International Scholars Journals

Frontiers of Agriculture and Food Technology ISSN 2736-1624 Vol. 12 (3), pp. 001-002, September, 2022.
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Commentary

Nanotechnology applications in food and agriculture

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Received: 16-Aug-2022, Manuscript No. FAFT-22-73959; Editor assigned: 19-Aug-2022, Pre QC No: FAFT-22-73959 (PQ); Reviewed: 05-Sep-2022, QC No: FAFT-22-73959; Revised: 12-Sep-2022, Manuscript No: FAFT-22-73959 (R), Published: 20-Sep-2022

DESCRIPTION

The use of engineered Nano Materials (NMs) and nanotechnology in the food and agriculture sectors aims to offer consumers and society a number of potential advantages, such as more nutrient dense processed foods, edible food coatings to prolong the shelf lives of fresh produce and environmentally friendly substitutes for conventional agrochemicals. The poor agricultural sector productivity, depletion of natural resources, substantial post-farming losses, lack of value addition, and rapid population expansion make it extremely difficult to provide food security in emerging nations. The gap between supply and demand for food is reducing thanks to modern technology. The use of effective pesticides and herbicides, the manipulation of soil features, wastewater management, and disease detection are some of the prospective applications of nanotechnology that might increase agricultural output. It has the same advantages for commercial food processing, including increased food output with great market value, improved safety, and better antimicrobial protection. By extending the shelf life with the use of nanoparticles, nanotechnology can also lower post-farming losses. The creation of smart and active packaging, nanosensors, nanopesticides, and nanofertilizers are just a few examples of how the conventional food and agricultural industries have been transformed by the rapid growth of nanotechnology. Numerous cutting-edge nanomaterials have been created to enhance agricultural growth, food quality and safety and environmental monitoring. One of the most cutting-edge technologies is nanotechnology, which unquestionably advances several industries, such as agriculture, biotechnology, engineering, architecture, the medical sciences, food security and food technologies. For the enhancement of crops, food shelf life, target-specific medicine delivery, and hard materials with a reduced weight, nanotechnology, nanomaterials and nanoparticle research play critical roles in generating superior nano-based goods. Over time, food perishes readily, as do food items. When compared to traditional and customary approaches to improving food quality, nano-based technologies provide a higher level of advantages. In addition to lowering contamination, storage, and packing, one of the primary uses of nanotechnologies will be to extend shelf life. The nutraceutical industry uses nanotechnology techniques to improve the safety of food items, similar to how pharmaceutical applications of nanotechnology do. Global issues include the rising need for enough food that is both safe and nutritious as well as the ongoing environmental harm caused by traditional agriculture. The constant growth of the world's population and the reckless depletion of its resources call for innovative solutions and more environmentally friendly methods of food production. The application of nanotechnology in agriculture provides intelligent methods for delivering nutrients, herbicides, and genetic components for greater soil fertility and protection, as well as improved qualities for improved stress tolerance. Additionally, nano-based sensors are the perfect method for precision farming to track every element that affects crop yield. In order to achieve sustainability, green chemistry involves the synthesis of chemical products with lower carbon footprints or reduces the toxicity of potentially dangerous compounds. Several worldwide concerns can be solved via green nanotechnology. In order to achieve sustainability in agriculture, the food industry, and animal feed, green nanotechnology is being viewed as a crucial instrument. In green nanotechnology, Nano Materials (NMs) are created biologically and have a wide range of uses in sustainable agriculture and related fields. The production of Nano Particles (NPs) has been carried out using a variety of plant tissues, including leaf, stem, bark, seed, root, fruit and flower. In order to meet the increased demand for food, agricultural production must increase. However, additional increases cannot be supported without a significant risk of negative environmental effects due to the use of agrochemicals and traditional farming techniques. In recent years, there has been an increase in the use of nanotechnology to agricultural

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operations, which has shown great promise for enhancing crop productivity. It is inevitable that additional chemicals will end up in water bodies as a result of the fast expansion in the production and usage of nano-agrochemicals in agriculture. The science of nanotechnology is fast developing and has opened up new opportunities for increasing agricultural output in a sustainable way. The recent rapid development of nano-enabled technology has improved the quality of food items while also helping to lessen the yearly financial losses brought on by pests and viruses. The nanobiotechnology-enabled agricultural system uses the fewest possible agricultural inputs for the best food production while also reducing agricultural waste before it reaches the consumer level. The nanosensors are essential for high-throughput plant-chemical phenotyping because they may be used to connect with actuating electronic devices to aid with the distribution of water and agrochemicals through an automated system and an improved control system. Thus, nano-enabled technology has great promise for increasing agricultural output while utilizing scarce resources and doing so at a reasonable cost