (2006) (Asadi and Mousavi), where the US states are the leader followed by Japan and China (Helmut Kaiser Consultancy, 2004). Food is a developing and leading global food company Which has had a significant impact on nanotechnology research such as H.J. Heinz, Nestlé and kraft. (Miller and Senjen 2008).

Nanotechnology in food is divided into two main parts:

First: internal applications (change in the same lunch item, which is the origin of this branch of science) such as taste enhancers and absorption.

Second: External applications such as lunch storage and packaging with nanomaterials or the addition of smart robots that work as analytical laboratories and walk with

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food in the human body.

Nanofood is a term used for the production of food, which is used in its entire production or at any stage of its production. Nanotechnology is the food used in nanotechnology for cultivation, processing, packaging, or even the addition of nanoparticles (Joseph and Morrison, 2006). Around 200 companies worldwide are involved in research and development of food using nanotechnology, and the use of this technology continues to be used (Popov *et al.*, 2010).

The new food production process is part of the field of consumer products based on nanotechnology, which is shown in the markets at a rate of 3-4 items per week. This is based on the proposal of the Project on Emerging Nanotechnologies (PEN), which was based on a report on the inventory of approximately 609 nanoparticles The menu contains three foods, a type of canola oil, called Canola Active Oil, a type of tea called Nanotea, and a group of diet chocolate called Nanoceuticals Slim Shake Chocolate, which contains an additive called nanotube. Designed to carry vitamins and minerals Chemicals plant through the digestive system and urea.

Objectives of Nanotechnology Food Technology

1. Improve the delivery of micronutrients and biologically active food ingredients.

There are four main groups of challenges associated with food delivery:

   (1) Stability (*i.e.* against heat, pH, and oxidation during food processing).

   (2) Taste and color (*i.e.* avoidance of taste and unpleasant smell).

   (3) Safety.

   (4) Bioavailability. Where this technology can address all this. Nanotechnology can be used to address each of these challenges

2. Control: Control of active biological compounds, such as (omega-3 fatty acids) to avoid cyclical actions and possible side effects. It has important applications for foods designed for people with diabetes, for example, where it would be desirable to maintain a steady state of glucose secretion.
3. Product Tracking: As recent melamine threats have shown, the ability to trace pollutants to their source is an important element of food safety.
4. Food safety: use of adherent and specific nanoparticles from pathogenic bacteria from poultry.
5. Develop packaging using smart covers that not only allow pollution prevention, but also detect other compounds. "The classic example of this type of application is to control the prolongation of the post-ripening period of green or yellow beans for as long as possible.

Nanotechnology is therefore a new tool for maintaining health that enables nanomaterials to reach the desirable and targeted part of the body.

The impact of nanotechnology in the food industry has become more pronounced over the past few years as it has the potential to revolutionize agro-food industries using new tools to treat molecular diseases, rapid detection of disease, enhanced ability of plants to absorb nutrients; On toxins and environmental protection. This demonstrates the importance of nanotechnology for science, engineering and agriculture in the food system.

Benefits of applying nanotechnology in food: Suresh and Digvir (2009)

1. Some foods of great interest, such as fish oil rich in Omega 3, which has a foul taste and odor unpleasant. But if they are made with nanoparticles, they can be added to any food we love with a good smell and taste. By converting them into nanoparticles, they will not affect our desirable meal, but we will get their nutritional benefits.
2. Food produced naturally by agriculture will not be sufficient to meet the growing needs of demand, and half of the foods produced globally either be damaged before consumption to expire or increase the need of the user. There must be a smart solution to reduce food losses, especially because of the damage and the provision of increasing quantities of it.
3. Processing food with nanotechnology extends the life of the lunch does not damage quickly and does not need to store in refrigerators.
4. Eliminate famine and provide food to all people, especially the poor, because food production will increase by modifying the methods of production of nano, prolonging its survival without storage, and producing integrated meals the size of tablets.
5. Some of the nutritional nanomaterials currently used are used as flavor enhancers. For example, they can add nanoparticles to processed materials that are not tasteful but of nutritional benefit.
6. There is less need for agricultural land and irrigation water because some lunch can be produced in a laboratory.
7. Diseases related to food can be removed because we control the main food and manufacturing. We can remove any unwanted part of them. It also

facilitates the elimination of obesity and fat problems.

7. Division of food into nanoparticles in solutions that increase the efficiency of absorption of the body to ensure the greatest possible benefit of the human food whenever the amount of food (as a result of increased surface area).

The most important applications

Food packaging

To date, packaging, preservation and preservation of more than 600 food products are being carried out by the technology of this technology. The food, which is not directly consumed, is protected from light, gases, moisture and many pathogens. The permeability, infiltration, and overlap of the feed material are the main problems of packaging and packaging. This relates to the nature of the packaging material and the food material, bearing in mind that there is no material that is not fully airborne And humidity.

The advances in nanotechnology have opened hopes for food packaging by increasing storage time, packaging operations have been safer than normal packaging, and food has become healthier (Suresh and Digvir, 2011). Nanotechnology is also used to make special antibacterial packages (Timothy, 2011).

Plastics are usually used in metal, glass or paper. These methods are still used for their permits and light weight. However, due to the migration problems and the high permeability of these materials, plastic has been used since plastic polymers have distinct physical and organic properties but the cost of production is high. The solution has been improved by polymer nanocomposites (PNCs: polymer nanocomposites) within the polymer complex. This can be nanofiller, carbon nanotubes, nanotubes, and other nanomaterials. Nanoparticles have significantly improved migration and permeability problems compared to polymers (Bondeson and Oksman, 2007). As well as light weight and high durability. This improves the mechanical properties of the packaging and increases its strength and tolerance to the external loads and stresses it undergoes during transport and storage operations (Bondeson and Oksman, 2007).

The nanomaterial filler within the polymer creates a spindle distribution path for gases and moisture compared with the linear propagation path with polymerization alone. Fig. 1 shows that this nanostructured feeder lengthens the shelf life of food as it secures thicker thickness by using smaller amounts of polymer. Nanoparticles to changes in the polymer itself, where it forms interstitial areas called interstitial regions that also inhibit the passage of gases and moisture to the food and thereby reduce its corruption.

Nanoparticles and nanowires are the most studied example of nanoparticles because of the low cost of their

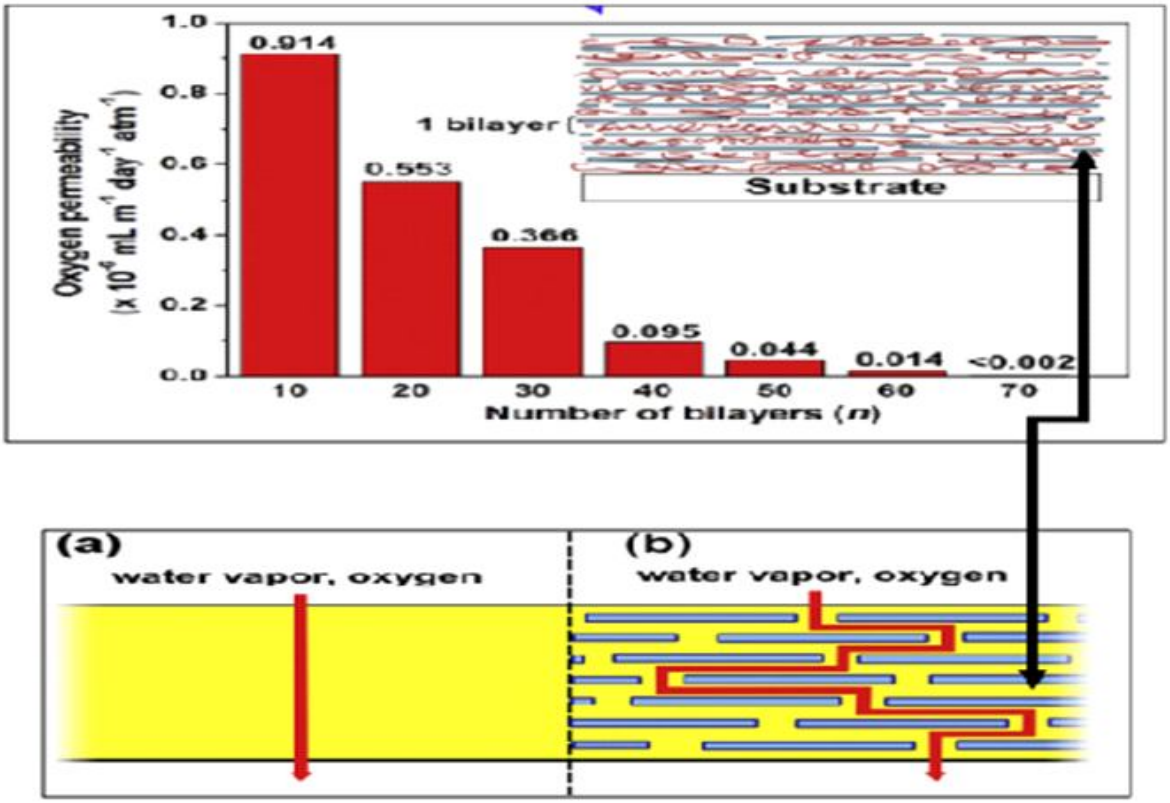

Fig. 1 : shows Comparison between twisted and vertical surfaces

preparation and efficiency. Nanoparticles are polymerized as polymer clay. The nanoparticle material has been effectively studied and has high surface area and forms interstitial areas Especially nanotubes with a thickness of a few nanometers with water-soluble polymers. This nanotubes were scaled into polyimers (PEI: Poly) and the diagram is shown in Fig. 1 (MMT / PEI). The more layers of this nanolymer used to be mined the less oxidation Thus prolonging the shelf life of the product (Bondeson and Oksman, 2007).

One company used gas drinks and was very effective in reducing migration and access. However, in another study when it was applied to storage of vegetables, a small number of nanocrystalline nanoparticles were observed to be removed from the product's packaging material and one study indicated that it should not be subjected to pressure higher than 300 megapacals, otherwise, not suitable for food processing

Silver was used in food packaging with nanowire as a nanocrystalline substance. Thus, we obtain nanodeveloper that encapsulates food and is antimicrobial together. It has been tested with real diets to determine its effect on food viability. A study in which carrot and carrot cake was processed using AgNP / sodium alginate Fig. 2. This diagram shows how this coating extended the validity period of the fruit at the highest storage value acceptable after 10 days of storing it compared to the low storage value indicated by the use of the polymer board its packaging was also fruit in the tenth day without fresh change observed in Tissue and taste (Bondeson and Oksman, 2007)

The multi-layers were used in thin-film-thin, thin-film-encased sheets with a thickness of about 1 nm and containing pyramidal structures of oxygen, silicon, aluminum and other metals (Duncan, 2011).

In addition, these nanoparticles added to the packaging reduce the weight of food packages by 2% to 8%. Carbon nanotubes, metal oxides and carbon nanotubes are the most commonly used. In addition to

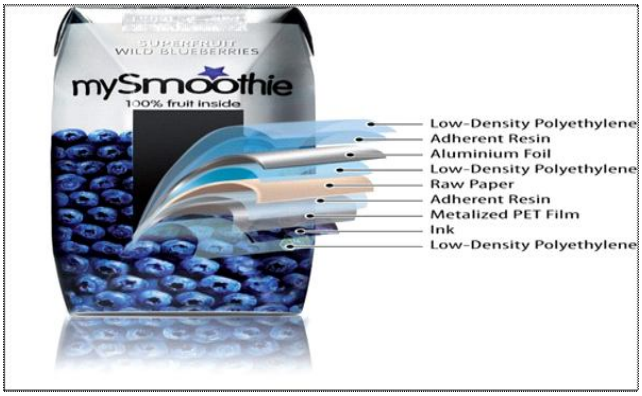

Fig. 2 : Smart wrappers with their exact layers

the use of nanotechnology in the preservation of pre-cooking or food products, they are also used in the preservation of fresh food such as meat, fruits, vegetables, baked goods, dairy products and fresh prepared meals by wrapping them with thin films of transparent polymers that do not exceed Thickness of 5 nanometers, where it incorporates granules or nanotubes working to close the pores to prevent the arrival of moisture to the fresh food inside the packaging. In addition to the role of these granules in improving the capacity of packaging films to resist the high temperatures surrounding the packaging and withstand the dangers of radioactive contamination, it also misses the opportunity for oxygen gases and carbon dioxide from leakage inside the packaging. Nanoparticles and nanotubes work to strengthen films and prevent them from rupture or damage during circulation.

Some companies specializing in the production of food packaging materials in the United States and Japan have succeeded in the production of anti-oxidant films made up of safe and non-toxic materials such as TiO_2, ZnO and CuO, External surfaces of fresh food products directly without having to be removed when eating foods coated with them. These thin film films are highly resistant to and defeat microbes that always accumulate on the outside surfaces of fresh food products (Cheng *et al.,* 2006)

In the past three years, nanotechnology has been used to produce advanced types of plastic bottles used to store a large number of foods, food liquids and soft drinks, to be used as an alternative to traditional glass bottles. These new bottles outperform their glass counterparts by being durable and unbreakable during transport and handling operations. These bottles, reinforced by the addition of nanotubes and clay pellets, allow them to retain their liquid food content without damage for long periods of up to 18 months.

Nanoparticles can be grouped into

Normal casings

The production of nanoparticles consisting of polymeric molds, which are controlled by dimensions of pore holes and have good mechanical and functional properties that can prevent the exchange of moisture and gases with the outer medium, which affect the distribution of colored materials, flavoring materials, antioxidants, enzymes, In the packaging of fresh food products such as meat, cheese, vegetables and fruits and others and save them even after opening the packaging to treat the surfaces of the outer packagings with a thin layer of anti-oxidation less than 5 nanometers and are characterized as elements of non-toxic, (Silver metal, some metal oxides such as titanium dioxide, copper oxides and zinc oxide). The granules of these oxides are characterized by their

ability to analyze pollutants from organic matter and bacteria, and to resist microbes that may accumulate On the external surfaces of food products during periods of conservation 18 months (Arora and Padua, 2010)

Portfolio packagings

The packaging of these packagings can release certain nanoparticles inside the packagings, such as antimicrobial growth agents, antioxidants, dyes, and food additives, to prolong shelf life, improve flavor, color, or nutritional value, and develop nanoparticles that can absorb any undesirable odors or odors originating within them. And the production of packages that can pump carbon dioxide or oxygen into the outside (Cioffi *et al.,* 2005).

Plastic bottles

Not to be damaged during circulation and to increase the survival of liquids intact without damage for up to 18 months by adding nanotubes and nanoparticles from the clay.

Paper Industry

The addition of nanotubes of tinium or silver in nanomaterials improves the barrier properties against water vapor, gases and odors and is used as antimicrobial and bacterial films for food packaging.

Nanoscapsulation

Nanoencapsulation is a technique to encapsulate materials minimally while maintaining the desired humidity level in food. Eatable covers are used to store fruits, vegetables, meat, chocolate, biscuits and pastries as a barrier to leakage of moisture and moisture, and constitute structural protection to prevent corruption. In these packages, polymers such as proteins (ores, organic compounds of corn, gelatin, cazine), fat and sugars (cellulose, starch, ketone, bactinate) or a combination thereof are used as a buffer to produce edible coatings with antimicrobial properties. Improve food by releasing antioxidants, colorants and food additives in foods or beverages to prolong shelf life, improve flavor, color or nutritional value, and develop nanotubes that can absorb unwanted odors or odors originating within (Freire, *et al.,* 2008).

Food packaging. Food packages containing nanotubes are also produced that can pump carbon dioxide or oxygen gases out of the food containers if they are damaged Fig. 3.

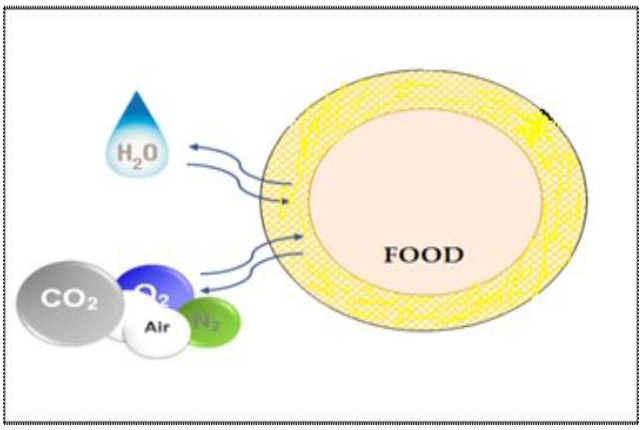

Fig. 3 : Nanoscapsulation

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