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REVIEW

Emerging application of nanotechnology for mankind

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Abstract
Nanotechnology has proven to be the greatest multidisciplinary field in the current years with potential applications in agriculture, pollution remediation, environmental sustainability, as well as most recently in pharmaceutical industries. As a result of its physical, chemical, and biological productivity, resistance, and matricular organization at a larger scale, the potential of nanocomposites revealed different sorts of assembling structures via testing. Biosensors are known some specifically promising inventions whereas carbon nanotube, magnetic nanoparticles (NPs), quantum dots, and gold NPs showed capability to repair damaged cells, molecular docking, drug-delivery, and nano-remediation of toxic elements. PEGylated(Poly ethyl glycol amyl gated) redox-responsive nanoscale COFs drug delivery from AgNPs and AuNPs are known to be sun blockers in sunscreen lotions. The emerging trends and yet more to be discovered to bridge the gaps forming in the field of nanotechnology, especially insights into environmental concerns and health issues most importantly the food web which is connected with the well beings of mankind to perform its tasks giving necessary results. The current review detailed emerging role of nanomaterials in human life.

Keywords Biosensors · Nanoparticles · Human health · Food chain · Environmental sustainability

1 Introduction

Nanotechnology has paved its way in providing a vast opportunity with innovative enterprises with a promising spectrum of applications [1]. It has been acknowledged from pre modern times through nanoscale measurements and a wide range of technologies leading in towards acceptance. Nanoparticles (NPs) composite are in control of bringing forth versatility in nature [2–5]. The post-modern discovered NPs have shown to possess higher surface area, surface toughness, spatial arrangements with exemplary matrices in showcasing providence attributes such as catalytic, magnetic [6], electronic [7], and optical properties [8].

NPs composites are structured in diverse forms exhibiting various properties. These composites are divided into two main categories that are organic and inorganic nanoparticle and again subdivided into-

(1) Metal-based or inorganic nanocomposites
(2) Carbonaceous nanocomposites
(3) Polymer-based nanocomposites
(4) Composite nanomaterials.

The excellence of providing universal quality functionalized NPs are necessitated with doping to achieve desired results than its original state. NPs composites are prepared through combining at a nanoscale division of dispersed phase from a multiphase which must be in a measurement of < 100 nm [9–12]. They must reduce toxic levels, promote catalysis, form membranes, support transformation, aid in

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drug delivery and nanotechnology based smart capsule to purify water [13, 14].

It is observed that the progress of any NPs composites are based on its grading form from which the source of materials being studied carefully to understand the magnitude of its mass production to exercise its unique function. Some other factors that play a key role in production of NPs are temperature, pressure, reaction time and biomass/water ratio in deciding vitality of structure of nanocomposites. Hydrothermal conversions have shown a great potential in manufacturing new nanocomposites [15, 16]. On accrediting some physical and chemical changes have encompassed natural synthesis of NPs with the support of microbes. The record of obtaining some engineered NPs composites transducing biosensors like carbon nanotubes (CNTs), magnetic NPs, quantum dots then AuNPs[17, 18].

2 Nanoparticles

NPs composites when aligned with each other they form aggregates having a measurement of 1 nm and 100 nm that has a capability of modification with respect to its physical and chemical attributes when comparing sheer substances, so with respect to its structure NPs are more reportable and approachable in nature [19]. The unique size of composites when assembled with each other have shown visible properties to draft all electrons to produce quantum properties. In AuNPs, uniqueness is in photonics, catalysts, electronics and biomedical applications towards mankind that's been demonstrated [20]. Bioremediation technique have shown practices using active microbes and vital microorganisms indirection to abolish hazardous wastes and toxins from soil, water and air by NPs thus to pursue advantageous persistent uses and preserve the ongoing cycles.

One of the major problematic behaviours of NPs is overpriced. The labour expenses are a bit costly and this is why the consequential commodities are quite pricey [21]. Furthermore, it is also difficult in set up and production of the technologic skill.

In the past few decades, nanotechnology has replaced skilled labours and are currently out of a job or seasonal employed being yet another major disadvantage connected with the evolution of technology [22]. The ongoing situation of nanotechnology in the manufacturing and traditional farming industry is that the loss is only expected to upsurge in the imminent time.

Nanotechnology have shown some replacements in futile sperm and mobility count but there is a major problem that awaits unknowingly is that the resultant progeny would have some genetic abnormalities that may not be corrected through nanobiotechnology [23]. There are still much more advancements needed in improvising future prospects of nanotechnology. However, in the end the cost factor plays a major role being too expensive and time-taking [24].

The crucial steps involved for biosynthesis are by firstly taking a suitable plant culture then incapacitating with metal ion or maybe enzyme within acknowledgement of right data in kinetics and pH followed by mixing solution of metal NPs [25, 26]. In the last step, UV–visible rays are conventional for purification and recovery methods that are later distributed according to shape, size and composition [27].

3 Biosensors

3.1 Carbon nanotubes (CNTs)

Diamond, graphene, and amorphous carbons are well-known allotropes of carbon [28, 29].The width of the CNTs are around 1–3 nm. The measurement of CNTs is far complex than its width and length; generally it is in few micrometers. In short, it can be a folded form of the two-dimensional graphene sheet. CNTs exhibit extraordinary mechanical properties, called as 'buckytubes' a platform to conjugate other compound at their surface, other characteristics are in its alignment with sp^2 bonds making it stronger and rigid which is helpful in electrical, magnetic, optical, mechanical and chemical features [30, 31].

CNTs are categorized as single-walled nanotubes (SWNTs) and multi-walled nanotubes (MWNTs) based on the number of walls [32–34]. These nanotubes sidewalls are formed from hexagonal lattice of carbon atoms which is comparable towards graphene's atomic planes. However, these are commonly topped with both ends of one-half fullerene like molecule [35, 36]. SWNTs have the most basic shape and may be represented as a single rolled-up graphene sheet. The structure of a nanotube may simply be specified by its chiral vector, which is given by the chiral indices (n) based on the orientation of the tube axis with respect to the hexagonal lattice. Additionally, the large surface area is able to hold large activation sites and encompassing active units of nanotubes having biosensing application are shown in Fig. 1.

A large number of active units in the area of CNTs for biosensor have been in use [37]. In fact, this combination affects depending upon its width and leniency, hence, CNTs have been established as semi-conducting or semi-metallic sources. It is structurally exemplar that the shielding bench structure turns as a metal, while the Criss cross structure is known to possess semi-conductor or quasi-metallic elements. In the latter case, the thickness of the semiconductor belt gap shown decreases with increase in CNTs diameter [38]. The two structures are accountable for providing high electrical conductivity of metallic CNTs as they have very few electron dispersion errors and showed good steadiness at

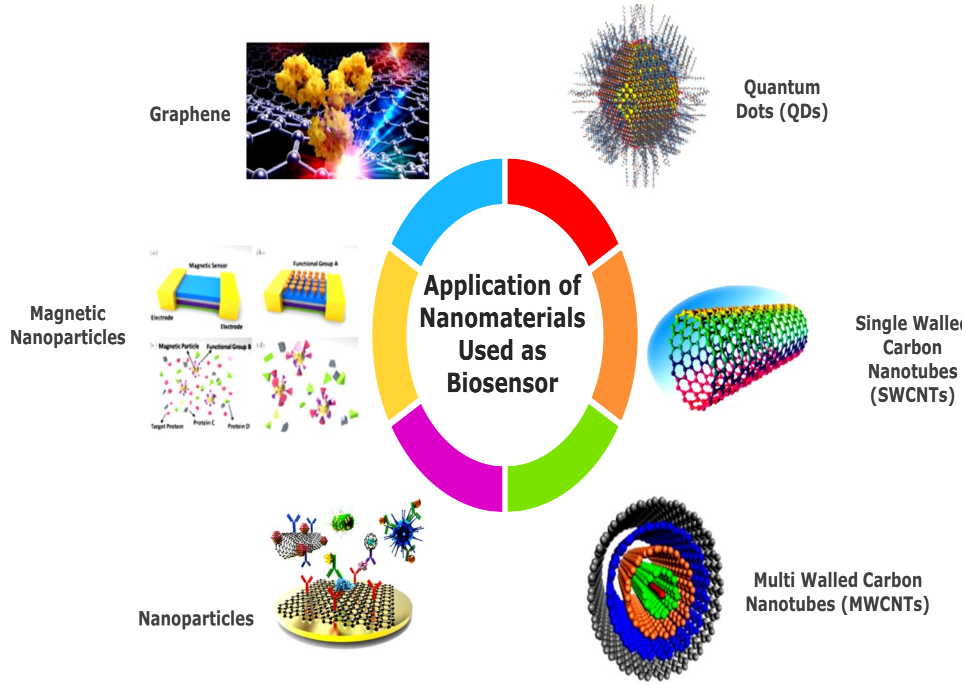

Fig. 1 Diagrammatic representation shown application of nanomaterials used as biosensor

high temperatures, i.e., 300 °C in air and 1500 °C in vacuum. Therefore, a good air-to-air conduction is also obtained. In addition, their mechanical assets are admirable combining high specialty and durability. The solid strength of SWNTs is about 20 times stronger than steel and the young modulus of CNTs is much larger than that of steel fibres [38]. CNTs can yield positive or negative magnetic resistance leading towards temperature based function.

Undoubtedly, magnetic field has been used as such with nanotubes displaying significant diamagnetic and paramagnetic responses, reliant on field route, Fermi strength, helicity and nanotubes size. The functionalization degree importantly has been demonstrated to affect tissular distribution and excretion patterns. Renal clearance is improved by increased CNTs functionalization [39], whereas lesser purposeful value increases reticula-endothelial system accumulation. As a result, the adjustment degree of surface chemical functionalization of nanotubes can provide researchers more control in vivo over specimens organ distribution and clearance patterns which is vital for CNTs-based recognition and treatments. To conclude, several research have shown surface functionalized CNTs acting physiologically differently and unhazardous than their pure counterparts [39]. CNTs shown in (Fig. 1) to be a pathway for brain repair by the process of endocytosis and being a great transportation with the best therapy outcome of medications [40].

3.2 Quantum dots (QDs)

Quantum dots (QDs) are used in a range of scientific applications due to its photoluminescent properties [41]. QDs are minuscule units or nanocrystals of a semiconductive solid with diameters in the display of 2–10 nm (10–50 atoms). Previously, the use of QDs as nano sensors has been discussed to detect toxins in biospecimens, especially in toxic environments. The estimated labour towards the practice of QDs in biosensors to detect toxins of phytotoxins, vertebrates and invertebrates, as well as microbial toxins present in biospecimens [42]. In addition, the role of QDs in the measurement of patient/victim biochemical parameters as an indirect source of toxicity is also highlighted.

Works from early sources describe applications such as the discovery of metallic particles and supplementary insignificant ion fragment sensors and cellular contaminants. One significant benefit of QDs are grouped by size and width places; excessive exposure to QDs has shown significant implications for biocompatibility, bioconjugation, and water solubility [43]. A different place for conversion methods have been used to provide them with a biocompatible situation such as shallow cover, enveloped in silicon capsules or polar-a polar chain groups and amphipathic exterior. From its photosensitive properties including fluorescence depends on its arrangement extent, it unfasten active opportunity by means of mixing QDs to simultaneously scrutinize the list of goals [44]. While developing a biosensor, it is most importantly dodged by means of hefty and stimulating QDs area to avert subsidiary requisite targeted particles. In this case, a solid foundation in manoeuvring the practice of polyethylene glycol (PEG) at between 11.9 and 13 parts PEGs as top-dressing representative.

Coating of hydroxyl in QDs remains are able to reduce 10 to 20 times indirect binding compared to that of protein and PEG-combined QDs and other countering active carboxylate QDs [45]. The use of QDs in holding is ace of the chief learning areas of QDs marketing accessibility and convenience QDs applications for biological detectors and method of yield in effectiveness completing unification of countless biological visualization tools [46]. Its practice to date is limited in propagation and visceral investigations, in fragment due to budding toxic problems with cadmium-based QDs still used in most survey. However, on examine for compilation of QDs towards branding them safe, thus replacing cadmium with less lethal matters might fix such problem.

Current ages par taken observed widespread use of QDs in biosensors. The subsequent segments assessment of QDs possessions with its application in fluorescence [47, 48]. QDs are normally in bioengineering, in light emissive as such the immunizing light through emissive analyses. Early submissions of cutting-edge excavation of supernaturally environment camouflage the protection of enclosing of amino polymer, nuclear-powered introducing active immunity, globular multifunctional proteins, micro aggregating tubulins cataloguing of immune fluorescence in stem cubicles and materials and photon emissive-based natural cross breeding or tainting the chromosomes of deoxynucleotide acid. Unfluctuating solitary of QDs can be detected in immunologically cytologic conditions by means of a high compassion close to one of QDs goal [49]. Because of their striking features, they have achieved a great deal in consideration of biological radar area. Many biological radar approaches use of QDs is cumulative of understanding, speed and dependability of biological discovery study.

QDs are cohesively involved in a backflow assessment line as a correspondent towards being fast. The stepwise aimed at determining the amount of nitrate ceruloplasmin, which is an important protein that carries copper in the blood and plays a significant use of QDs that remains to be explore uncovering of pathogen. The training that included insusceptibility compelling differentiation and QDs fluorescence towards calculating *Escherichia coli* [50, 51]. First, Fe oxide central Au case(Fe_3O_4Au) compelling nanocomposites treated through biological tin plated antiserum to seize *Escherichia coli*, then mixed with chitosan quantum dots (C-QDs) fixed through second additional antiserum. Viruses are released from the matrix via IMS fluorescence analysis method. Selective testing was performed according to other strains including *Enterobacter* genome [51], *Enterobacter* dissolution, *Staphylococcus aureus*, and *Pseudomonas aeruginosa*, then none any other disturbances were reported, reaching the acquisition limit of 30 CFm through an entire investigation period about 120 min.

Current investigations marks towards rationing with mRNA and DNA from scientific reports stating that QDs coupled oligonucleotide sequences in genetic factor expertise through assigning such QDs via surface carboxylic acids [52]. Numerous revisions contribute verified QDs coupled oligo nucleic acids arrangements to remain utilized in inheriting expertise in conferring classifications towards QDs exterior COOH assemblages. A significant setback regarding towards QDs, especially in vivo medicine application stays indisputable is cell poisoning [53]. Cd based QDs stays an excellent example in this case where Cd^{2+} can kill cells due to their subject QDs. A well-made superficial covering for high quality QDs is the greatest explanation and very much critical to avoid this problem as it allows for the detection of biological QDs. QDs are covered through silicon oxide fewer compared to those covered with simple regular particles.

Cell poisoning correspondingly hinge on numerous extra influences counting extent, number of QDs, building resources, shade, dispensation structures, in additional location is projecting. It is observed that there are two types of cell death in human body 1) necrosis and 2) apoptosis. The cell death which is caused by necrosis is unpreventable and caused due to infection by external environment, premature cell death and is uncontrollable [53]. Necrosis can be detrimental and cause severe tissue damage in leading organ failure as the aggregate cells do not function properly as it requires a lot of energy in it. The second type of cell death apoptosis which is a natural process and somewhat beneficial in the human being as it helps in preventing incurable diseases and infection caused by the external environment. It is a programmed cell death unlike necrosis and helps in body development. $Cd^{+2}$when not in a specific concentration can lead in necrosis. Cd^{+2}individually is diluted and then capped with amylose protein or capped with mercapto propionic acid (MPA) and encapsulated with silica in order to avoid leakage leading towards cytotoxicity. If the process of QDs death of cells is programmed then it would most probably support apoptosis which is directing in right way but if in the opposite then the situation is necrosis which can be detrimental when working with heavy metals [54]. In scheming the destruction of core (Cd^{2+}), the development of permitted free ions as well as communications between QDs and intracellular partitions may result in cytotoxicity. Basically, more of pharmaceutical and toxicological studies are needed. QDs applications are recognized as drug delivery, lubricant, catalysation, photovoltaic cells, sensors, bio-imaging and doping ability with nitrogen, fluorine, phosphorus, sulphur and boron [54].

3.3 Gold nanoparticles

On its interface amongst nanocomposites and natural chemical report in form of active clusters are the nanostructures in unit magnitude additionally as composite status per the form of cell and target organelle. The AuNPs are in the range of 1–100 nm. Among the various sorts of nanostructures, metallic nanostructures, specifically Au nanocomposite, shows attractive deal of attention within investigator's cutting-edge on various pitches of science because of their unique properties [55]. Meanwhile the commencement of the 20th epoch, researchers showed extensive research authenticity of an isotropic Au nanocomposites thus they have initiated structural, physical assets, automated structures, magnetic structures, and reaction initiator structures of an-isotropic golden nanostructures; diverged into subsequently globular and Au nanostructure that are usually highly associated with round Au nanostructures [56]. Some benefits of AuNPs are as follows:

(1) Ionizing penetrators engagement in constant remains of height
(2) Modest synthesis operation
(3) Physicochemical structures of elements that can be exactly exact
(4) Strong binding relationships of mercaptans, disulphide and amines
(5) Different flexible photosensitive and automated attributes
(6) Widely used in nanoelectronics, optoelectronics, reaction promoters, and biomedical suggestion. Au nanostructures with such attributes have shown some significant application towards mankind like photon mobilizing treatment, photothermal treatment, ionizable penetrators tomography, treatment transportation and sensing [57–59] are shown in Fig. 2.

Photon transportable treatment is measured to be a significant behaviour for a certain barriered. The layering ailments or transmittable illnesses, with photon sensitivity by the ways of photalgia intermediaries formerly is an optical maser (wavelengths connected over colorant-engrossing ideas). Remote oxygen in addition permitted free ions manufactured by photosensitizer power including tumour cell apoptosis or necrosis [60, 61]. Au nano conjugates are easy to combine with thiols, disulphides, and amines to promote intracellular penetration [62, 63].

Photon updraft remedy similarly recognized by the way of existing excision before ophthalmic hyperthermy, remains a slow, broadly used method of malignancy behaviour. Au nanocomposites consume a high captivation rate in the long run observable in adjacent to ultraviolet rays that harvest warmth [64]. Compact Au nanocomposites cultured with 50 nm in remoteness stay mutual in the cutting-edge photon-temperature performance due to solid captivation in the adjacent electromagnetic light area [65]. In calculation, Au nanocomposites remedy duo stays also useful in indicative and photonic thermal imaging treatments [66, 67]. A like photon mobilization treatment, the sturdy obligatory structures with Au nanocomposites have shown an important part cutting-edge on their intra-linking unit transmission [68].

X-ionizing spectrum mediators in comparison to Au nanocomposites take a lot of attention in outstanding their in-height coefficient of X ionizing captivated as well as non-lethal and local performance [69]. Common arteriographic trough examples like iodine-containing particles take a small unit mass. Even though these pungent complexes take hike in aquatic ionizability in addition to short harmfulness properties, its seen to have a brief circulatory system also rapidly

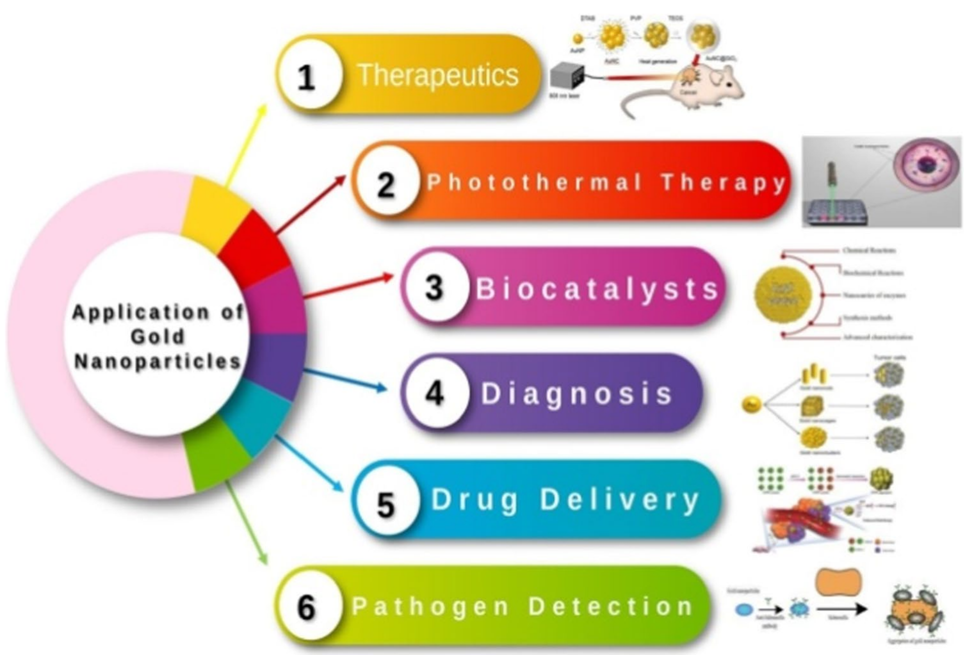

Fig. 2 Diagrammatic representation shown application of gold nanoparticles

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evacuating through renal system. Consequently, more doses of iodine-containing complexes lead to thyroid dysfunction associated towards conventional representatives and Au nanocomposites take a long artery safeguarding construction towards an utmost for tomography claims [70].

It is stated previously, Au nanocomposites take several compensations, as per exceptional ophthalmic and physically-biological duo possessions, being progressive in natural modifications, purposeful elasticity, flexible one-track coat, measured delivery, advanced drug loading, toxicity and stability, creating actual nanocomposite transporter and lastly cutting-edge preparation distribution schemes. It is with such extremely operative nanocomposite transporter accomplishment which is enough in distributing a wide variety of drugs such as peptides, proteins, plasmid DNA (pDNA), minimal RNA (siRNA) and chemotherapeutic agents [71]. Au nanocomposites nanorod inhibits the disposal belongings of the reticular endothelial lining of the classification, which provides an effective remedy transfer system and additional nanocomposites transporter is the gold plated nano-enclosure. Therapeutically antidote transfer can be accomplished by obligatory cell receiver towards superficial nano-enclosures outward bounding towards organically active element as in each remedy. Au nanocomposites shaft is an appropriate treatment transfer mobilization aiding in its capability of expert external plasmon quality in order to adapt occurrence in ionic energy into current vigour, in that category of foundation for targeting claims of photon remediation medicinal distribution with cancer conducting immunizations against it [71].

On in sighting toward forth most vital proposals of Au nanocomposites as a nature-organic radars [30, 72, 73], it is subjected that an operative radar has in detection with so many other analysers likewise relating with ferric particles, negative ion, complex saccharides, nucleic acid, polymers of amino groups and pollutants. In terms of understanding, the Au nanocomposite radar has shown some diverse constraints and unlike sorts of nanocomposite natural radars customizing dissimilar appearances of Au nanocomposites [74]. Envisioned for sampling leading to such undeveloped brashness of calorimetric radars is proceeding for ostensible shade modification triggered with the combination of Au nanocomposites [75].

3.4 Magnetic nanoparticles (MNPs)

The growing number of science focused books are showing mounting curiosity in the wider scientific community. Significant growth has been concluded in integration of fascinating constituents on anticipated dimensions, geomorphology, biochemical structure and external interaction [76]. The belongings of magnetic NPs depend on the amalgamation process and biochemical assembly. In most occurrences, it ranges from 1 to 100 nm in size and can display superparamagnetic property. This amalgamation in its capacity to turn an external compelling arena with rich possibilities of layers guaranteeing its magnetic device as a universal tool for magnetic separation of small molecules, biomolecules and cells. In the field of biology, magnetic units are presently used as drug transporters and besides various agents of magnetic resonance imaging (MRI) with magnetic hyperthermia [76]. Magnetic NPs being a part of nanotechnology based materials that contribute to fields of diagnostic understanding, biological detecting and nano remedy [77, 78]. Following applications defining 'magnetic NPs' in diagnosing-treating diseases in the succeeding years to be -

(1) The compelling leave-taking of living organizations has underwritten to the progress of treatment
(2) Attractive nano-transporters contribute to drug delivery
(3) Controlled radio frequency magnetic NPs have provided a new form of cancer treatment.

To illuminate rapid progressive ground and upcoming projections, it is imperative to address the tasks linked with design developments, integration and characterization. The synthesis of magnetic nano-composites is vital in regard with its application and reproducibility techniques in order to exercise different activities [79]. Magnetic NPs are found to be two types according to its magnetic property based on manufacturing of magnetic portion mainly oxides of nickel (Ni), cobalt (Co), iron (Fe)and other compounding metals including copper (Cu), barium (Ba), zinc (Zn) and strontium (Sr) others seen included are in the form of nanoalloys and metallic NPs provided with agglomeration of coating to increase longevity [80].

At the tissue level in human physiology, ulcers have an asymmetrical vesicular system and their aptitude to eliminate high temperature strain is reduced. Heating also surges in cell compassion towards other forms of therapies such as radioactivity, remedy and chemical treatment [81]. Compared to other approaches the attractive subdivision rising temperatures makes it a limited heating of targeted tissue by embedding magnetic particles into the target bundle and using externally rotating magnetic field to heat it. Influencing elements are vaccinated right into the lump or vein that confiscates the tumour. In addition, magnetic NPs can be detected using magnetic quality tomography as well amalgamation of treatment and analysis conceivable [82]. Exciting biosensor of automated biochemical magnetic triggered CD4 + T-lymphocytes natural detectors described by CD4 + T-lymphocytes, characterizing the prime mark of HIV, being secluded independently by means of the challenging receptor immunogens [83]. Different cell assemblies and density in tissues are responsible for certain photo comportment in attractive grounds and allows for the detection of variances in pictures [84]. Nearby binary foremost groups of dissimilar agents chelating lanthanide ion metal evolution and substances being weakly attracted by the poles of a magnet subdivisions. Particles of magnetic iron oxide present the most widely used magnetic-particle-based contrast agent [85]. Comparable MRI contrasts needs to be accomplished through subsequent necessities: need to advance brightness (to promote high dynamic magnetic field) being biocompatible and providing an ideal location for identifying therapeutic molecules [86]. Profitably the magnetic particles in their natural well-matched has been extensively tested for and physiological iron metabolism is responsible for their decline. Moreover, their (high) paramagnetic sites iron oxide attractive NPs can powerfully degrade the magnetic field camps and create differences that exceed their body size. Indisputably, the existing inclination in medicine investigates linking desirable drug assets for diagnostic and therapeutic purposes [87].

A good example of magnetic NPs in delivery of drugs mutual with hyperthermy or general MRI is magnetic iron oxide (γ-Fe_2O_3, Fe_3O_4) subdivisions are the maximum used materials for this reason due to higher natural compensation than other constituents [88]. Alternative policy to support the interaction of DNA with magnetic molecules is to attract attention of charged components and promote electrostatic interactions with the nucleic of poorly stimulating phosphate base dosages [89]. It has remained in the areas prepared by NH_2 groups provides an upright rushing in intense environments due to protonation of NH_2 groups and furthermore delivering static interactions deprived of supplementary mediator useful in disrupting the hydrogen bonding [90]. The situation was noted that congestion of amino groups positively influences the ability to advertise double stranded DNA analogically growth and hereby could remain achieved by coarse-grained particles or magnetic particles of amine-mesoporous silica magnetic [91].

Poly-ethyleneimine (PEI) as a particle with high NH_2 fractions may stay cast-off for molecular alteration [92]. Multiple electric magnetic subdivisions prepared via earth polishing which can be silicon oxide, poly-vinyl pyrrolidone or tri-poly-phosphate stays in an informal variety conducting research laboratory and shows DNA interaction to separate the magnetic applications. Subsequent direct separation of nucleic acids can be performed using attractive pitch subdivisions coated through oligomers nucleic acids reviews that detect the mark nucleotide biopolymer according to their classification [93].

4 Nanocomposite biological remediations (NBRs)

Nanocomposite biological remediations (NBRs) encompasses the practice of nanocomposite materials to moreover in situ (in dwelling), or ex situ (off-dwelling) towards pollutant resources. In the past few years, the ratio of various contaminants in terms of organic and metallic organic waste products have risen [58, 94, 95]. The main cause of such unhealthy contaminants were on the basis of its ease on decomposition which has lead the fact that implementation of such pollutants must be handled in the ways of observing the physical, organic and within biochemical assembly in the forsake of long term disposable and at the same time being cost effective with less hazardous impact towards the environment. The need for such banishment of contaminants was detected with its unstoppable infiltrated ways impending on our natural diet resources making it however more and more suitable for mankind. The wide scope of studies has found such contaminants consumption leading to some serious forthcoming overdose of detrimental pesticides and fertilizers.

These detrimental chemicals cannot be over shadowed towards human health. It is thus seen that its ways of combating such environment threat have majorly affected which plays an indirect role in threatening the relationships with environment towards mankind. Some of the major tactics of biological remediation involve the usage of microbes, herbaceous border and enzymatic remediation [96]. Vegetative natural remediation is known to be effective against natural, organic and metallic-organic pollutants remediation in combination with nano catalysts such as zero valent ions. Other cost-effective joint activities are with a combination of nano enclosed enzymes that has enabled curative versatility such as nano sized Fe composites with catalysation which have shown promising results in wastewater treatment [97, 98]. These nano Fe composites are tremendously beneficial in reversing the toxic pollutants making it effective in remediating heavy metals like Arsenic and mercury not only from water resources but also in the nano remediation of soil. This is somewhat a great aid in ploughing, agriculture, irrigation and rearing livestock [99] (Fig. 3).

COVID-19 outbreaks are happening more often now than ever before. Pharmaceutic and non-pharmaceutical counter measures are used in pandemic preventive techniques, including vaccinations and antiviral.

Non-pharmaceutical measures are advised as a critical strategy because appropriate pharmaceutical supplies won't be immediately available [100]. Since proper pharmaceutical supplies will not be available right away, non-pharmaceutical approaches are recommended as a crucial tactic. Subsequently, the quality of water and soil are the deciding factors towards the quality of crops, yield creation, engineering of goods and reservoir of water resources. Forthcoming these attributes plays a major impact in terms of diversity of nutrient packed diet as an effective natural remedy for the wellbeing of mankind [101, 102].

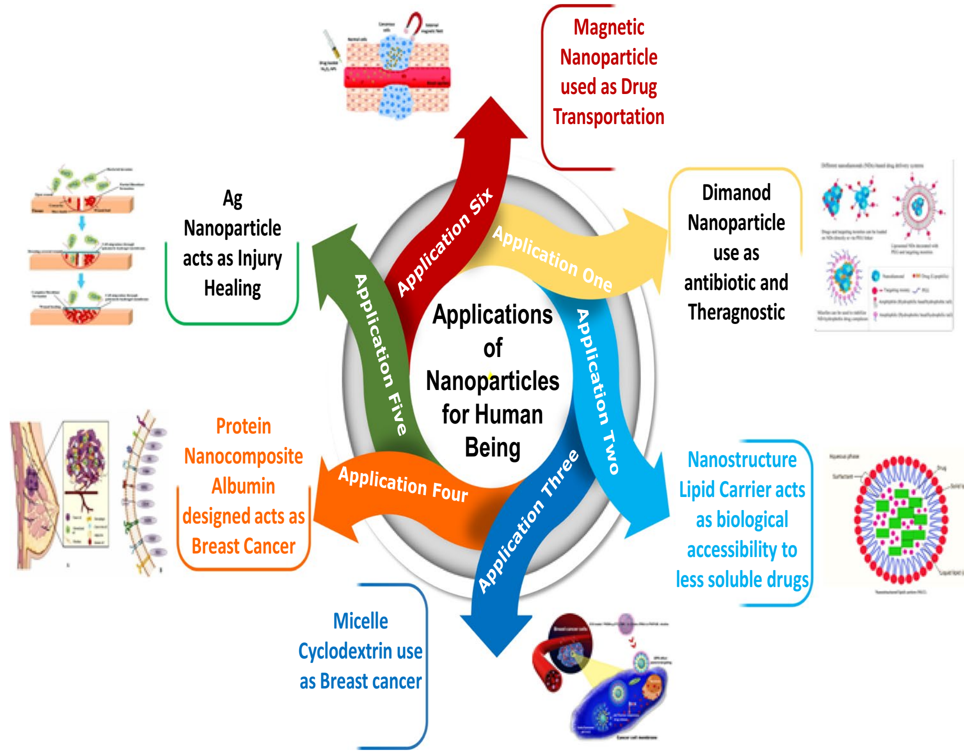

Fig. 3 Diagrammatic representation shown application of nanoparticles for Human Being

5 Nanostructured therapeutic treatment

The wide range of nanocomposites have been discovered over the past few years with promising functionalization in the era of therapeutic nanomedicine [103–105]. This unique functionalization of each particular nanocomposite is known to produce an array of results involving technology. The contributing factor of these nano based therapeutic treatment is with progression in technology involving dependent pathways on the basis of -

1) Nanoscale dimensions and matrixes of the desired nanocomposites [106].
2) Nature-chemical pathways of distribution towards the target cell of the corporal host [107].
3) Improvement in genetic sciences and protein identifications for biological engineered microorganisms [108].
4) Polymerization of desired protein through cell aggregate production technology and substituting and mending damaged cell aggregates carried out within a living system [109].
5) Nanocomposite based drugs must be stabilized in order to dodge any outflow caused by retrograde activities with the system [110].
6) Biologically well-matched material must be able to target on a specific tumour in order to provide furtiveness attributes after recognition [111]. Different types of nanocomposites progression [112–127] for mankind are shown in (Table 1).

6 Conclusion and future perspective

It is proven that nanoparticle composites through various experimentation have made significant breakthroughs in terms of innovation and advancements. The benefits of the nanocomposites are observed with different types of consequences with lesser number of weak attributes in a nanocomposite respectively. Nanoparticles have served multipurpose for human beings in many ways, however, there are still cons in terms of toxic level and drug delivery in the need of major research reducing the weights of side effects. The microelectronic structures of CNTs stay aimed at transmitting electrically natural, biologically recognized, or charge localization motions; nevertheless, one another specific visual characteristic besides regarding their ability to penetrate easily concluded living membrane, making these ideal for the expansion of photonic sounding locating system.

Nevertheless, when pro-positioning biological radars the situation shifts towards considering nanometric constituents even if minors stay non-essential for leaving the body they can be considered attackers and as a result attacked. Therefore, the problems associated in the direction with the extent of thickness, life expectancy, steadiness, strength, power-driven possessions, corporeal habitational, so, harmfulness should stay estimated in a scientific and order technique. Definitely, after cast-off in its purest form, directly after compaction, carbon nanotubes containing impurities still possess harmful effects. However, when cleaned and operated on a high level, their toxicity

Table 1 Different types of nanocomposites progression for mankind

Serial Number	Nanoparticle	Application	References
1.	Carbon nanotubes	Clearance patterns in vivo, effective in cancer treatments	[112]
2.	Magnetic nanoparticles	Drug transporters,Magnetic imaging	[113]
3.	Quantum Dots	To detect toxins in biospecimens	[114]
4.	Gold Nanoparticles	Drug transportation, photonic heat stage, membrane sore therapeutic	[115]
5.	Nano structured zerovalent Ions	Shows degradation of organic contaminants	[116]
6.	Nano sized Fe composites	Wastewater and loam treatment	[117]
7.	Polyethylene glycol Ag nanoparticles	Antibacterial, injury healing, Aces in breast cancer remediation	[118]
8.	Nanostructured Lipid carriers (NLC)	Biological accessibility to less soluble drugs	[119]
9.	Diamond Nanoparticles	Detection, remedy distribution, theragnostic, antibiotics, and material production	[120]
10.	Polyurethane/strontium-substituted hydroxyapatite composites	Bone regeneration/ Bone tissue production	[121]
11.	Micelle Cyclodextrin-PEG micelle Camptothecin	Ovarian/tubal/adnexa cancer, rectum malignancy	[122]
12.	Liposome Irinotecan	Compact lump	[123]
13.	Conjugates Polymer medium Docetaxel	Prostatic gland malignancy	[124]
14.	Protein Nanocomposites Albumin designed	Tumour cells- breast cancer	[125]
15.	Virial units Von Wille brand feature Cyclin gene	Pancreatic cells- cancer	[126]
16.	Poly (glycerol-succinic acid) dendrimers	Colonic, left and right ovary, respiratoria malignancy	[127]

is greatly reduced and represents a platform suitable for all types of applications. In addition, it has been revealed to be continuous that undeveloped CNTs strands as a safe technique in avoiding probable hazards, particularly as soon accustomed on implanted electrodes within vivo testing. The latest few years has recorded many successful QDs applications in a variety of ways of biological radar stages validate the inordinate possibility of experimental submission of primary findings in ailments like malignancy, heart complications and neurodegenerative ailments. Presently, substantial metallic elements depending upon its magnitude have led to extensive discussions about their toxicity, that are ranging on or after being innocuous towards huge poisonous stages staying grounded on the constituents. The cutting-edge transience remains to be non-problematic for biological radar, requiring a special consideration in the in-case vivo, and this should be considered in forthcoming advances trendy pitch for biological radar determinations. In the enlightening of functional adaptation in environment it can stay an alternative option in resolving particularity as well as understanding of QDs built in radar stages. In specimens, prearranged the challenge of these miniature nanoscopic magnitude, nanocomposites may mark strong standard living molecular compartments, such nanocomposites unregistered proceeding our insusceptible classification for its extent. Some functionalizing nanocomposites when infused with other efficient nanocomposites have shown in some revolutionized multi oriented nanocomposite transporters allowing continual molecules, remediations and analysing device towards patient in a faster approach. During the cell aggregation manufacturing there is a need of stability which has not been seen due to partial hemi natural life and deprivation of proteins not allowing it to be functional within the body. In brief, it is required to learn more and start correctly functionalizing nanotechnology beforehand in order to aid patients with maximum benefits.

Abbreviations *QD(s)*: Quantum dot(s); *SWNTs*: Single-walled nanotubes; *CNTs*: Carbon nanotubes; *MWNTs*: Multiwalled nanotubes; *MRI*: Magnetic resonance imaging; *CD4 + Tlymphocytes*: Helper T cells; *PEG*: Polyethylene glycol; *PEI*: Polyethyleneimine; *IMS*: Ionmobility spectrometry; *mRNA*: Messenger ribo nucleicacid; *SiRNA*: Short-interfering ribo nucleicacid; *NBR*: Nanocomposite biological remediation

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Declarations

Conflict of interest The authors declare no competing interests.

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