

# Nanotechnology in Food related applications: A review

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**Abstract:** *Companies are exploring nanomaterials that will be considered not only in the food preparation, but also in adding the nutritious values.*

*Inclusion of nanomaterials in food packaging is already into existence. In this paper, Nanotechnology and a few more applications related to Food Industry is addressed and reviewed.*

**Keywords-***Nanotechnology, Packaging, Nutritional Elements,nanomaterials*

## **Introduction**

Nanotechnology is having an impact on several aspects of the food industry, from how food is grown to how it is packaged

One example is bottles made with nanocomposites that minimize the leakage of carbon dioxide out of the bottle; this increases the shelf life of carbonated beverages without having to use heavier glass bottles or more expensive cans Ref[1].

Nanotechnology has dominated every field especially agriculture and food based industries. The major connection of nanotechnology in terms of food is improving food processing and nutrition values.

In the next five years, dozens of food products would be treated based on nanotechnology, including a pineapple milkshake that supposedly tastes good and is more nutritious than conventional shakes.

## **Literature Review**

The nanotechnology is considered as one of the upcoming areas for the benefits of mankind .A few examples from the literature would prove the statement. One example is bottles made with nanocomposites that minimize the

leakage of carbon dioxide out of the bottle; this increases the shelf life of carbonated beverages without having to use heavier glass bottles or more expensive cans. Another example is food storage bins with silver nanoparticles embedded in the plastic. The silver nanoparticles kill bacteria from any food previously stored in the bins, minimizing harmful bacteria Ref [2].Likewise, there are many more applications related to Food industries.

There are other food packaging products currently under development. For example ,nanosensors in plastic packaging can detect gases given off by food when it spoils and the packaging itself changes color to alert you to food gone bad. Plastic films are being developed that will allow the food to stay fresher longer. These films are packed with silicate nanoparticles to reduce the flow of oxygen into the package and the leaking of moisture out of the package.

Nanosensors are being developed that can detect bacteria and other contaminates such as salmonella on the surface of food at a packaging plant. This will allow for frequent testing at a much lower cost than is incurred by sending samples to a lab for analysis. This point-of-packaging testing, if conducted properly, has the potential to dramatically reduce the chance of contaminated food reaching grocery store shelves. There are also nanosensors being developed to detect pesticides on fruit and vegetables.

## **Nanomaterials for food applications**

Nanoparticles are generally used to add vitamins or other nutrients in food without affecting the taste or appearance. Research is also initiated to develop nanostructures containing nutrients that would be included when nanosensors come to understand any deficiency in your body. Vehemently, this research would

result in a energy storage system in our body for the proper functioning of all the organs.

Gold and silver are the two important energy boosting elements found in nature which would be incorporated in health supplements. They exhibit different properties at nanosized dimensions which play vital role in chawanprash and healthy tonics.

Investigators are facing the challenge of lack of knowledge in the above field so as to understand better the health risks if any. There is a requirement of more findings in terms of research in nanotechnology based food applications Ref[3]

Nanotechnology raises the opportunity of using molecules as starting material, so that new interaction are achieved which in turn generates the required properties. The paradigm shift resides in the fact the food formulation will based on the use of "food matrix precursors or structural elements Ref[4]. Among the processing issues the most of the applications are related with the use of nanoparticles and nanocapsules. Nanoparticles avoid the degradation produced by the surrounding environment of the food or by the manufacturing process.

Omega 3 was successfully nanoencapsulated and used in bread making. In addition of the positive effect in taste masking, thermooxidation during baking was reduced. As a consequence of that, the production of other further degradation by-products (i.e. acrylamide) was strongly reduced.

One advanced aspect of the use of nanotechnology is the possibility of acting straight onto the food structure. Nanostructured foods aimed at producing better texturized, flavoured and other properties can be obtained.

Several examples could be derived from bakery, confectionery, meat products, dressings and spreads. Another example is the prepared foods. In general, foam and emulsion stability can be improved in the presence of nanoparticles and nanostructures.

Polysaccharides (i.e. starch or cellulose) represent can be considered as a cheap and a quickly source of nanomaterial for food uses. Direct absorption of

nanoparticles is controlled by size and surface chemistry of the particle

#### **Comparison of Recent work**

Some food processing techniques utilize enzymes to modify food components to improve their flavor, nutritional quality or other characteristics. Nanoparticles are used as a source to immobilize these enzymes which may aid in the dispersion throughout the food matrices and enhance their activity. Nano-silicon dioxide particles with reactive aldehyde groups which covalently bind to a porcine triacylglycerol lipase effectively hydrolyze olive oil. This helps in improving the stability, adaptability, and reusability .Nanocharcoal adsorbent is a nanoparticle product used for the decoloration of food products Ref[5].

The main benefits that could be attributed to the nano – sized additives would be better dispersibility of water insoluble additives (e.g. colours, flavours, preservatives, supplements) in food products without the use of additional surfactants/emulsifiers . This is believed to enhance the taste and flavour due to the larger surface areas of the nano-sized additives, enhanced absorption and bioavailability in the body. Currently available products are vitamins ,antioxidants, colours, flavours, and preservatives.

Nanoencapsulation is the technology of enclosing substances in miniature by using nanocomposite, nanoemulsification, and nanostructuring techniques. This allows the controlled release of the core active molecule . The protection of compounds like vitamins, antioxidants, proteins, and lipids as well as carbohydrates may be attained by use of Octenyl succinic anhydride- $\epsilon$ -polylysine. This acts as bifunctional molecules as either surfactants or emulsifiers in the encapsulation of nutraceuticals or drugs or as antimicrobial agents. Hydrophobically modified starch formed micelles encapsulating the active ingredient of turmeric, curcumin . The performance of antioxidants are enhanced by Lipid-based nanoencapsulation systems thereby by improving their solubility, bioavailability, stability, and preventing unwanted interactions with other food components. Nanoliposomes, nanocochleates, and archaeosomes are efficient lipid-based nanoencapsulation systems that can be used for the protection and delivery

of foods and nutraceuticals. The application of nanoliposomes as carrier vehicles of nutrients, nutraceuticals, enzymes, food additives, and food antimicrobials was reported. Coenzyme nanoliposomes were produced with the desired encapsulation quality and stability. Colloidosomes are minute capsules made of particles one tenth the size of a human cell and assemble themselves into a hollow shell. Molecules of any substance can be placed inside this shell. Molecules of any substance can be placed inside this shell.

### CONCLUSIONS

Nanotechnology encompasses with building blocks only nanometers large. Elements at that scale can take on absolutely different properties not observed in their bulk counterparts. Gold is normally chemically inert, which keeps gold rings lustrous, gold nanoparticles can prove highly reactive. Similarly, Silver is used in health supplements.

Nanoparticles, nanotubes and other nanoscale components might have advantages in many applications but unforeseen consequences are to be studied for the safer side. The paper studied different literatures which zeroed in on the food processing applications and the need of the hour is to understand the disadvantages also as this is related to health.

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