Review Article

BIOMEDICAL Journal of Scientific & Technical Research

ISSN: 2574 -1241

DOI: 10.26717/BJSTR.2022.41.006663

Nano Packaging and its Potential Application: A Review

Sangeetha V[1], Supriya V[2]* and Deepa Parvathi V[3]*

[1]*Department of Clinical Nutrition, India*

[2]*Department of Clinical Nutrition, India*

[3]*Department of Biomedical Sciences and Technology, India*

***Corresponding author:** Supriya V, Assistant Professor, Department of Clinical Nutrition, Faculty of Allied Health Sciences, Sri Ramachandra Institute of Higher Education and Research(DU), India

Deepa Parvathi, Assistant professor, Department of Biomedical Sciences, Faculty of Biomedical Sciences and Technology, Sri Ramachandra Institute of Higher education and Research(DU), India

ARTICLE INFO

Received: January 27, 2022

Published: February 11, 2022

Citation: Sangeetha V, Supriya V, Deepa Parvathi V. Nano Packaging and its Potential Application: A Review. Biomed J Sci & Tech Res 41(5)-2022. BJSTR. MS.ID.006663.

Keywords: Nanomaterials; Microplastics; Nanotechnology; Antimicrobial Activity

ABSTRACT

Background: Nanotechnology is the branch of science which deals with atoms of dimensions less than 100 nano meters and is gaining more and more importance in the field of food packaging. It bids an advanced anticipation in food packaging that can assure longer shelf life of goods and safer packaging with enhanced food quality and traceability.

Scope and Approach: This review focuses on advances in different nanomaterials as food packaging and emphasis on the detrimental effects of plastic packaging to the environment and on the human being and nanomaterial as a biocompatible packaging, which presents an alternative to most commonly used non-degradable polymer materials.

Conclusions: Commercialization of such environmental friendly food packaging would be very helpful globally. It would also be easier for the country to overcome processing, storage wastages and easy accessibility of foods thus reducing the matrix of hunger index. Reducing the risk of microplastic ingestion and proper antimicrobial activity shelf life speaks for itself. Also, production of such technology will open up the prospects of using various nanomaterials as food packaging making it not only ecofriendly but also achieving consumer's satisfaction.

Introduction

Food goods are packed and hygienically transported to guard and conserve them from any unacceptable change in quality before reaching the end consumer. Food packaging continues to evolve along with the brain child in material knowledge and technology as well as in light of consumer's demand. Presently the contemporary consumers of competitive providence demand for food with natural quality, assured safety, minutest processing, extended shelf life and ready to eat generalization. Innovative packaging systems not only ascertains ride preservation and effective distribution, but also facilitates communication at the consumer statuses. Nanotechnology manipulates and creates nano meter scale stuff, of saleable and scientific pertinence. Importance of nanoscience in food packaging industry has been prioritized due to safety and stability issues. Further nanotechnology predicated packaging intimate's consumers about the real time quality of food product.

Methods of Manufacturing

Nanomaterials can be produced through two broad approaches known as top-down and jewel- bottom-up. The top-down approach

DOI: 10.26717/BJSTR.2022.41.006663

is generally used for recovering inorganic stuff through traditional systems matching as milling, grinding, raising, and chemical responses. Homogenization is a representative of a top-down system that utilizes pressure to reduce the size of stuff matching as fat globules. Milling mechanically reduces the size of stuff to meliorate their functions. The bottom-up approach involves the assembly of lower patches through nature- institute, affecting in the layout of supra-molecular structures which retain unheard-of functionalities. Solvent evaporation and scale by scale settlings are representatives of the bottom-up approach, which is normally employed in food uses using members matching as phospholipids.

Different Nanoparticles in Nanopackaging

i) Silver Nanoparticles

Ag nanoparticles can attach to the surface of the cell and damage lipo-polysaccharides, thus forming a quarry within the cell membrane. The combination of Ag nanoparticles into plastic polymers for packaging can be executed in quite a few diverse methods. For example, silver ions can be deposited or trapped in the porous zeolite, and these materials can then be applied to plastics. They have antimicrobial, anti-yeasts, anti-fungal, and antiviral activities as they have a larger surface area per mass compared to micro-scale silver particles or bulk silver content. Active nanocomposite along with the combination of heat treatment has proved to be an effective antimicrobial nanomaterial.

ii) Nano Clay

The pattern of nano clay dispersion in the polymer matrix is classified into three categories: tactoid, intercalated, or exfoliated. It has been described bio-composite films prepared with Agar and Nanoclay (Cloisite-Na^+) and demonstrated that nanoclay greatly influences tensile strength, water vapor permeability, and hydrophobic behaviour of agar films. Nano clay enhances the physical properties of plastic packaging preventing the accumulation of gas and moisture inside the packaging. Nano clay composites have an interpolated form, depending on the grade of nanoparticles diffusion in the polymer medium. Exfoliated nanoclay clusters readily lose their tendency to agglomerate and are separated into single flakes, thereby facilitating dispersion of the Nanoparticles in a polymer matrix. The interpolated method varieties only a restrained level of dispersion of clay into the polymer matrix. Therefore, exfoliated nanoparticles exhibit proper blockade phenomenon and strengthening properties.

iii) Nano Zinc Oxide

Zinc oxide-Nanoparticles also exhibit diverse morphologies and shows robust inhibition against growth of broad-spectrum bacterial species. It has been reported that the antibacterial activity of zinc oxide-nanoparticles on *Salmonella typhimurium* and *Staphylococcus aureus* in ready-to-eat poultry meat and the potential activity of these nano-zinc oxide-Nanoparticles can protect the food from bacterial contamination. Studies has found that zinc oxide nanoparticles act better against *Pseudomonas* species, *Shewanella putrefaciens Acinetobacter* and *Moraxella* than other metal oxides. Compared to silver Nanoparticles, zinc oxide-nanoparticles are predominantly striking for packaging applications because it is more affordable and less toxic to animals and humans. Furthermore, because of the anti-bacterial quality shown by zinc oxide nanoparticles they have the capability to produce significant amount of hydrogen peroxide when exposed to UV irradiation thus resulting in oxidative stress of bacterial cells.

iv) Titanium Nanoparticles

Titanium nanomaterials tends alter the properties of biodegradable films and are considered to be less expensive, light stable and non-hazardous. TiO2 is inert and non-toxic to human, it can oxidize the unsaturated poly-phospholipid component of a microbial cell membrane, thereby resulting in a biocidal effect. Several studies performed on the antimicrobial effects of TiO2 suggested that, under sunlight or ultraviolet light, TiO2 damages the cell membrane of the microorganisms by producing reactive oxygen species (ROS) such as H2O2, superoxide anions and hydroxyl radicals.

v) Nano Silica

Nano-silica is primarily used during hydrophobic coatings, particularly for materials which are self-cleaning. A non-adhesive covering of nano silica can make the food and food products into a free-flowing material of nature inside the containers. Goods that profit from this technology include alcoholic beverages and instant soup mixes. Growth of super aquaphobic paperboard by covering Aerosil silica nanoparticles exhibited protuberant ability of water repellancy resulting in lotus-like surface created by nanosized silica. Some articles specifically analysed a number of nanomaterials that are currently used or researched for food packaging [1-8].

Conclusion

Through bettered outlook of nanomaterials and the realization of their eventuality in the food diligence the influx of nanotechnology in foods will give results for persisting problems associated with foods and will offer long name profitable benefits. Technically nations will be benefited from increased food productivity with cost effective returns, innovative products with tunable parcels to deliver smarter and healthier foods and inversely intelligent packaging systems having enhanced storehouse parcels for better food protection. In conclusion nanomaterials in foods will have a huge impact on sustainability and will be accompanied by health and environmental benefits if regulated duly.

References

1. Abdou ES, AS Osheba, MA Sorour (2012) Effect of chitosan and chitosan-nanoparticles as active coating on microbiological characteristics of fish fingers. Int J Appl Sci Technol 2: 158-169.
2. Bouwmeester H, S Dekkers, MY Noordam, WI Hagens, AS Bulder, et al. (2009) Review of health safety aspects of nanotechnologies in food production. Regul Toxicol Pharmacol 53(1): 52-62.
3. Carlson C, SM Hussain, AM Schrand, LK Braydich Stolle, KL Hess, et al. (2008) Unique cellular interaction of silver nanoparticles: size-dependent generation of reactive oxygen species. J Phys Chem B 112: 13608-13619.
4. Cockburn A, R Bradford, N Buck, A Constable, G Edwards, et al. (2012) Approaches to the safety assessment of engineered nanomaterials (ENM) in food. Food Chem Toxicol 50(6): 2224-2242.
5. Chen L, M Subirade (2005) Chitosan/β-lactoglobulin core– shell nanoparticles as nutraceutical carriers. Biomaterials 26(30): 6041-6053.
6. Fedotova AV, AG Snezhko, OA Sdobnikova, LG Samoilova, TA, Smurova, et al. (2010) Packaging materials manufactured from natural polymers modified with silver nanoparticles. Int Polym Sci Technol 37(10): 59-64.
7. Kim JS, E Kuk, KN Yu, JH Kim, SJ Park, et al. (2007) Antimicrobial effects of silver nanoparticles. Nanomed. Nanotechnol Biol Med 3(1): 95-101.
8. Sheikh FA, Kanjawal MA, Saran S, Chung WJ, Kim H (2011) Polyurethane nanofibers containing copper nanoparticles as future materials. Appl Surf Sci 257(7): 3020-3026.

ISSN: 2574-1241

DOI: 10.26717/BJSTR.2022.41.006663

Supriya V, Deepa Parvathi V. Biomed J Sci & Tech Res