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Nanotechnology in Food: Improving Nutrient absorption

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Abstract: -

Through increased bioavailability, improved nutrient absorption, and improved food quality, nanotechnology is revolutionizing the food sector. The use of nanomaterials, such as nanoemulsions, nanocarriers, and nanoliposomes, to maximize the transport of vital nutrients is examined in this article. The advantages, possible dangers, and legal issues surrounding food nanotechnology are also covered.

1. Introduction:

The effectiveness of food-based nutrition is largely dependent on the efficiency of nutrient absorption. A number of vital nutrients, including vitamins, minerals, and bioactive compounds, have low solubility, stability, and bioavailability. Nanotechnology provides creative answers to these problems by facilitating precise nutrient delivery, enhancing solubility, and shielding nutrients from deterioration.

2. Nanotechnology Applications in Nutrient Absorption

2.1 Nano-Encapsulation for Enhanced Protection :-

To ensure that nutrients reach their appropriate absorption locations without losing effectiveness, nano-encapsulation entails encasing them in nanoparticles, such as liposomes or polymer-based carriers, to shield them from environmental variables including heat, pH, and enzyme destruction.

The Role of Nanotechnology in Human nutrition :-

Human nutrition is greatly impacted by nanotechnology, which presents numerous chances to enhance the safety and quality of food. Food scientists have been working hard in recent years to create new food items with improved functional qualities. Making nanocolloids for use in food applications, for instance, has become a viable substitute for encapsulating nutrients and bioactive

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substances, enhancing their bioavailability and absorption in the gastrointestinal tract. Usually made from proteins, polysaccharides, or lipid molecules, these nanostructures can be made up of a single molecular species or a mix of multiple molecular components. Nanoemulsions, nanomicelles, nanocapsules, and other such structures are examples of often encountered nanocolloids. The demand for nanocapsules is growing due to their application in smart medicine delivery within the body and the creation of liposomal nanocapsules used in food science, medicine, and agriculture . By providing defense against deterioration during processing, nanocapsules may allow for the controlled and/or prolonged release of active ingredients .Additionally, these nanomaterials, which range in size from 10 to 1000 nm, can also contain therapeutic compounds by combining a protective matrix shell with a core containing one or more active chemicals . A variety of methods are used in the production of nanocarriers, such as arc discharge, emulsion polymerization, interfacial polymerization on the surface of an existing polymer, and monomer polymerization in a water-based solution . Liposomal nanocapsules and spherical bilayer vesicles made by dispersing polar lipids in hydrophilic fluids are more examples . All disciplines are very interested in protein- and NP-based nanocapsules . Proteins have unique functional properties that make them ideal for encasing bioactive substances, such as their interaction with water and their capacity to produce gels or emulsions.Essential micronutrients for our diet include proteins and other nutraceuticals, such as probiotics, vitamins, antioxidants, and bioactive peptides . The persistence of active ingredients in the body after consumption is necessary for their disease-prevention efficacy. Because of the widespread demand for safe ingredients, delivery methods that use synthetic chemicals in biomedicine or pharmaceuticals might not always be appropriate in the food business. As a result, probiotic nanoencapsulation presents itself as a secure substitute for the distribution of bioactive food ingredients . Probiotics are defined as live bacterial species that have positive effects when consumed. They have been shown to strengthen the body's immune system, lower blood cholesterol, and improve general well-being. Since electrospinning was used to create nanofibers, probiotic nanoencapsulation has become more popular in recent years. Probiotic strains' durability and vitality have been greatly increased by encasing them in sodium alginate and corn starch nanofiber mats, outperforming those of non-encapsulated cells .Sodium alginate and starch nanofiber mats made by electrospinning have shown better protective qualities than those made by microencapsulation or nanoencapsulation with a single biopolymer . Dairy products such yogurt, milk, cheese, puddings, and beverages have been made with these nanofiber mats . While there are many benefits to using probiotics in food that are nanoencapsulated, including increased intestinal delivery effectiveness and probiotic protection, there are also some drawbacks, including high production costs, complicated regulations, potential instability during processing, and worries about negative nanoscale effects. When creating and manufacturing these products, these factors need to be taken into account.

Future Perspectives :-

The goal of ongoing research is to create biodegradable, safer nanomaterials for use in culinary applications. Nanotechnology developments may result in customized nutrition plans that distribute nutrients according to each person's unique dietary requirements. To guarantee the long-term safety and efficacy of food items based on nanotechnology, more research is needed.

Conclusion :-

Nanotechnology is a useful technique for enhancing food-based nutrition because it promises promising improvements in nutrient absorption and bioavailability. To guarantee its proper usage in the food business, safety and regulatory issues must be resolved. Harnessing the full potential of nanotechnology in food applications will require ongoing research and open rules.

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