Research Open

Nanotechnology and Advanced Material Science

Volume 5 Issue 3

Short Commentary

Advances, Prospects and Concerns in Nanomaterials for Food Processing

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Received: December 01, 2022; **Accepted:** December 07, 2022; **Published:** December 14, 2022

The advent of nanotechnology has boosted various sectors of human endeavors including food processing and packaging, the medical sector, and environment amongst others. It has improved the food industry significantly through enhanced food packaging, nutrient bioavailability and food preservation [1,2]. Nanomaterials generally are considered as those particles having particle dimensions lower than 100 nanometers at which their novel physicochemical properties make them significantly different from their bulk counterparts making them useful for various applications. Various investigations have been carried out and many more are in progress focusing on the potential usage of nanotechnology in the area of food packaging. Nanofood is a concept that is applied to food materials generated through the use of nanotechnology in production, processing, securing and packaging. Nanotechnology has outstanding potential in post-harvest processing of food [3,4]. The application of nanomaterials ensures food consistencies, which is attained through particle size modification, formation of desired clusters as well as the surface charges of the food nanoparticles. Furthermore, the emergence of nano-mediated delivery systems for nutraceuticals, and the synergistic actions of nanoparticles in food security as further aided the advancement of this area. More recently, there are numerous consumable nano-coatings that are used in fruits, cheese, meat, bakery foods and fast food. Nanofilters have been adopted for the removal of undesired colours from beetroot as well as lactose from milk to make nano-modified milk available for patients that are lactose intolerant [5]. The introduction of bio-active nanomaterials into polymeric matrices further enhances the efficiency of the packaging materials and makes provision for enhanced functional components and attributes such as scavenging, antimicrobial and antioxidant potentials. The formulation of various nanocrystalline particles has aided in the reduction of carbon dioxide inflow in beers. Oxygen carrier in alcohol production is enhanced through the use of clay nanomaterials. There foregoing shows that nanotechnology has remarkable superiority over the conventional approaches to food processing with an enhanced shelf life of the products, production of high quality food and prevention of contamination [6].

Presently, millions of dollars are spent at a global scale for food security and safety. The utilization of nanomaterials has the unique potential of improving food processing and packaging and also enhancing their taste and nutritional values. Nanotechnology can be utilized for the enhancement of food texture and flavor, reduction of the contents of fat, encapsulation of various nutrients, and prevent the degradation of vital nutrients and bioactive components during storage. The introduction of intelligent food packaging through the integration of nanosensors can further provide consumers with reliable details on the food present. The food packages are enclosed with nanomaterials thereby giving an immediate alert to the consumers on the safety levels of the food [7].

Despite of the recent advances in this direction, most of such applications are at present in their elementary stage, with most aimed at products of high value. Also, the evaluation of nanofood safety has not been fully established. It is paramount for various regulatory agencies to set pragmatic standards to be followed in the evaluation of food safety, packaging as well as the supplementary usage of nanomaterials [8]. There are limited studies on the exploration of naturally occurring nanostructures and their potential benefits in food processing. It is therefore not easy to conclude in the overall merits and demerits of nanotechnology in this regard. Currently, nano-modified foods are not usually labeled making it difficult for potential consumers to identify which is modified or not and make the decision to consume such food products. It is vital for standard testing of such nano-modified food prior to their discharge into the market. There is therefore pressing need for novel and reliable approaches to studying the effects of nanomaterials on human cells with the intent of assessing their inherent hazardous impacts. It is envisaged that nano-modified food products will be increasingly available to consumers at a global scale [9].

More recently, there are numerous emerging concerns in the application of nanomaterials in the food industry. One of the major areas of interest to researchers is their toxicological and environmental impacts. Although the nanomaterials present in the surfaces of food do not pose harm directly from some available studies, however their transportation and integration in the food can affect human health adversely. The toxicological concerns associated with these nanomaterials are primarily due to their non-dissolvable nature, non-biodegradability and persistency in living cells and the environment [10]. Their poor consumer awareness, government policies, and methods of detection for risk assessments of nanomaterials deter detailed understanding of toxicity inherent with the utilization of nanotechnology. The toxicity associated with a nanomaterial has been reported to increase with a decrease in the sizes of the nanoparticle. Due to the high reactivity of nanoparticles they readily passed through the membrane bringing about various toxicodynamic and toxicokinetics effects. There is a need for extensive studies in this regard. Although there are wide applications of nanomaterials only a highly limited study exists on the in vivo toxicological effects using nanoparticles in mammalian models [11,12].

Nanomaterials are currently being applied in various parts of the world, although there are few countries in the world with reliable regulatory policies and standards for the use of nanotechnology in the food sector. There is a dearth in the scientific exploration of the various nanosystems thereby creating challenges in reaching a good conclusion about their efficacy. There is a paramount need for efficient labeling of packaged nanofood so that consumers can make their choice. The utilization of nanotechnologies if effectively managed and regulated would play a remarkable role in the improvement of food processing technology for the well-being of humans.

References

1. Inobeme A, Adetunji CO, Ajai AI (2022) Future perspectives in nanomaterials for environmental and medical applications. *Int J Nanomater Nanotechnol Nanomed* 8: 005-006.
2. Assey G, Malasi W (2021) Advances in Nanomaterials Sciences and Nanotechnology for Sustainable Development: A Review *Tanzania Journal of Science* 47: 1450-1463
3. Noah N (2020) Design and Synthesis of Nanostructured Materials for Sensor Applications, *Journal of Nanomaterials*.
4. Adetunji CO, Ogundolie FA, Olaniyan OT, Mathew JT (2022) *Nanobiomaterials for Food Packaging Sensor Applications*.
5. Sharma C, Dhiman R. Rokana R, Panwar H (2017) Nanotechnology: An Untapped Resource for Food Packaging. *Front. Microbiol Sec. Food Microbiology*
6. Peidaei F. Ahari H. Anvar S, Maryam Ataee (2021) Nanotechnology in Food Packaging and Storage: A Review 2: 123-153.
7. Sharma P, Pandey V, Sharma M, Patra A, Husen A (2021) A Review on Biosensors and Nanosensors Application in Agroecosystems. *Nanoscale Res Lett.* 16: 136.[crossref]
8. Peidaei M, Panigrahi C, Vishwakarma S, Kumar J (2022) A Review on Nanotechnology: Applications in Food Industry, Future Opportunities, Challenges and Potential Risks. *J Nanotechnol Nanomaterials*.;3: 28-33
9. Tirado-Kulieva V, Sánchez-Chero M, Jimenez D. Sánchez-Chero J. Garcia L.(2022) A Critical Review on the Integration of Metal Nanoparticles in Biopolymers: An Alternative for Active and Sustainable Food Packaging.
10. Inobeme A, Mathew JT, Adetunji CO (2023) Recent advances in nanotechnology for remediation of heavy metals. *Environ Monit Assess* 195: 111.
11. Subhan M, Choudhury K, Neogi N (2021) Advances with Molecular Nanomaterials in Industrial Manufacturing Applications. *Nanomanufacturing* 1: 75-97.
12. Adetunji CO, Ogundolie FA, Olaniyan OT, Mathew (2022) Bio-and Nano-sensing Technologies for Food, Royal Society of Chemistry. *Nanobiomaterials for Food Packaging Sensor Applications*. 167-180.

Citation:

Inobeme A, Mathew JT, Adetunji CO, Maliki M, Onyeachu BI, et al. (2022) Advances, Prospects and Concerns in Nanomaterials for Food Processing. *Nanotechnol Adv Mater Sci* Volume 5(3): 1-2.