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Editorial

Current Scenario on Food and Agriculture Nanotechnology

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EDITORIAL

Nanotechnology is concerned with nanoparticles with at least one dimension of 1 to 100 nanometers. Inorganic, organic, and mixed nanomaterials have all been tested in the food business. Silver NP is the most commercially produced and used metal NP due to its antibacterial action, whereas gold NP is being explored as a sensor/detector. Titanium dioxide nanoparticles have also been investigated as a disinfectant, food additive and flavour enhancer. Natural products NPs are typically used as a delivery system in the food sector, but they can also be used as ingredients or supplements. Many components of customer products, such as food packaging, additives, and food preservation, have been penetrated by food nanotechnology. Food processing and storage have evolved as a result of the acknowledgment of this unique technology [1].

Many common chemicals used as food additives or packaging materials have been discovered to exist in part at the nanometer scale. Food-grade TiO_2 NPs, for example, have now been discovered in the nanoscale range up to over 40%. Although nanoparticles such as TiO_2 NPs are generally considered minimally hazardous at ambient temperatures, long-term exposure to such nanomaterials can result in negative consequences. The use of innovative food nanotechnology, as well as the presence of nanoscale substances, has sparked public concern about the potential dangers [2]. In this part, we take a close look at the current state of food nanotechnology application. A list of nanomaterials found in food products is provided. The Food and Drug Administration of the United States and the European Commission are the primary sources of food nanotechnology legislation and regulation. Some FDA and EC approvals are predicated on a risk evaluation of a substance's conventional particle size; as a result, the authority may need to review engineered NPs on a case-by-case basis [3].

A few research and development applications are also included to highlight potential future applications. Color and flavour additives, preservatives, and carriers for food supplements, including animal feed products, can all benefit from nanomaterials. Engineered nanoparticles' particular features make them ideal for use as additives or supplements in food production. Inorganic oxide compounds like SiO_2 (E551), MgO (E530), and TiO_2 (E171) are also allowed as anti-caking agents, food flavour carriers, and food colour additives by the US FDA. TiO_2 is, for example, commonly used as a culinary additive in gum, white sauces, cake icing, candies, and puddings. Except for carbon black and titanium nitride, all of the compounds have current food processing authorizations based on conventional particle size [4].

Those compounds utilised in foods, on the other hand, are frequently detected on a nanoscale size. Nanotechnology is used in agriculture to improve food production while maintaining or improving nutritional content, quality, and safety. The most essential approaches to boost agricultural output are to employ fertilisers, insecticides, herbicides, and plant growth factors/regulators more efficiently. Nanocarriers can be used to deliver pesticides, herbicides, and plant growth regulators in a controlled manner. Poly nanocapsules, for example, have recently been developed as a herbicide carrier for atrazine [5]. When mustard plants were treated with atrazine-loaded poly nanocapsules, the herbicidal activity was significantly increased compared to commercial atrazine, with a significant decrease in net photosynthetic rates and stomatal conductance, a significant increase in oxidative stresses, and ultimately weight loss and growth reduction in the tested plants. Other nanocarriers, such as silica NPs and polymeric NPs, to distribute pesticides in a controlled manner, a modified release system was designed [6].

Nanoscale carriers can be used to achieve the delivery and delayed release of these species to perfection. Precision farming is a type of farming that increases crop yields while minimizing soil and water harm. Most importantly, Nano encapsulation can reduce herbicide dosage without sacrificing efficacy, which is good for the environment. Insect-resistant cultivars were developed using nanoparticle-mediated gene or DNA transfer in plants, in addition to nanocarriers [7]. More information is available in previously published reviews. Furthermore, certain nanomaterials can act as insecticides by themselves, with increased toxicity and sensitivity. Low nutrient absorption efficiency and excessive losses are significant problems with traditional mineral fertilisers. The invention of nanofertilizers offers a fresh remedy to such financial losses. Nano fertilizers can help crops and soil microorganisms absorb more nutrients by minimising nutrient loss and increasing

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nutrient absorption [8].

At the nanoscale, commercialised nanofertilizers are primarily micronutrients. Other nanomaterials, such as carbon nano-onions and chitosan NPs, have been suggested as potential crop growth and quality enhancers [9]. In the coming decade, innovative nanofertilizers are expected to inspire and revolutionize conventional fertiliser producing businesses. Nanosensors, particularly wireless Nanosensors, have been created to monitor crop diseases and growth, fertiliser efficiency, and environmental conditions in the field due to the many advantageous properties of nanomaterials. Engineered Nanosensors, for example, can detect pesticides and herbicides, as well as diseases, at very low levels in food and agricultural systems. Together with the right use of nanofertilizers, Nano pesticide, and nanoherbicides, such in situ and real-time monitoring systems serve to mitigate potential crop losses and boost crop yield [10].

Conflict of Interest

None

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