OPINION

Nanomaterials in the agrifood and pharmaceutical industry

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ABSTRACT

Nanotechnology has recently emerged as one of the most fascinating scientific breakthroughs. Metal nanoparticles created by nanotechnology have received a lot of interest. Due to its practical applications aimed at the manufacture of novel materials at the nanoscale level, this is emerging as a rapidly rising discipline.

Nanomaterials are attracting a lot of attention in a variety of industries, including agri-food and biomedical items. Nanomaterials can be used in a variety of applications in the agri-food industry, including fertilizers, herbicides, insecticides, sensors, and quality boosters, as well as food processing, food packaging, and nutraceuticals to improve nutritional value. These agricultural uses result in improved crop quality and yield, as well as a reduction in pollution produced by numerous chemicals.

Key Words: *Biomedical; Agrifood.*

INTRODUCTION

Nanotechnology has the potential to enhance nutraceuticals and functional meals by protecting and transporting active chemicals (hydrophobic and hydrophilic) through inclusion into food items. Nanotechnology usually refers to the usage of nanoparticles with a size of 1 nm to 100 nm. Nanotechnology's foundations are based on materials adopting alternative and often more favourable qualities at their nanoscale as compared to their usual size, due to an increase in surface area. Medicine, agriculture, food science, food technology, recreation, and civil engineering are just a few of the sectors where nanotechnology can be used. Nanotechnology has enormous promise in many sectors, and some uses have already proven to be beneficial to businesses and consumers. Nanotechnology has been employed by engineers to make goods that are stronger, lighter, rustproof, and stain/fire resistant. Although advances in nanotechnology have been made in a variety of sectors, the food industry has been sluggish to develop and accept the technology. This is primarily due to public scepticism; many people are uninformed of and misunderstand nanotechnology as a science. Consumers should be aware, however, that nanoparticles can be found in both natural and processed foods.

NANOMATERIALS IN THE AGRIFOOD INDUSTRY

Nanoscience has risen to prominence as one of the most cutting-edge technologies in the agricultural and food industries. Nanomaterials can be used in the agrifood industry as nanoformulations for crop enhancement, crop protection for disease detection, nanodevices for plant genetic manipulation, plant disease diagnostics, and other applications. A variety of nanoparticles have been used to promote agricultural food plant growth and development. In many food crops, such as alfalfa, cucumber, corn, lettuce, onion, pumpkin, ryegrass, rape, radish, spinach, soybean, tomato, and wheat, this positive impact has resulted in increased germination percentage, biomass production, and physiological parameters such as photosynthesis and nitrogen metabolism. Nanotechnology is important in biomedical and pharmaceutical products because it makes everything easier, from diagnosing ailments to delivering drugs to human organs to combat infectious infections. Due to their ability to bind, absorb, and carry small-molecule drugs, DNA, RNA, and proteins with high efficiency, nanoparticles have unique biological properties that can be used for disease detection, prevention, and treatment, drug delivery, and gene therapy of cancer and pulmonary diseases. Indeed, liposomal medication formulations (e.g., doxorubicin) have been successfully employed to treat breast and ovarian malignancies, as well as Kaposi's sarcoma. When compared to conventional preparations, liposomal medication formulations for amphotericin and hamycin cancer medicines showed substantially superior efficacy and safety. Nanomaterials have been used as active ingredients (nanocrystals), excipients (drug-metal complexes), drug transporters (liposomes), and complexes/conjugates (drug-protein) in therapeutic formulations. Nanotechnology may offer nutritional health benefits in the future. People with type 1 diabetes should be able to swallow a nanoengineered biodegradable substance that contains insulin and can be released in response to high blood glucose levels. The use of nanotechnology-derived anti-inflammatory medicines on the mucosal lining of individuals with inflammatory bowel disease or Crohn's disease has also piqued curiosity. It's also suggested that using nanotechnology on particular nutrients may allow people to broaden their food tolerances and choices.

NANOMATERIALS IN THE FOOD INDUSTRY

Nanotechnology has a lot of potential for improving and creating new food concepts that go beyond what is now possible. Agriculture, food processing, food packaging, and supplements are all examples of areas where they might be used. Food packaging could be produced to prevent microbial invasion or to inform consumers when food is no longer edible using

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nanosensors. Food can also be made healthier for consumers through nanotechnology. Both "soft" and "hard" nanomaterials can be found in food. Soft nanoparticles are created through the preparation of natural products or food components, such as homogenized milk, ricotta cheese, and coenzyme. The Food Standards Agency, on the other hand, is more concerned about h-rd nanoparticles. These materials are insoluble, and little is known about the qualities they possess. Metals, for example, are considered hard nanomaterials. By the "Novel Foods Regulation," current approval of nanotechnology foods and procedures would be required, according to the FSA.