**Recent Trends in Fascinating Use of Nanotechnology**

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**Abstract:**

The tunable optical, morphological and surface properties of nanoscopic delivery enhance the quality of integrated nanodevices and sensors. They are later used in optoelectronics, biomedicine and catalysis. The use of nanomaterials to fabricate nano biosensors and various other organic and inorganic functional nanomaterials holds great promise. They possess excellent electronic and surface-to-bulk reactivity. It may be attractive to modify the surface, structure, and physicochemical properties of nano-connected metamaterials. Nanoparticle technology will be particularly useful in developing a new generation of more effective cancer treatments that can control the various biological, biophysical, and biomedical barriers that the body stages against standard interventions. is. Their various proposals include metal- and metal oxide-based nanoparticles, wires, clusters such as carbon nanotubes. Recently, hybrid nanomaterials have been extended to modulate sensory work functions in the fields of nanomedicine and pharmaceutical companies. The integration of nanotechnology into food packaging systems shows promise for improving food quality and shelf life.

**Keywords:** Nanomaterials,Applications of Nanotechnology

**Introduction:**

Nano connections are produced in a variety of shapes and sizes, including various dimensional structures (inorganic, organic, and dendrimers). Particles can be wrapped in the form of particles, foils, rods, and wires, depending on their dimensionally constrained electronic characteristics. Such sketched nanostructured surface sites and band structures have been synthesized by different techniques and processed for different applications in different medical fields. Two-dimensional carbon nanomaterials and semiconductors such as CNTs, graphene, and quantum dots (TiO2, ZnO, CuO, etc.) are also taking over to improve the quality and safety of medicine.

Nanotechnology is very active and important for advancing small particles with multi-dimensional forces in the fields of food, agriculture, cosmetics, paints and coatings, personal care products, catalysts, power generation, lubricants and security printing. emerging as a growth area. , molecular computing, structural materials, drug delivery, medical therapeutics, pharmaceuticals and diagnostics [1]. The tremendous nano size of these materials provides a large surface area to volume ratio and correspondingly more surface atoms compared to their microscale analogue. This improves the properties of materials with small surface defects [2]. Additionally, nanomaterials have been extended as nanocomposites, which produce solid materials that are formed when two or more different components with different physical and chemical properties combine to create new substances. [3] Nanocomposites are hybrid materials composed of mixtures of nanometre-scale polymers and inorganic solids such as clays and oxides. Nanocomposites with very complex structures of one phase (such as nanoparticles (NPs) and nanotubes) have a nanoscale analysis that has a dominant over that of micro composites with aggregate structures. [4]

The concept of nanotechnology was introduced by Richard Feynman in 1959, and the term "nanotechnology" was later coined by Norio Taniguchi in 1974. Nanotechnology primarily involves the fabrication, characterization, and delivery of nanoscale (<100 nm) molecules. Applications of nanotechnology in polymers include the design, fabrication, processing, and application of nanoparticle-filled and/or nanoscale polymeric materials. [5]

# Discussion:

## **Important Nanoparticles**

Big promising from this promising interposes have attracted the attention of researchers in interdisciplinary fields such as life sciences, chemistry, engineering, and physics. Due to the great interest worldwide, nanotechnology is projected to impact the global economy at around US$ 3 trillion by 2020, resulting in around 6 million You will need a human expert. Various methods can be applied to enhance the barrier properties of natural polymers, including the use of high-barrier coating materials, including polymer blends, multilayer films, and high-barrier films [6]. In addition to these guidelines, the use of nanocomposites in food packaging is a new technology for this purpose. Nanocomposites enhance barrier properties and have a positive effect on the thermal and mechanical properties of packaging materials [7]. However, the main concern regarding the attractiveness of nanotechnology in food packaging is related to the small size of the nanomaterial particles, which give them different chemical and physical properties than their macroscopic chemical counterparts. [8], giving rise to potential health-enhancing issues. This article first briefly discusses the various applications of nanocomposites in food packaging. Second, start the ability to analyse them. Third, we discuss the important concern that nanocomposites can become potentially hazardous materials. Prevents use in food packaging.

To date, many nanoparticles have been recognized as fillers for the synthesis of polymer nanocomposites, enhancing their packaging activities. Among them, clays and silicates are attracting attention because of their layered structure. This is because they are large, inexpensive, easy to operate, and offer considerable magnification [9]. There are three main forms of polymer clay. H. Tactoid (or phase separation), intercalation and exfoliation [10]. In the tactoidal structures that typically occur in micro composites, the polymer chains and sound passages do not mesh well with each other and are therefore immiscible. Nanocomposite structures do not exhibit their morphology [11]. In an ideal polymer-clay nanocomposite, there is a high affinity between polymer and clay, which is typical for flake-like structures, with polymer chains penetrating the interlayer spaces of the clays to form individual layers. increase. If the clay exhibits moderate affinity for the polymer, the result is an intercalating structure. Other particulate fillers in use have been reviewed in the literature, including silver, zinc oxide, titanium dioxide, carbon nanotubes, graphene nanoplates, copper and copper oxide. Graphene nanosheets (GNPs) have been observed to be able to form nanocomposites with improved thermal stability and barrier properties, making them an excellent choice for food packaging. [12]

## **Nanomaterials for Cancer Therapy:**

Cancer is an advanced motive of loss of life global. From a complete of fifty-eight million deaths globally in 2005, most cancers bill for 7. 6 million (or13%) of all deaths. The maximum common most cancers sort global are (a) amongst men: lung, stomach, liver, colorectal, esophagus, and prostate; and (b) amongst women: breast, lung stomach, colorectal and cervical (Pan American Health Organisation, WHO 2006). Nanoparticles examined for anticancer drug shipping may be crafted from a number of materials, which include polymers, dendrimers, liposomes, viruses, carbon nanotubes, metals etc.

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| **Nanoparticle placed delivery systems** | **Medicinal and systematic use** |
| Liposomes | Managed and targeted drug delivery; Targeted gene delivery. |
| Dendrimers | Targeted drug delivery |
| Nano shells | Tumor targeting |
| Carbon nanotube | Tumor targeting |
| Fullerene based derivatives | As targeting and imaging agent |
| Gold nanoparticles | Imaging agent and Targeted delivery  |
| Paramagnetic nanoparticles | As imaging agent and targeting agent |
| Quantum dots | As imaging agent and targeting agent |
| Solid lipid nanoparticle (SLN) | Disciplinned and targeted drug delivery |
| Nanowires | As imaging agent and targeting agent |

**Improved Packaging Through Nanocomposites:**

Nanocomposites, which combine conventional food packaging materials with nanoparticles, are of great interest in the food packaging field. In addition to its remarkable antibacterial spectrum, it exhibits excellent mechanical performance and strong hostile properties [13]. Nanocomposites typically consist of a continuous or discontinuous phase polymer matrix [14]. It is a multi-phase material in which matrix (continuous phase) and nano-dimensional material (discontinuous phase) are fused. On the basis of nanomaterials, nano-dimensional phases are generally characterized as nanospheres or nanoparticles, nanowhiskers or nanorods, nanotubes. [15] Nano-sized phases improve the physical properties of polymers and transfer flexible strain to nano-strength materials. Because of these properties, nanocomposites have been evaluated as the gold standard for exemplifying the physical and barrier properties of polymers.

**Environmental Applications:**

Nanotechnology has come to be steadily a truth nowadays, and at the side of it there's a want for speak associated with ability advances, in addition to the impact at the surroundings and human fitness that generation can cause. Nanomaterials makes use of and additionally recommendations at the surroundings. Among their numerous applications, nanomaterials were used for declining the toxicity of agrochemicals to non-goal organisms [16]. In addition to nano-primarily based totally systems, others substances may be hired as molecular vendors for agrochemicals, consisting of the cyclic oligosaccharides cyclodextrins [17]. There is an enhancing challenge concerning the supportability of the strategies used for the synthesis of nanomaterials. Instead of classical chemical strategies, inexperienced syntheses of nanomaterials have regarded in latest years, with the usage of plant extracts, fungi or microorganism withinside the policies.

# Bio-Stranded Nanocomponents for Food Packaging System:

The incorporation of practical nanomaterials into polymer matrices can help withinside the improvement of meals packaging substances with progressed mechanical and hurdle homes. Moreover, the essential homes of packaging substances, consisting of flexibility, durability, protest to temperature, moist, and flame protection, maybe in addition obtained through the addition and changing the one-of-a-kind nanomaterials to beautify the best of the meal’s product.[18]

 

**Fig.1. Application of Nanotechnology in Medicine**

# Nanomedicine:

Nanomedicine is an amazing department of nanoscience’s for detecting problems via way of means of a particular analysis. The analysis and remedy is obtainable the usage of nanomaterials as dealers or biomarkers [19]. Highly astonishing pharmaceutical companies are essential for simplifying the numerous fitness elements and problems with decrease toxicity to everyday tissues.[20] The liposomal structures had been done via way of means of many different scientists, and that they together invented those makes use of in society for wholesome life. In the development of liposomal-primarily based totally drugs, particular lipid gadgets play a essential role. It substantially will increase the pharmacological effects [21]. The semiconducting nanomaterials, consisting of ZnO, CuO, and TiO2, are commonly carried out in drug transport because of their functionalized securities and moves. The functionalized metal-oxide nanoparticles are discovered extra effective closer to drug placing and transport. They have floor rotate and pressing moves in organic structures. The garnishing floor of such nanoparticles could be very studied and normally hired for biomedical applications, which include their confinement effects and floor-to-extent vicinity assets. Apart from the liposomes, CNT, atonic layered systems of carbon (graphene), and its oxides have additionally been in working. However, silicon-primarily based totally natural and doped nanomaterials have moulded molecular dendrimers.[22] Metal-primarily based totally nanostructures, which include natural and inorganic nanomaterials, have capacity in biomedical areas. The cap potential and precision of those nano-ranged substances have range of blessings to triumph over a few important fitness issues via way of means of the enactment of nanocarriers, markers, and bioimaging. The optical susceptibility and spectral homes of such superior nanomaterials lead them to genuine for numerous biomedical actions.

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