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Nanotechnology and Its Application in Food Industry

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ABSTRACT

Nanotechnology is that the technology of manipulation of matter at the nanometre scale. Materials of nanostructure might possess distinctive physical and chemical characteristics. Nanotechnology permits the development of latest merchandise in varied fields. It additionally paves the way for the advance of existing conventional merchandise with higher effectivity, solubility and bio-availability. Engineering science has been applied in various sectors as well as electronics, medicine, medical specialty, military, food business etc. the application of nanotechnology in food has gained nice importance within the recent years visible of its potential within the development of novel and healthier food. Food engineering science unveil new prospects for development of innovative food merchandise. Application of nanotechnology in food includes improvement of packaging, processing, nano-additives, clean-up and sensors for detection of contaminants. This paper deals with the applications of nanotechnology in food business.

INTRODUCTION

Nanotechnology is mostly outlined because the design, production, and application of structures, devices, and systems through management of size and shape of materials at 10-9of a meter scale Nanotechnology that is an emerging space of science has potentials to come up with radical new products and processes within the food sector. Concepts in engineering science give a sound framework for developing an understanding of the interactions and assembly behaviour of food components into microstructure that influences food structure, rheology, and practical properties at the sub microscopic scale [2]. There are several disclosed materials referred to as 'nanomaterial's' that are used for various food applications on an industrial scale. Titanium dioxide, that may be a nanomaterial, is wide used as additive and antimicrobial agent for food packaging and storage containers [3] and additionally proven to create no cytotoxic result with an intermediate concentration on rats [4]. Silver nanoparticles (AgNps), ar used as antimicrobial agents in food packaging, storage containers, chopping boards and refrigerators and additionally as health supplements [5]. Zn and oxide are used as biological process additives and additionally as antimicrobial agents in food packaging [3]. Silicon dioxide and carbon have particles of a few hundred nm in size and are used as food additives and for food packaging [6]. Platinum and gold nano-wires are used as biosensors to improve food analysis [7, 8], nanoproteins and nano saccharide and processed carbon particle are used for packaging food [9-11]. Search for different nanoparticle and testing toxicity of disclosed nano-material with laboratory rat is the trend [8]. The food and bioprocessing business is facing huge challenges with developing and applying systems that may turn out top quality, safe foods moreover as feed to an economical, environmentally satisfactory, and property person. Whereas finding out the solution of those complex set of engineering and scientific challenges, innovation is required for brand spanking new processes, products, and tools within the food industry. Engineering science is gaining momentum and turning into a worldwide vital tool for the food and bioprocessing business in meeting up the world demand that leads to increasing population

growth and incomes in developing countries [12].

Nanotechnology has potential applications altogether aspects of food chain as well as storage, quality monitoring, food process, food packaging, improvement within the tastes, texture, flavour, enhanced nutrient absorption, improved packaging techniques and higher infective agent detection system.

Nanotechnology in food industry

Bio-nanotechnology has the potential to resource bioactive constituents in eatables whereas improvement in foodstuffs at the nanoscale because of anti-pathogenic ability and increased properties of nanoparticles. Nanoscale biomaterials will participate in pathogen detection, still as helps in nanoscale purification systems for improved food quality. Some necessary aspects lined like nano-additives, intelligent packaging, management and nutraceuticals delivery, nano-coding of plastics and paper materials and nano-encapsulation and target delivery currently, some nutrients primarily vitamins are encapsulated and targeted into the blood. Some foods and drinks were elated with nanoparticles while not affecting the style or look. Nanoparticles emulsions are being used in frozen dessert and spreads of this nano-emulsion will improve the texture and uniformity of the frozen dessert. Development of smart food packaging materials that may offer info relating to packed foodstuffs remains challenge for researchers. In recent times, some packaging materials integrated with "nano-sensors" to find the oxidisation method in food. In such packaging materials once the oxidation happens within the foodstuffs, nano-sensors indicate the colour change and inform concerning the contamination of the foodstuffs like milk and meat. In precise, nanoparticles have broad-spectrum antipathogenic properties against different pathogens causative agents of food borne malady. The antimicrobial mechanism of action of NPs is generally thought of as of few prototypes like aerobic stress and cell injury, metal particle unharness, or non-oxidative mechanisms. This property of metal nanoparticles is extremely useful in increasing the shelf-life of foodstuffs. Nanoparticles have been effectively entrenched within the packaging materials for creating food storage, so minimizing pathogenic growth on keep foodstuffs. Therefore, the technology could be an innovative method and acts as AN agricultural biosecurity.

Food packaging:

Improvements within the physical or chemical characteristics of packaging materials, like strength, barrier quality, antimicrobial activity, and resistance to temperature, are being developed exploitation nano-composite materials. Other applications of engineering in packaging embrace sensors that may sight food spoilage, nanoclay-nylon coatings and silica barriers forglass bottles that impede gas diffusion, metallized films, antimicrobials incorporated in packaging, smarter bar codes, and improved pigments, inks, and adhesives. Nano-silver is finding increasing applications as associate antimicrobial, anti-odorant, and a health supplement. Although the present use of nano-silver relates primarily to health-food and packaging applications, its use as associate additive in antibacterial drug.

Nano-sized supplements and nutraceuticals:

These are developed to reinforce nutrition, and to improve health and well-being. Nano- sized supplement relates to process of foodstuffs to develop nano- scale structures and stable emulsions/mixtures to improve the consistency, style and texture attributes of the food. Nano-textured foodstuffs alter reduction of fat usage thereby conducive to healthier food. Associate example of product would be a frozen dessert, mayo or spread that is nano-textured, that may low in fat however as "creamy". These product would render „healthy" but still tasty food product. Development of micronized starch, cellulose, wheat and rice flour, and spices for food applications are presently on going [2]

NANOTECHNOLOGY IN FOOD QUALITY SURVEILLANCE

The development of chemical sensors and biosensors over many decades has been

investigated resulting in novel and very interesting sensing devices with great promise for many areas of applications including food technology. The incorporation of such sensors into the food packaging technology has resulted to what is referred to as 'smart or intelligent packaging' [11]. Recent analysis has shown that luminescence O biosensor is additional compactible, comparatively cheaper than another biosensor, in packaging materials for food monitoring [12]. The principles of smart packaging engage the use of with chemicals or biologically created a device to monitor the standard, integrity, wholeness, and safety of food from the producers to the costumers via delivery chain. This technology can result in an exceedingly style of sensor designed to change its cryptography once there is a breach of set parameters like pathogens invasion, leakage, carbon oxide, oxygen, pH, time or temperature change. Thus, this technology is required as on-line quality management and has great potential within the development of recent sensing systems integrated into the food packaging, that square measure on the far side the existing conventional technologies, like management of weight, volume, colour and look [13]. Quality assurance in food and bioprocessing industry is of utmost importance as a result of consumers demand safe and wholesome food, as well as governments, impose rigorous regulations to confirm food safety and feed hygiene. Sensors or detection systems for –rapid detection of spoilage of product elements, for quality control, and for abuse detection at the source and through production chain is feasible through applied science [1].

NANOTECHNOLOGY IN FOOD PACKAGING

Nanotechnology offers higher hopes in food packaging by promising longer time period, safer packaging, higher traceability of food product, and healthier food. Chemical compound nanocomposite technology holds the key to future advances in flexible, intelligent, and active packaging. Intelligent, smart, and active packaging systems produced by applied science would be ready to repair the tears and leakages (self-healing property), and reply to environmental conditions; amendment in temperature and wet. Intelligent food packaging will sense once its contents are spoiling, and alert the buyer. Currently, researchers are victimisation salt nanoparticles to supply a barrier to gasses (for example, oxygen), or wet in an exceedingly sheet used for packaging. This might scale back the possibility of food spoiling or dry out. Zinc oxide nanoparticles will be incorporated into plastic packaging to dam actinic radiation rays and supply antibacterial protection whereas up the strength and stability of the sheet. This will allow for frequent testing at a far lower price than causing samples to a research lab for analysis. This point-of-packaging testing, if conducted properly, has the potential to dramatically scale back the chance of contaminated food reaching grocery store shelves [1]. On Processing Re-Write Suggestion Done (unique Article)

Cleaning and disinfection:

Titanium dioxide is employed as a disinfecting agent because it generates reactive oxygen species within the presence of light-weight/ultraviolet illumination/UV/actinic radiation/actinic ray} light that cause degradation of unhealthful microorganisms. However, this potency of the titanium dioxide is impaired as most of the excited electrons recombine and don't manufacture radicals. Deposition of silver on nanoparticles of pigment improves the bactericide activity of pigment against E. coli whereas once combined with carbon nanotubes it exhibits increased activity against Bacillus cereus spores. Silver-doped pigment nanoparticles additionally inactivated B. caryophylloid dicot genus spores on metal and polyester surfaces and destroyed mobile microorganism and molds once incorporated into an air cleaner. Nanoparticles of silver once stabilised with SDS or PVP effectively inhibits the unhealthful microorganism like. Coli and Staphylococcus aurous. Surfaces of refrigerators and storage containers are coated with silver nanoparticles to prevent growth of pathogens and spoilage microorganism

CONCLUSION

Nanotechnology has many key and vital applications within the food trade in terms of food safety and internal control. Engineering science has the potential to boost the nutritionary price of food, to come up with new novel food product, new safe food packaging for extended storage. However, this new technology additionally raises concern concerning risk assessment. It is critical to develop reliable tools to detect the presence of nanoparticles and assesses the possible adverse effects because of the applying of nanoparticles.

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